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When a Registered Dietitian Becomes the Patient: Translating the Science of the Low FODMAP Diet to Daily Living



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Irritable Bowel Syndrome (IBS) can severely affect quality of life due to abdominal pain, bloating, diarrhea and/or constipation. Symptoms can be improved by following a diet low in fermentable oligosaccharides, disaccharides, monosaccharides and polyols (FODMAPs), but implementation of this restrictive diet can be challenging. This article provides guidance for all 3 phases of the low FODMAP diet from an IBS patient, who utilized her knowledge as a registered dietitian nutritionist to successfully resolve symptoms, discontinue IBS-related medications, and maintain a nutritionally complete diet.

INTRODUCTION

Irritable bowel syndrome (IBS) is a functional gastrointestinal (GI) disorder that can severely affect quality of life due to abdominal pain, bloating, diarrhea, and/or constipation.^{1,2} The pathophysiology is complex and multifactorial, including visceral hypersensitivity³, alterations in the GI microbiome,⁴⁻⁸ and psychosocial factors including the brain-gut axis.⁹ Often, IBS is not diagnosed until other causes for symptoms have been ruled out, such as cancer, infectious colitis, inflammatory bowel disease, or celiac disease.¹⁰ Since the pathophysiology of IBS is multifactorial, more than one treatment method

is often used, including medication management of symptoms, stress management including biofeedback, and dietary intervention.^{1,2} This article focuses specifically on the implementation of a low FODMAP (fermentable oligosaccharides, disaccharides, monosaccharides and polyols) diet, which has been shown to reduce symptoms in those with IBS and is included in the National Institute for Health and Care Excellence Clinical Guidelines for IBS.²

IBS is divided into four categories: IBS-D (IBS with diarrhea), IBS-C (IBS with constipation), IBS-M (IBS with mixed symptoms), and IBS-U (IBS un-subtyped). The Rome IV criteria is used to determine the type of IBS based on abdominal pain and stool consistency; this classification is then used to guide treatment.¹¹ The Gastrointestinal Symptom Rating Scale (GSRs) is a symptom

(continued on page 22)

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(continued from page 20)

assessment tool that measures the baseline severity and frequency of these symptoms, as well as the response to treatment. It has been validated for both clinical and research application in patients with IBS.¹² Many trials evaluating dietary interventions for IBS, such as the low FODMAP diet, use the GSRS to assess symptom change.

Treatment goals are typically designed to match the outcome measures used in these studies, such as the GSRS. This is important for diet standardization to determine which foods have the highest likelihood of inducing symptoms. Beyond that, each individual patient should determine goals for their own therapy. For example, one patient may focus most on reducing frequency or urgency of diarrhea, while another patient may prioritize reduction in abdominal pain and bloating.

Oftentimes, treating one symptom also helps alleviate others, but patients need to stay focused on a “what’s in it for them” framework in order to maintain adequate motivation and adhere to such a restrictive diet. Examples of patient-centered goals are listed in Table 1.

Dietary Intervention for IBS – The Low FODMAP Diet

In a recent survey of 1,562 U.S. GI physicians, nearly 60% indicated that at least half of their patients with IBS associate food with their GI symptoms. Prior to seeking treatment with a GI specialist patients were more likely to use ‘trial and error’, or a lactose-free or gluten-free diet rather than trying a low FODMAP diet.¹³ Over half of the GI physicians recommended diet therapy to > 75% of their patients with IBS with the low FODMAP

Table 1. Sample Goal Sheet

Treatment Goal	How it Will be Measured
Reduce bloating after meals	Goal: less than 3 episodes of post-meal bloating per week (as compared to 15+ episodes of post-meal bloating per week prior to intervention)
Decrease diarrhea	Goal: less than 1 episode of diarrhea per day, only occurring on 2 days per week (as compared to 2+ episodes of diarrhea per day, 5-7 days per week)
Decrease constipation	Goal: soft, formed stool at least once every 3 days.
Reduce abdominal pain	Goal: no occurrences of abdominal pain for at least 20 days.

