

How to Implement the 3-Phase FODMAP Diet Into Gastroenterological Practice

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Background/Aims

The 3-phase fermentable oligo-, di-, mono-saccharides, and polyols (FODMAP) diet has shown a high level of efficacy in irritable bowel syndrome, largely based on dietitian delivered education. However, access to dietitians can be limited, and challenges exist when applying the diet to a wide range of cultures, such as limited FODMAP analysis of local foods. This review aims to discuss ways to optimally use the FODMAP diet in practice in a wide range of cultures, directed at gastroenterologists from a dietitian's perspective.

Methods

Recent literature was analysed via search databases including Medline, CINAHL, PubMed and Scopus.

Results

The dietetic process involves detailed assessment and follow-up through the 3 stages of the FODMAP diet (restriction, re-introduction, and long-term maintenance). Emerging evidence suggests the diet can be delivered by other health professionals such as the gastroenterologist or nurse, but training on how to do so successfully would be needed. Self-guided approaches through use of technology or specialised food delivery services may be an alternative when dietitians are not available, but efficacy data is limited. Regardless of delivery mode, nutritional and psychological risks of the diet must be mitigated. Additionally, culturally appropriate education must be provided, with accommodations necessary when the FODMAP content of local foods are unknown.

Conclusion

While the diet has shown improved irritable bowel syndrome outcomes across studies, it is important to acknowledge the essential role of dietitians in implementing, tailoring, and managing the diet to achieve the best outcome for each individual.

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Key Words

Diet, carbohydrate-restricted; Diet, food, and nutrition; Diet therapy; Irritable bowel syndrome

Introduction

Irritable bowel syndrome (IBS) is a disorder of the gut-brain

interaction (DGBI), characterized by abdominal pain, bloating, constipation, and diarrhea¹ with a worldwide prevalence of 4.1% according to the Rome IV criteria.² Various physiological mechanisms have been suggested to contribute to the development of IBS,³

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including alterations to the intestinal microbiome⁴ and interaction of the central, autonomic, and enteric nervous systems.^{5,6} A wide variety of treatments are utilized in IBS management. This includes a range of pharmacological and non-pharmacological therapies such as gut-directed hypnotherapy⁷ and dietary modifications such, as the low fermentable oligo-, di-, mono-saccharides, and polyols (FODMAP) diet.⁸ Taking an integrated approach through utilizing a range of treatments has recently become the preferred option due to lack of ability to predict response in the individual.⁹ In this review paper, we analyze recent literature from search databases including Medline, CINAHL, PubMed and Scopus, to discuss how to implement the 3-phase FODMAP diet, paying attention to the role of the dietitian. We also provide recommendations for practice in a range of cultures, and where FODMAP data is scarce.

What Is the 3-Phase FODMAP Diet?

FODMAPs are types of short-chain carbohydrates found in a wide variety of foods. They comprise monosaccharides and polyols that are slowly absorbed in the small intestine, and di- and oligo-saccharides that are not digestible because of the lack of suitable hydrolases in the human small intestine or reduced/absent hydrolase activity in a proportion of the population (such as lactose, sucrose, and trehalase). Mono- and di-saccharides and polyols attract water into the intestinal lumen via their osmotic effect due to their relatively small molecular size.¹⁰⁻¹² and those passing into the colon are rapidly fermented by bacteria with the release of gas.¹³ Acutely, symptoms are generated by the distension of the intestinal lumen with water (small intestine) or gas (proximal colon), although other mechanisms are involved in modulating these responses in the