Table 2. Resources to Assist with Food Identification

FODMAP food lists and recipes available from Kate Scarlata, RDN; FODMAP and IBS expert: katescarlata.com
FODMAP recipes and diet guidance from Diet vs Disease website: DietvsDisease.org
Labels for low FODMAP foods sold in grocery stores are available on the FODMAP Friendly website: fodmapfriendly.com
FODMAP foods lists (App for smart phones also available) from Monash University: monashfodmap.com
The IBS Elimination Diet and Cookbook by Patsy Catsos: ibsfree.net

(continued on page 24)

(continued from page 22)

diet being the most common.

For many individuals, foods that contain FODMAPs (all of which are carbohydrates), have been shown to exacerbate IBS.¹⁴⁻¹⁶ Consuming a diet that restricts foods with high levels of FODMAPs has been shown to reduce symptoms and therefore improve quality of life in 50-80% of patients with IBS.¹⁷⁻²⁵ FODMAPs are highly osmotic (draw water into the gut), poorly absorbed, and are rapidly fermented by intestinal bacteria resulting in excess gas production.

FODMAP rich foods are categorized into those containing fructans/galacto-oligosaccharides (GOS), lactose, excess fructose (fructose to glucose ratio > 1), and polyols. Some foods may contain more than one category. Table 2 provides resources to help identify foods in each category.

Fructans and Galacto-oligosaccharides (GOS)

Fructans are fructose polymers (oligosaccharides) that are found in many foods, including onions,

garlic, and some fruits and cereals. Also included in this category are inulin and fructo-oligosaccharides that are added to many foods as prebiotics. The small bowel (SB) cannot hydrolyze the fructose-fructose bonds, so fructans enter the colon instead of being absorbed in the SB.²⁶ In the colon they are fermented by colonic bacteria, causing the symptoms associated with IBS in those with visceral hypersensitivity. Wheat, onions, and garlic are fructans that are highly prevalent in the U.S. food supply. GOS molecules consist of galactose-galactose bonds that also cannot be hydrolyzed or absorbed in the SB, causing similar symptoms as fructans in the colon. Lentils, chickpeas (and therefore hummus), and red kidney beans are common sources of GOS.

Lactose

Many individuals, even those that do not have IBS, are lactose intolerant or lactose maldigesters.²⁷ Lactose is a disaccharide of glucose and galactose, normally hydrolyzed in the brush border of the

Table 3. Three Phases of the Low FODMAP Diet

Restriction Phase (Phase 1)

- First 2-6 weeks of the diet, depending on length of time for symptom resolution.
- No foods or beverages containing high amounts of FODMAPs should be consumed during this period. Portion sizes of moderate FODMAP foods and beverages should be small.
- If this phase does not successfully reduce symptoms, a full return to a regular diet is suggested and different treatment methods pursued.
- If this phase successfully reduced symptoms, continue restriction and move to the second Reintroduction Phase.

Reintroduction Phase (Phase 2)

- One new food is reintroduced every three days. Choose one food from a different FODMAP category for each three day period.
- Most RDNs recommend returning to a three day restriction phase between food challenges.
- Symptoms are monitored in response to food reintroduction – if symptoms are present, the food is discontinued again, and foods in the same FODMAP category are also avoided until a future food challenge.

Maintenance Phase (Phase 3)

- All foods that are successfully reintroduced in the Reintroduction Phase are consumed on a regular basis.
- If symptoms begin again, a careful evaluation of the diet is necessary to determine which newly introduced foods triggered symptoms and should be restricted again.
- It may be helpful to limit portion sizes of all moderate and high FODMAP foods even if successfully reintroduced.

proximal SB. When lactose is malabsorbed, the disaccharide can cause gas production and distension in both the SB and colon. Common sources of lactose include milk, ice cream/cream, yogurt, and some cheeses.

Fructose

Fructose is more readily absorbed in the SB in the presence of glucose, so foods with excess fructose compared to glucose will lead to fructose malabsorption.²⁶ Individuals with IBS and visceral hypersensitivity will have abdominal distension, pain, and bloating in response to this fructose malabsorption. Foods with excess fructose content include, but are not limited to, watermelon, pineapple, honey, apples, pears, and all foods and beverages with high fructose corn syrup.

Polyols

Polyols are reduced calorie/carbohydrate sweeteners,²⁸ commonly known as sugar alcohols (such as sorbitol, mannitol, xylitol, isomalt). Sorbitol and mannitol are naturally occurring in foods like mushrooms, avocados, prunes/prune juice, and stone fruits, but are also added to sugar-free foods such as gelatin, pudding, and beverages. Xylitol and isomalt are added to commercially sweetened products such as chewing gums and products marketed as “sugar-free.” These polyols are slowly absorbed along the length of the SB. They often reach the colon where they act as osmotic agents pulling fluid into the bowel in addition to being fermented by colonic bacteria. This causes the ‘bloating and distension’ that is common in IBS. All individuals, not just those with IBS, are susceptible to diarrhea when consuming these products in high amounts, thus the warnings on many products containing artificially added sugar alcohols – “excess consumption may have a laxative effect.” Individuals with IBS may have a lower threshold for reacting to polyols.²⁸

FODMAP Diet Implementation

Although implementation of the low FODMAP diet can be challenging, the survey of GI physicians indicated that only 21% of gastroenterologists commonly refer patients with IBS to a registered dietitian nutritionist (RDN), indicating a need for

improved interdisciplinary care of these patients.¹³ A RDN should complete a nutrition assessment and develop a nutrition care plan to help the patient and significant others plan a successful low FODMAP diet. The RDN should first conduct an anthropometric and diet history. Some patients with IBS may perceive themselves as overweight or have body dissatisfaction due to the frequent bloating associated with eating. The RDN should work with the patient to establish a healthy and reasonable weight goal, if needed. A food frequency questionnaire can be a helpful diet history tool, as this will highlight foods or food groups that are already avoided due to known symptom induction, intolerances, or allergies. It will be important to note which foods are regularly consumed that are high in FODMAPS, suggesting alternative food choices for these.

The RDN should also investigate lifestyle factors such as stress, physical activity, and social/environmental situations to determine impact on symptoms and ability to implement the 3 phases of the diet. Baseline food-related knowledge can be built upon to teach the diet specifics and food label reading. The planned diet should be consistent with the patient’s beliefs associated with food, whether cultural, religious, ethnic, or for other reasons. Additionally, confirmed or suspected food allergies or intolerances need to be considered during diet planning.

Documenting current and historical medications, including frequency and dosage, can provide insight into symptom longevity, severity, and frequency. It is important to note that some medications may contain FODMAPs as fillers or sweeteners. The ability to reduce or discontinue medications while achieving symptomatic improvement will be a measure of the FODMAP-modified diet success for most patients.

FODMAP Diet Phases

After a nutrition assessment has been completed and goals for treatment have been set, diet implementation follows. The diet is broken into 3 phases (see Table 3). Phase 1 is the Restriction Phase, Phase 2 is the Reintroduction Phase, and Phase 3 is the Maintenance Phase.

(continued on page 30)

(continued from page 25)

Table 4. Food Challenge Chart with Sample Completion

Date Restriction Phase Began: _____ Total number of days in Restriction Phase: _____