longer term.¹⁴⁻¹⁶

The traditional practice of implementing the FODMAP diet are to initially restrict all FODMAPs, ie, the low FODMAP diet, to determine its effect on symptoms, then, if symptomatic response is achieved, to develop a strategy for maintaining the benefits over the longer term with less restriction. Thus, the FODMAP diet involves a 3-stage strategy, restriction, reintroduction, and personalization, with the ultimate goal of maintaining symptom control while maximizing FODMAP intake, as outlined in Figure 1, which has been described in detail elsewhere.^{17,18} Other less restrictive variations of the FODMAP diet have been suggested for situations where nutritional adequacy or the ability to adhere to the FODMAP diet may be compromised.¹⁸ Such an approach has been variably termed the “bottom-up” or “FODMAP-gentle” approach, which involves restricting a limited number of foods that are highly concentrated sources of FODMAPs, and/or restricting foods high in specific FODMAPs if these are suspected of triggering symptoms.¹⁹ However, the efficacy of this approach on IBS symptoms has not been formally studied.

Proving the efficacy of the FODMAP diet poses challenges common to dietary intervention studies.²⁰ The first stage of the diet is amenable to randomized controlled trials (RCTs), which have been heterogeneous in design utilizing feeding or dietary counseling methodologies with a variety of comparator diets. However, these studies consistently show improvements in bloating, pain, and quality of life. When the studies are subjected to a network meta-analysis, the FODMAP diet is superior to other dietary interventions.²¹ Efficacy of the first stage of the diet in real-world clinical practice has also been demonstrated,²² while prospective observational studies show that mild FODMAP restriction in the third stage of the

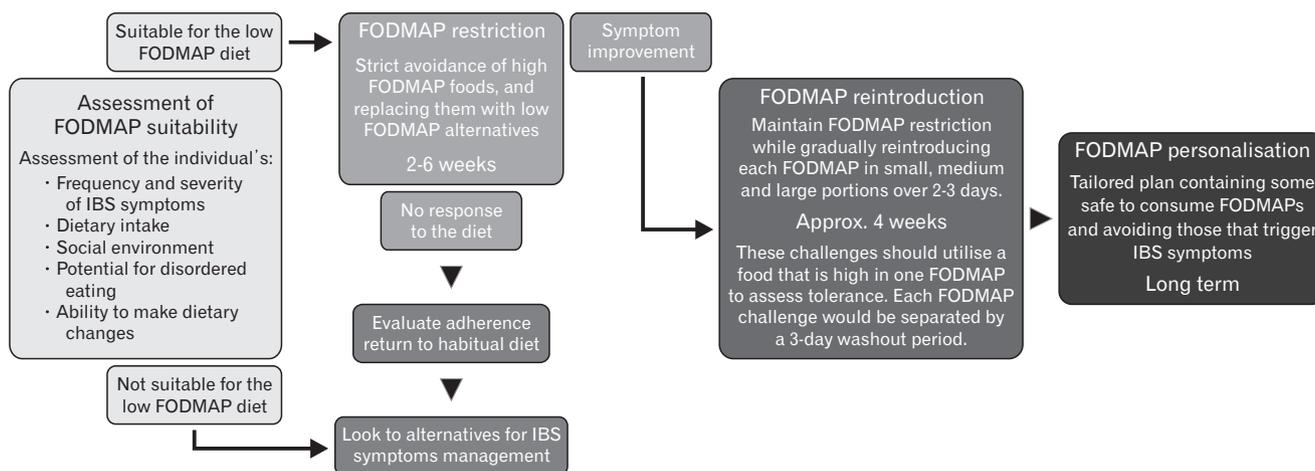


Figure 1. The stages of the fermentable oligo-, di-, mono-saccharides, and polyols (FODMAP) dietary strategy.

diet (personalized FODMAP diet), ameliorates symptoms in the majority of patients.²³⁻²⁶

Published analysis of RCTs and real-world experience have nearly all been related to dietitian-led interventions. While the FODMAP diet may not work for all individuals with IBS, as some may achieve better symptom reduction through other interventions, it is possible that, for others who do not experience symptom relief, this may be due to low adherence²⁷ or a poor understanding of the diet. In a retrospective evaluation of 80 patients with IBS, patient-led implementation of a FODMAP diet was linked to more than double the intake of FODMAPs during the restriction phase, than when dietitian-led. Additionally, patients supported by dietitians displayed significantly higher adherence through each stage of the diet.²² This exemplifies the importance of the dietitian in the implementation of the FODMAP diet.