FODMAP Category	Date	Food Reintroduced (serving size)	Symptoms
Lactose Common foods in category: <ul style="list-style-type: none"> • Milk • Yogurt • Ice cream • Ricotta and cottage cheese • Custard *If lactose intolerance has been confirmed, do not try to reintroduce these foods into the diet.	Day 1	4 oz yogurt at breakfast	None
	Day 2	4 oz yogurt at breakfast and 4 oz yogurt at lunch	Slight distension for 1 hour after eating lunch
	Day 3	6 oz yogurt at breakfast and 6 oz yogurt at lunch	None
Fructose Common foods in category: <ul style="list-style-type: none"> • Asparagus • Sugar snap peas • Apples, pears • Mango • Cherries, boysenberries • Honey *High fructose corn syrup (HFCS) is in this category; foods and beverages with HFCS are not recommended to be reintroduced until later and should only be consumed in very small quantities if at all.	Day 1	1 cup sugar snap peas at dinner	Gas within 30 minutes of eating, continuing for 3 hours
	Day 2	No foods from this category consumed	N/A
	Day 3	½ cup mango at lunch	Bloating within 30 minutes of eating, mild abdominal pain
Fructans Common foods in category: <ul style="list-style-type: none"> • Onion, garlic • Artichokes, peas • Ripe bananas • Wheat, rye, barley • Beans, lentils 	Day 1	½ slice whole wheat bread at breakfast	None
	Day 2	Sandwich with 2 slices of whole wheat bread at lunch	Severe diarrhea
	Day 3	No foods from this category consumed	N/A
Polyols Common foods in category: <ul style="list-style-type: none"> • Mushrooms, cauliflower • Apricots • Blackberries, cherries *Sugar alcohols used as sweeteners (sorbitol, mannitol, isomalt, xylitol) cause diarrhea even in people without IBS. These should not be reintroduced early in Phase 2.	Day 1	4 oz Vitamin Water Zero (sweetened with sugar alcohol)	Watery diarrhea
	Day 2	½ cup apricots	Diarrhea
	Day 3	No foods from this category consumed	N/A

Due to the symptoms induced, this individual should continue to avoid foods in the excess fructose, fructans, and polyols group. Future food challenges in Phase 3 may include trials of different foods in those categories.

Phase 1. Restriction

In Phase 1, all foods high in FODMAPs are restricted completely, and foods with moderate levels of FODMAPs are limited to small portions. The cut-off level for what is considered low, moderate, or high FODMAP content is not well defined; therefore, food restrictions may differ based on the individual’s threshold response and can be fine-tuned throughout the Restriction Phase.²⁹ Tables 4 and 5 provide commonly eaten foods in each FODMAP category, but this is not an exhaustive list. Monash University and other groups periodically retest foods as changes in agriculture and the environment can influence the FODMAP levels in food and food analysis techniques become more sophisticated and accurate over time.³⁰ For example, Monash University retested bananas because many people reported discomfort after eating ripe bananas. Also, fruits available in grocery stores may be larger than in the past, influencing the total fructose content. This is why food and symptom logs (see Table 4) can be helpful to identify exactly which foods in which quantities are the most likely to trigger symptoms in an individual person.

Viewing lists of high and moderate FODMAP foods can be overwhelming to an individual with IBS who is learning this diet for the first time. Table 5 provides a chart that can be used for the RDN and patient to complete together, identifying commonly eaten foods from the FODMAP food

lists (from the resources in Table 2) that should be avoided completely, eaten in small portions, or eaten in the usual portion sizes. This can also help the individual focus more on what they can eat, not what they cannot eat.

This Restriction Phase should be maintained for 2-6 weeks to determine if it will be effective for symptom reduction, as many people will see significant symptom improvement by week 2, while others may require a longer period of complete FODMAP restriction.¹⁰ If symptoms have not improved by week 6, then it is unlikely that the diet will be effective. In this case, a return to the previous/usual diet is warranted with new treatment modalities pursued, such as stress or medication management. If symptoms have improved by week 4, the patient should start the Reintroduction Phase rather than waiting the full 6 weeks. The goal is to increase diet variety as much as possible to ensure compliance and reduce the risks of nutrient deficiencies that may come with prolonged restriction. This is especially important because Phase 1 of the low FODMAP diet limits many common food sources of fiber, vitamin D, and calcium.

Compliance with Phase 1 can be even more difficult if traveling or eating in social situations. Packing FODMAP friendly snacks and ingredients that are easy to prepare when traveling can be helpful. Table 6 provides examples of simple meals that are consistent with a low FODMAP diet. RDNs

Table 5. FODMAP Customization list with Sample Completion

FODMAP Category	Avoid	Limit	Ok
Fructans/GOS	Wheat, barley, rye, onions, garlic, ripe bananas, dates, beans, lentils, hummus, cashews	Nuts and nut butters	Sourdough Blueberries, cantaloupe, grapes, lemons, pineapple
Excess Fructose	Honey, high fructose corn syrup	Canned fruit, ripe bananas, tomatoes, avocados, green peas	Carrots, green beans, spinach, potatoes, sweet potato
Lactose	Milk, yogurt	American cheese	Lactose free milks, most cheeses
Polyols	Sugar alcohols, sugar free gum		Rice, gluten free breads, cornmeal
More than one category	Peaches, figs, watermelon	Cocoa	

can also help IBS patients learn how to read food labels for packaged foods that are available in airports and convenience stores.

Many find it helpful to document their intake on a food and symptom log such as that in Table 4 to monitor their own compliance and more easily track intermittent symptoms back to specific foods. Also, since food analyses can be updated, maintaining a log may facilitate decision-making on which foods should be limited in the future. For example, symptoms may be associated with a meal in which no moderate or high FODMAP foods were eaten. Future food analysis may then identify one of those foods with higher FODMAP content than originally thought. The food and symptom log can be used to identify foods that may need to be avoided based on the new analysis.

Phase 2. Reintroduction

No randomized control trials exist to guide the Reintroduction and Maintenance phases of the diet; Whelan and colleagues published guidance based on limited research and best practices followed in their center.¹⁰ The resources listed in Table 2 are also helpful for Phase 2. This article includes additional

guidance using the author’s experience as both a RDN and IBS patient. Tips for reintroducing foods are included in Table 7.

Patients may be fearful of inducing symptoms with food reintroduction. However, in order to avoid unnecessary restriction and promote a nutrient-complete, more enjoyable diet, as many foods as possible need to be reintroduced over time.

At the beginning of the Reintroduction Phase a second nutrition assessment with an RDN is helpful to evaluate anthropometric and clinical changes and progress towards the patient-centered care goals. A revision of the goals at this point may be necessary. A new food frequency questionnaire can be completed to determine compliance with the Restriction Phase and identify key nutrient intakes that may be at risk. For example, if the individual has not been consuming calcium-fortified products or cheese, and has maintained a strict dairy restriction as recommended, he/she may require calcium and vitamin D supplementation. Therefore, if lactose intolerance has not been confirmed, the first category of foods to be reintroduced should be lactose containing foods. Yogurt is a good choice as it is often better tolerated than milk or ice cream.

Table 6. Examples of Simple Meals Consistent with a Low FODMAP Diet

Sample Breakfasts	Sample Lunches	Sample Dinners
1 cup Cheerios ½ cup lactose-free milk 1/3 cup blueberries Boiled egg	Chicken Quesadilla: 2 corn tortillas, mozzarella cheese, shredded chicken with pepper 1 cup strawberries 1 cup carrots	4 oz Steak ½ cup sweet potato ½ cup brown rice 1 cup grapes
String cheese 2 slice toast (gluten free bread) 2 tbsp peanut butter	3 oz tuna, canned in water mixed with 1 tbsp mayo 1 cup corn chips 1/8 avocado ¼ cup diced fresh tomato	4 oz chicken breast 1 cup brown rice ½ cup sliced pineapple 1 tbsp teriyaki sauce 1 cup lactose-free milk
½ banana (not overly ripe) 2 tbsp peanut butter 1 cup grapes 5 saltine crackers	Sliced turkey Swiss cheese ½ cup spinach Small bag of plain potato chips	4 oz pork Small baked potato with pepper 1 cup carrots