The Dietetic Process—Clinical Management of Irritable Bowel Syndrome

The dietetic management of IBS predominantly takes place in an ambulatory setting, rather than in the acute setting. As illustrated

in Figure 2, dietitians can recognize dietary habits that may influence gastrointestinal (GI) function and, following detailed assessment, implement dietetic interventions, such as the FODMAP diet, where appropriate.

Initial Dietetic Consultation (60 Minutes)

Assessment (approximately 30 minutes)

During the initial consultation, the dietitian documents the individual’s clinical issues (validated tools such as the Rome IV criteria, which measures frequency and severity of symptoms,²⁸ and the Bristol stool form scale may be used²⁹) as a baseline for future assessment of response, and confirms that a DGBI is likely (especially in cases not referred from gastroenterologists) and that alarm features have been assessed. The dietitian would also assess the individual’s health and food knowledge and social environment, taking note of food preparation skills, personal responsibilities or social systems that may influence their ability to adhere to dietary advice; and dietary intake, taking note of FODMAP intake and potential triggers. Dietary intake may be measured utilising the Monash University Comprehensive Nutrition Assessment Questionnaire

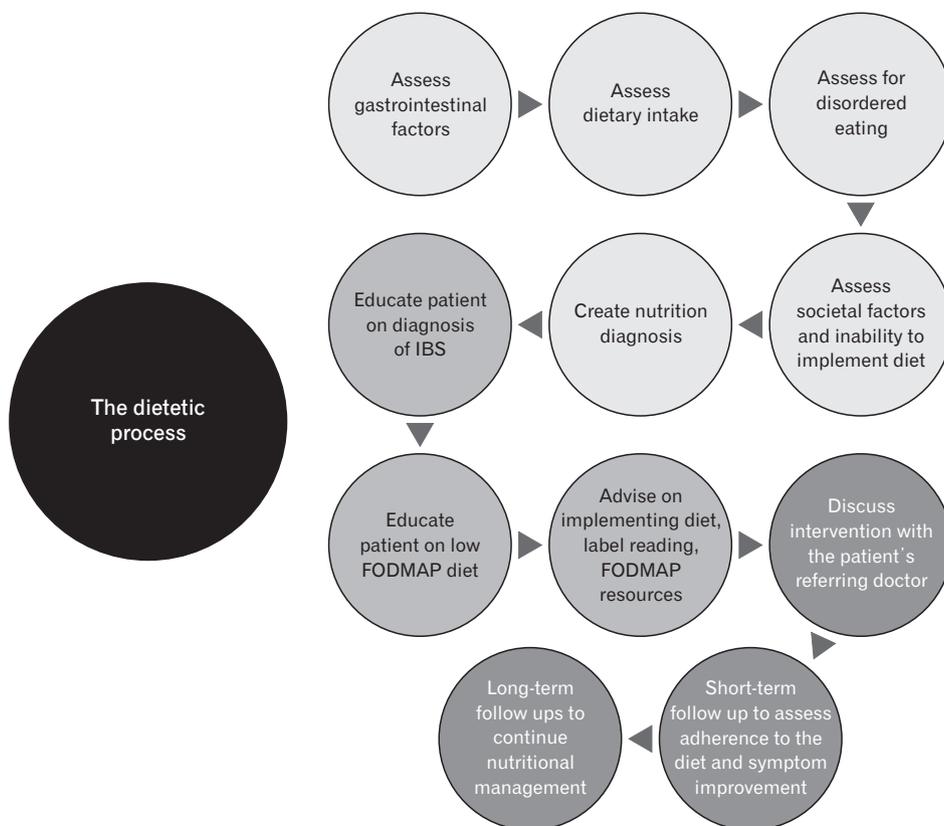


Figure 2. Summary of the steps involved in the dietetic process of patients with irritable bowel syndrome (IBS). FODMAP, fermentable oligo-, di-, mono-saccharides, and polyols.