(continued on page 34)

(continued from page 32)

One new food from only one new food category should be reintroduced every 3 days during a food challenge, while continuing to restrict other foods. A food from a new category should be chosen for each food challenge, as people will often respond similarly to foods in the same category. For example, both wheat and onions are in the fructan category, so a person with IBS who responds poorly to wheat will probably have a similar reaction to onions and other fructan-containing foods. Dose dependent reactions may occur,²⁹ so smaller-than-usual portion sizes should be trialed on day 1 of a food challenge. For example, if wheat is being reintroduced, 1/2 slice of bread may be eaten on day 1, increasing to a full slice on day 2 and then 2 slices on day 3 if still asymptomatic.

Some foods fit in more than 1 category, such as apples in both the polyols and excess fructose groups. These foods are not good choices for the first round of food challenges, as it will be too difficult to discern which category of foods is responsible for symptoms.

A return to a full restriction for 3 days between food challenges can help ensure symptoms are not

a result of overlap between food categories. The following pattern is suggested for the first round of food challenges:

- 2-6 week full FODMAP restriction
- 3 day food challenge – small servings of wheat reintroduced (fructan)
- 3 day full FODMAP restriction
- 3 day food challenge – small servings of yogurt reintroduced (lactose)
- 3 day full FODMAP restriction
- 3 day food challenge – small servings mushrooms reintroduced (polyols)
- 3 day full FODMAP restriction
- 3 day food challenge – small servings of honey reintroduced (excess fructose)

All foods successfully reintroduced can now be continued in normal serving sizes. New 3-day food challenges could be implemented with new foods,

Table 7. Tips for Reintroducing Foods

- Start with small serving sizes of foods. For example, if reintroducing wheat, start with half a slice of bread on days 1 and 2. If no symptoms, increase to a full slice of bread on day 3.
- Juices should be consumed with caution, since one cup of juice usually contains 4-5 servings of fruit.
- The first foods reintroduced should be those that contain nutrients that have been missing in your diet. For example, if whole wheat bread was previously your main source of fiber, you may consider reintroducing wheat in the first food challenge.
- If a food contains two different FODMAP components, this should not be reintroduced until later. For example, pears contain high amounts of both fructose and polyols, so if they elicit symptoms you will not know if fructose or a polyol is an offending factor.
- If one food in a category causes symptoms, it is possible that another food in that category will as well. For example, if wheat causes symptoms, rye and barley probably will too because they contain similar amounts of fructans.
- Many people reintroduce favorite foods first, which is fine – just remember to start with small serving sizes.

(continued on page 36)

(continued from page 34)

without needing to repeat periodic full FODMAP restrictions, since all FODMAP categories have been trialed.

Maintenance Phase

Most people with IBS will remain in this phase for the rest of their life to continue symptom-free. Good compliance with the diet has been reported due to symptom resolution when the diet is followed, improving quality of life.³¹ The ultimate goal is to consume as many different foods as possible in order to meet nutrient requirements. If some foods produce mild symptoms, these may still be eaten in small amounts on special occasions if so desired. For example, those with IBS who are sensitive to fructan-containing foods may choose to eat small portions of bakery goods made with wheat flour at a celebration.

Many choose to return to the guidance provided in the Reintroduction Phase to retry foods previously not tolerated, especially if they are favorite foods. The lifetime FODMAP modified diet can be continually refined, especially as new treatment strategies are advanced.

Additional Considerations

Liquid medications, such as cough syrups and pain relievers, contain high fructose corn syrup and sugar alcohols (polyols) as well as other FODMAP components. Individuals with IBS should consult with their physicians and pharmacists for alternate medication selections if needed.

A sustained low FODMAP diet may alter the gut microbiota due to reduced intake of inulin and GOS, the fructans that are natural prebiotics.^{4,8} It is difficult to know the long term consequences of this alteration, because only short term studies have been done to elucidate this effect.¹⁰ Other dietary modifications may also contribute to changes in the microbiome. One randomized control trial demonstrated beneficial microbiota alterations when probiotics were consumed concurrently with the FODMAP modified diet.⁸ Since more research needs to be done on the type and dose of probiotics that might be beneficial, individuals with IBS should discuss possible probiotic supplementation with their gastroenterologist and/or primary care physician.

CONCLUSION

A FODMAP modified diet has been shown to improve IBS symptoms. With careful planning this diet can be nutritionally complete. Significant improvement in the quality of life for those suffering from IBS may promote diet compliance. Gastroenterologists should refer patients with IBS to a RDN for nutrition assessment, education, and diet planning. ■

References

1. Definition and Facts for Irritable Bowel Syndrome. National Institute of Diabetes and Digestive and Kidney Diseases website. National Institutes for Health, U.S. Department of Health and Human Services. <https://www.niddk.nih.gov/health-information/digestive-diseases/irritable-bowel-syndrome/definition-facts>. Updated November 2017. Accessed February 21, 2018.
2. Irritable bowel syndrome in adults: diagnosis and management of irritable bowel syndrome in primary care. Clinical Guideline 61. National Institute for Health and Clinical Excellence website. Available at: <https://www.nice.org.uk/guidance/cg61>. Updated April 2017. Accessed February 22, 2018.
3. Kanazawa M, Hongo M, Fukudo S. Visceral hypersensitivity in irritable bowel syndrome. *J Gastro Hep.* 2011;26(suppl 3):119-121.
4. Staudacher HM, Lomer MCE, Anderson JL, et al. Fermentable carbohydrate restriction reduces luminal bifidobacteria and gastrointestinal symptoms in patients with irritable bowel syndrome. *J Nutr.* 2012;142(8):1510-1518.
5. Halmos EP, Christophersen CT, Bird AR, et al. Diets that differ in their FODMAP content alter the colonic luminal microenvironment. *Gut.* 2015;64(1):93-100.
6. Chumpitazi BP, Cope JL, Hollister EB, et al. Randomised clinical trial: gut microbiome biomarkers are associated with clinical response to a low FODMAP diet in children with the irritable bowel syndrome. *Aliment Pharmacol Ther.* 2015;42(4):418-427.
7. Bennet SMP, Bohn L, Storsrud S, et al. Multivariate modeling of faecal bacterial profiles of patients with IBS predicts responsiveness to a diet low in FODMAPs. *Gut.* Published Online First: 17 April 2017.
8. Staudacher HM, Lomer MCE, Farquharson FM et al. A diet low in FODMAPs reduces symptoms in patients with irritable bowel syndrome and a probiotic restores bifidobacterium species: a randomized controlled trial. *Gastroenterology.* 2017;153(4):936-947.
9. Jones MP, Chey WD, Singh S et al. A biomarker panel and psychological morbidity differentiates the irritable bowel syndrome from health and provides novel pathophysiological leads. *Aliment Pharmacol Ther.* 2014;39(4):426-437.