(CNAQ), which is a food frequency questionnaire that can specifically measure FODMAP intake.³⁰ The CNAQ is available for use online, however at over 200 items long, it may be too cumbersome for regular usage in clinical practice. Alternatives may include conducting a 24-hour diet history with the patient or asking them to complete a 7-day food diary prior to attending the consult. This nutritional assessment may also involve screening for disordered eating as will be discussed in further detail below, using a validated tool such as the Sick, Control, One Stone, Fat, Food (SCOFF) questionnaire.³¹ During this session, the dietitian may produce a nutrition diagnosis to identify the nutritional problem that may be related to the individual's IBS. For example, a nutrition diagnosis may identify that the individual is consuming sufficient quantities of FODMAPs to render a FODMAP diet is a suitable intervention. Another example may be identification of a very low fiber intake that may in itself be a causal component of symptoms. Two of the important assessments made are the appropriateness of the implementation of a restrictive diet and its nature for that individual.³²

Education and intervention (approximately 30 minutes)

If deemed to be appropriate for the FODMAP diet, the dietitian would then educate the individual on normal gut physiology and the pathophysiology of DGBI, including relevant concepts of visceral hypersensitivity and altered bowel motility, what FODMAPs are, their mechanisms of action and food sources. They would also provide the patient with information to implement the initial stage of the diet including suitable low FODMAP alternatives to incorporate. The dietitian would then add suitable adjustments to the diet needed for existing dietary restrictions, such as vegetarian or certain uncontrolled environments, such as dining out. This may involve providing printed diet sheets or recommending resources to assist with identifying high FODMAP foods³³ including label reading to identify foods likely high in FODMAPs, and recipe modification. While there are many written educational resources on the FODMAP diet available, it is important that these are screened and described to patients by qualified dietitians, as patients have reported a low level of understanding when given these resources by gastroenterologists and general practitioners alone,³⁴ and diet sheets lack personalization to the patients usual diet. Digital resources may also be utilized and recommended to patients including the Monash University FODMAP Diet app, which provides comprehensive and up-to-date information about the FODMAP content of food, and other useful resources such as background education on the role of FODMAPs in DGBIs.

It is important to note that the dietitian uses their clinical knowl-

edge to provide nutrition education that is tailored and appropriate for each patient. This may not always align with the recommendation of the referring doctor. For this reason, it is important for the lines of communication between dietitian and referrer to be open to ensure the best outcome for the patient.

Short-term Dietetic Follow-up (2-8 Weeks Since Initial Appointment, Approximately 30-45 Minutes per Appointment)

Following this first consultation there would be a short-term follow up at the conclusion of the "restriction" phase of the diet, to assist the patient with implementing "reintroduction."²⁷ Clinical assessment at this stage may involve measuring IBS symptoms and assessing adherence to the dietary modifications. If there has not been adequate symptom reduction by this stage, this may be an indicator that there has been low adherence, or that the diet is ineffective for this individual. If the latter is the case, the best practice is to cease implementation of the diet and look to other potential therapies. The dietitian may then refer the patient back to the gastroenterologist or primary care physician who may recommend alternative therapies such as gut-directed hypnotherapy or pharmacological support for specific symptoms.⁷ In integrated care, such referrals may occur directly from the dietitian. For those patients continuing the diet, depending on the requirements of the individual, regular short-term follow-ups may occur throughout the "reintroduction" phase to assist with implementation and addressing challenges with reintroduction. For other individuals, only a final follow-up consultation to administer "personalization" may be required.

Long-term Dietetic Follow-up (Approximately 30-45 Minutes per Appointment)

The "personalization" phase involves evaluating the impact of the FODMAP diet on the patient, and tailoring a long-term diet that encourages nutritional adequacy and avoidance of the FODMAPs that trigger IBS symptoms for the individual. Prospective evaluation of patient cohorts in this stage have found adequate symptom relief and quality of life improvement.^{23,24,35} Considering that the FODMAP diet is restrictive during the initial stages, it is important that the long-term personalised FODMAP diet is more flexible. The patient should be encouraged to continue to reintroduce poorly tolerated high FODMAP foods periodically to reassess tolerance, as tolerance may change over time. Education may also be centered around application of non-dietary DGBI therapies and how they may be combined with dietary therapy. For example, how peppermint oil, antispasmodic agents, and α -galactosidase³⁶⁻³⁹

may be used to reduce symptoms and allow more FODMAP flexibility in uncontrolled eating environments. These additional strategies may be targeted to individual requirements, such as the use of α -galactosidase in galacto-oligosaccharides sensitive individuals requiring vegetarian protein sources such as legumes and pulses.

Since the severity of symptoms fluctuates over time, patients are advised that FODMAP restriction can be increased or decreased according to their needs. Using such strategies in the long-term, FODMAP intake generally normalizes to include tolerated high FODMAP foods.²⁵ However, episodes of high FODMAP intake (FODMAP “binges”) are generally avoided.

Mitigating Risks of the FODMAP Diet

A FODMAP diet is a restrictive diet and this poses nutritional and psychological risks for the patient. Strategies to mitigate these risks are highlighted in Table 1.

Nutritional Risks

Since FODMAPs are naturally found in a large variety of commonly consumed foods, strict long-term FODMAP avoidance may result in nutritional deficiency. In a study of over 3000 patients, those who adhered strictly to the FODMAP diet in the “restriction” phase recorded significantly lower intakes of calcium, magnesium, vitamin C, folate, and riboflavin than those who adhered less strictly,⁴⁰ suggesting that individuals may develop deficiencies if they were to follow this stage of the diet longer than necessary. To reduce the risk of nutritional deficiency, dietitians should encourage the substitution of high FODMAP foods with nutritionally equivalent

FODMAP alternatives. For example, substituting a high FODMAP dairy product, such as cow’s milk, with a FODMAP dairy alternative, like lactose free cow’s milk or calcium-fortified soy protein milk. Notably, patients who follow the diet without guidance from a professional record significantly lower intakes of beta-carotene, riboflavin, calcium, magnesium and phosphorus than those who are guided.⁴¹ This again exemplifies the importance of the dietitian.

Some short-term studies have indicated that fiber intake may be reduced during the initial restrictive phase of the FODMAP diet.^{42,43} However, other studies have shown maintained fiber intake,^{44,45} and intake is often improved in longer-term studies that include the reintroduction and long-term personalization phases.^{23,25,42} Constipation did not improve following a physician-led FODMAP diet, possibly due to inadequate education about fiber intake, although dietary intake was not measured.⁴⁶ Due to the many health benefits of fiber, and the knowledge of potential short-term reductions in intake, regardless of how the FODMAP diet is delivered, it is key that patients are educated on ways to maintain or improve fiber intake. However, considering the time involved and expertise required to adequately educate patients on suitable fiber sources in IBS, dietitians are likely best placed to provide this. The alternative is to use fiber supplements. A recent RCT has indicated that a minimally fermented fiber (sugarcane bagasse) can improve stool characteristics without exacerbation of other symptoms.^{47,48} If the desire is to add a fermentable fiber such as resistant starch, this can generally be tolerated when combined with a minimally fermented fiber to slow fermentation down in the colon.^{47,48}