10. Whelan K, Martin LD, Staudacher HM, et al. The low FODMAP diet in the management of irritable bowel syndrome: an evidence based review of FODMAP restriction, reintroduction, and personalization in clinical practice. *J Human Nutrition Dietetics*. 2018. Epub Ahead of Print.
11. Lacy BE, Mearin F, Chang L, et al. Bowel disorders. *Gastroenterology*. 2016;150(6):1393–1407.e5.
12. Svedlund J, Sjodin I, Dotevall G. GSRS—a clinical rating scale for gastrointestinal symptoms in patients with irritable bowel syndrome and peptic ulcer disease. *Dig Dis Sci*. 1988;33(2):129–134.
13. Lenhar A, Ferch C, Shaw M, Chey WD. Use of dietary management in irritable bowel syndrome: results of a survey of over 1500 U.S. gastroenterologists. *J Neurogastroenterol Motil*. Article in Press.
14. Bohn L, Storsrud S, Tornblom H, et al. Self-reported food-related gastrointestinal symptoms in IBS are common and associated with more severe symptoms and reduced quality of life. *Am J Gastroenterol*. 2013;108(5):634–641.
15. Hayes P, Corish C, O'Mahony E, et al. A dietary survey of patients with irritable bowel syndrome. *J Hum Nutr Diet*. 2014;27(Suppl 2):36–47.
16. Monsbakken KW, Vandvik PO, Farup PG. Perceived food intolerance in subjects with irritable bowel syndrome – etiology, prevalence and consequences. *Eur J Clin Nutr*. 2006;60(5):667–672.
17. 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(3):897–906.
18. Rao SSC, Yu S, Fedewa A. Systematic review: dietary fibre and FODMAP-restricted diet in the management of constipation and irritable bowel syndrome. *Aliment Pharmacol Ther*. 2015;41(12):1256–1270.
19. Altobelli E, Del Negro V, Angeletti P, et al. Low-FODMAP diet improves irritable bowel syndrome symptoms: a meta-analysis. *Nutrients*. 2017;9(9):940.
20. Varjú P, Farkas N, Hegyi P, et al. Low fermentable oligo-saccharides, disaccharides, monosaccharides and polyols (FODMAP) diet improves symptoms in adults suffering from irritable bowel syndrome (IBS) compared to standard IBS diet: A meta-analysis of clinical studies. *Stengel A, ed. PLoS ONE*. 2017;12(8):e0182942.
21. Zhan Y, Zhan Y, Dai S. Is a low FODMAP diet beneficial for patients with inflammatory bowel disease? A meta-analysis and systematic review. *Clin Nutr*. 2018;37(1):123–129.
22. Halmos EP, Power VA, Shepherd SJ, et al. A diet low in FODMAPs reduces symptoms of irritable bowel syndrome. *Gastroenterology* 2014;146(1):67–75.e5.
23. Ong DK, Mitchell SB, Barrett JS, et al. Manipulation of dietary short chain carbohydrates alters the pattern of gas production and genesis of symptoms in irritable bowel syndrome. *J Gastroenterol Hepatol*. 2010;25(8):1366–1373.
24. Staudacher HM, Lomer MCE, Anderson JL, et al. Fermentable carbohydrate restriction reduces luminal bifidobacteria and gastrointestinal symptoms in patients with irritable bowel syndrome. *J Nutr*. 2012;142(8):1510–1518.
25. Staudacher HM, Lomer MCE, Farquharson FM, et al. A diet low in FODMAPs reduces symptoms in patients with irritable bowel syndrome and a probiotic restores bifidobacterium species: a randomized controlled trial. *Gastroenterology* 2017;153(4):936–947.
26. Barret JS, Gibson PR. Clinical ramifications of malabsorption of fructose and other short-chain carbohydrates. *Pract Gastro*. 2007;53:51–52, 54–65.
27. Swagerty DL, Walling A, Klein R. Lactose intolerance. *Am Fam Phys*. 2002;65(9):1845–1850.
28. Lenhart A, Chey WD. A Systematic Review of the Effects of Polyols in Gastrointestinal Health and Irritable Bowel Syndrome. *Adv Nutrition*, 2017;8:587–96.
29. FODMAP Stacking Explained: Do Your Food Combinations Trigger Symptoms? Diet vs Disease website. Available at <https://www.dietvsdisease.org/fodmap-stacking-explained-food-combinations-trigger-symptoms/>. Accessed March 3, 2018.
30. Monash University FODMAP blog. <https://www.monash-fodmap.com/blog/update-bananas-re-tested/>. Accessed February 28, 2018.
31. McIntosh K, Reed DE, Schneider T, et al. FODMAPs alter symptoms and the metabolome of patients with IBS: A randomised controlled trial. *Gut*. 2017;66(7):1241–1251.

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