Psychological Risks

As the initial stage of the FODMAP diet is restrictive, it has been suggested that it may impact emotional and mental health.³² A population study of nearly 3000 individuals found that those with GI diseases on therapeutic diets displayed lower health-related quality of life, but the results were not statistically significant.⁴⁹ Specifically, the gluten-free diet in patients with celiac disease has been linked to food-related anxiety and social exclusion, especially upon initial diagnosis of the disease.⁵⁰ However, these feelings appear to dissipate over time as the individual gains knowledge and the confidence to self-manage their diet.^{51,52} As a diet that can alter and normalize over time to suit an individual’s lifestyle while still managing their IBS symptoms, it is unclear if the FODMAP diet carries similar social stigma, although a recent study of 205 participants in the long-term personalization stage of the diet experienced lower food related quality of life than controls.⁵³ Unlike celiac disease, in

Table 1. Summary of Key Recommendations to Minimize the Negative Consequences of Restrictive Diets

1. Ensure the patient is given a clear diagnosis before commencing diet therapy.
2. Establish an effective partnership with the treating team.
3. Set clear expectations of symptom outcomes.
4. Weigh risks and benefits of a restrictive diet.
5. Aim for nutritionally equivalent substitutions.
6. Screen for eating disorder risk.
 - a. Refer on to eating disorder health professionals, or refer back to their medical practitioner for further management.
 - b. Consider alternative diet or non-diet therapies in patients at risk of developing an eating disorder.
7. Use language thoughtfully. Avoid labelling foods as “good” or “bad,” “safe” and “unsafe” as this language can contribute to food related fear and feelings of guilt or shame.

which ingestion of gluten has pathological consequences such as mucosal damage,⁵⁴ consuming FODMAPs in IBS may be associated with symptoms after the meal, but no evidence has suggested that these symptoms are related to mucosal damage, and they can be managed. This risk of more serious consequences when ingesting gluten may account for the psychological impacts. High quality studies are required to examine the social effects of the FODMAP diet.

On the other hand, it is important to acknowledge the high risk of disordered eating behaviors in this patient group. An individual may have disordered eating if they demonstrate irregular eating behaviours that do not fit the criteria for an eating disorder as defined by the Diagnostic and statistical manual of mental disorders, fifth edition.⁵⁵ This may include calorie counting or skipping meals to an extent that impacts their health or nutritional status.^{32,56} Severe IBS symptoms are associated with higher rates of disordered eating in adolescents⁵⁶ and adults.⁵⁷ One study of 45 adults with IBS found that 71% were classified as having an actual eating disorder when measured by the SCOFF questionnaire.⁵⁸ Likewise, when specifically examining the FODMAP diet, it was found that 57% of IBS patients classified as having an eating disorder closely adhered to the “restriction” phase of the diet for 6 weeks, while 36% of those who did not have an eating disorder closely adhered.⁵⁹ The SCOFF was designed for, and has been validated in, individuals with anorexia and bulimia nervosa.³¹ However, the eating disorders that are thought to be associated with IBS are those linked to restrictive food choices rather than body dysmorphia, such as avoidant restrictive food intake disorder (ARFID) or orthorexia nervosa. Hence, the accuracy of data generated using the SCOFF is uncertain.

ARFID is defined as the fear of eating specific foods or food groups due to sensory characteristics or the potential adverse consequences of consuming foods.⁵⁵ Dietitians have suggested that individuals with IBS may be at risk of ARFID, due to their strict avoidance of specific foods that may trigger GI symptoms.⁶⁰ While an emerging area of research, clinical trials have reported an ARFID prevalence of 13-21% in individuals with DGBIs.^{61,62} Notably, 44% of individuals with ARFID had previously been prescribed a FODMAP diet by their gastroenterologists to manage their symptoms.⁶² However, it was not mentioned if these patients had also seen a dietitian for guidance. Moreover, orthorexia is characterized by restricting foods based on perceived health quality.⁶³ Similar to ARFID research, orthorexia is still a novel concept. However, preliminary research has found that IBS symptom severity may be positively correlated with orthorexia.^{58,64} Various screening tools have been developed to assess risk of ARFID and orthorexia,

but none have been validated in IBS. Considering that groundwork research has indicated a relationship between IBS and eating disorders, future research should explore this link further.

As mentioned, patients with IBS should be screened for eating disorders at the initial assessment. Individuals who are found to be classified as having an active eating disorder should not be placed on a FODMAP, or other restrictive diet, and clinicians should instead advise of alternative therapies to manage their symptoms.⁶⁰ Additionally, clinicians may refer these patients to experienced eating disorder dietitians and psychologists.³² In IBS patients who are not classified as having an eating disorder, but are at risk or exhibit disordered eating behaviours, a discussion of the risks and benefits of restrictive diets is warranted, along with recommendations of alternative diet or non-diet therapies. The FODMAP-Gentle approach may be suitable¹⁸ with long-term studies showing that good symptom management is achieved when patients restrict only a small number of very high FODMAP foods.^{53,65}

The Problem of Printed Diet Sheets

IBS patients are often provided with printed diet sheets to educate on the FODMAP diet. The inadequacy of these printed sheets was highlighted in a small qualitative study from the United Kingdom. Eight IBS patients who were handed printed diet sheets by their general practitioner or gastroenterologist were asked about their real-world experience. Patients reported that the sheets were overly simplistic, often just “food lists” with little or no personalization to accommodate social, cultural or family needs, and that the non-personalized nature of these sheets reduced their utility.³⁴

A one-size-fits-all approach to restrictive diets is inadequate for several reasons. First, diet sheets include inaccurate information and often there are discrepancies between different diet sheets, as there are in published papers,⁶⁶ compounding patient confusion.³³ Secondly, food composition data included in these sheets quickly becomes out-dated, unlike data in digital applications that are updated regularly. Thirdly, food lists are limited in the breadth of foods they cover and fail to account for socially and culturally diverse eating habits. Fourthly, lists indicate high vs low FODMAP content on the basis of standard servings and do not consider individuals who consume larger portions, which can alter the FODMAP rating from low to high. Fifthly, supermarkets contain thousands of packaged and processed foods. The FODMAP content of these cannot be communicated via a simple food list and deciphering FODMAP content from food labels is complex and therefore difficult for many patients.⁶⁷ Furthermore, the actual FODMAP intake of

a processed food may not be predictable according to the food label list of ingredients. The last two issues have been partly addressed on the Monash University FODMAP Diet app by using an orange symbol for borderline content and by including some processed and packaged foods where the ingredients remain constant. Lastly, diet sheets provide no context as to why the foods are restricted, how this may be manipulated for individual differences and how the food lists relate to their diagnosis. This may fuel misunderstanding on the use of dietary therapy, diminish compliance and potentially compound the risks outlined above.

The Importance of a Multidisciplinary Team, Including a Dietitian

While gastroenterologists may be the initial contact for patients with GI disorders, treatment response is improved when the patient is managed by a multidisciplinary team. This was highlighted in a study which showed that 84% of GI patients managed by a multidisciplinary team (including a gastroenterologist, dietitian, hypnotherapist, psychiatrist, and physiotherapist), experienced symptom improvement, compared to 57% managed by the gastroenterologist alone.⁶⁸ Another recent study of 35 patients provided with FODMAP diet education via the physician, rather than dietitian, suggested that, while understanding of the diet was adequate and symptoms were improved, lack of dietitian involvement resulted in poor compliance, with only 52% reporting they followed the diet most of the time.⁴⁶ Additionally, more than 3 patients out of 4 reported they wished to see a dietitian at least once, highlighting the importance of a multidisciplinary approach including a dietitian. Despite this evidence, clinical practice does not always utilize a multidisciplinary approach.

Addressing the Barriers to Dietetic Involvement

Although the value of dietetic input is now recognized in clinical guidelines, this is not universal.⁶⁹ For example, while the American College of Gastroenterology recommends use of the FODMAP diet administered only by dietitians,⁷⁰ the Korean and Japanese guidelines make no mention of dietitians and only recommend limited use of dietary therapies in IBS.^{71,72} Moreover, a survey of gastroenterologists found that, while 60% agreed that patients associated dietary intake with IBS symptoms, only 21% regularly referred to dietitians. Additionally, over half of gastroenterologists recommended the FODMAP diet to patients,⁷³

Table 2. When to Refer to a Dietitian (Adapted From Simons et al³²)

- Patients who intend to start a FODMAP diet
- Patients who are already on the FODMAP diet but are stuck in stage one and have failed to challenge or re-introduce foods, especially where the FODMAP diet is self-managed
- Patients who are following multiple restrictive diets simultaneously, eg, FODMAP diet plus gluten-free or vegetarian diet
- Patients at risk of or have malnutrition (have experienced 5% weight loss in 1 month or 10% weight loss in 6 months)
- Patients with disordered eating behaviors
- Patients with chronic health issues that require medical nutritional management such as diabetes

FODMAP, fermentable oligo-, di-, mono-saccharides, and polyols.

suggesting they may appreciate the importance of diet therapies, but not the value of a dietitian. Recent studies conducted in Australia and the United States have reported that the barriers to dietetic referral include a lack of access to specialised dietitians, a poor understanding of their role, and the out-of-pocket costs for patients due to limited insurance coverage of dietetic services.^{74,75} Therefore, it is essential that both gastroenterologists and dietitians advocate for the role of dietitians in this specialized fields, as 78% of non-complex GI patients could be managed exclusively by a dietitian.⁷⁶ Simons, Taft, Doerfler, Ruddy, Bollipo, Nightingale, Siau, van Tilburg³² proposed guidelines to assist doctors to determine when they should refer IBS patients to dietitians, as presented in Table 2.

Professional Standards for Gastrointestinal-experienced Dietitians

As the role of dietitians in GI disorders involves evaluation of the patient and providing an individualised approach, it should be appreciated that the understanding of, and experience in managing, such disorders, in terms of pathophysiology, differential diagnosis, and therapeutic options is essential to achieve optimal patient outcomes. Unfortunately, there is no formal training program for GI dietitians, and specialization in the field is generally related to the amount of clinical experience and professional development undertaken by the individual. Hence, it is difficult to discern what is a “GI dietitian”. An Australian survey revealed that 30-51% of currently practicing dietitians in the state of Victoria, stated that they were involved in the management of patients with IBS, celiac disease, liver disease, inflammatory bowel disease, food allergies and other disorders associated with the GI tract.⁷⁷ However, the level of GI training of the dietitians surveyed was not explored, and to describe all those working in GI and food allergy spaces

as “GI dietitians” is inaccurate, and could be likened to calling all primary care physicians “gastroenterologists” because they deal with GI problems in some of their practice. Formalization of the specialization in GI dietetics is clearly needed.

Professional development courses are available for dietitians to upskill in the field. In Australia, 2 such courses include the Monash FODMAP online course and the Dietitians Australia Centre for Advanced Learning course on GI nutrition provide specific education to dietitians about IBS and dietary therapies. While these courses exist, there is no accreditation to provide formal recognition of GI dietitians. In other areas of dietetics in Australia such as sports dietetics, completion of an internationally recognised course combined with at least 1 year of practical experience in the field can qualify a dietitian to become an accredited sports dietitian. This type of accreditation could be applied to GI and may be a way forward in the future to provide formal recognition.

How to Deliver the Diet in Areas Where Dietitians Are Not Available?

Numerous papers and clinical guidelines now specifically recommend dietitian-led delivery of the FODMAP diet.^{65,70,78-81} However, in situations where dietitian availability is limited or patients choose a self-guided approach, several considerations may be made depending upon the scenario.

(1) Access to dietitians is limited: In many parts of the world, face-to-face dietitian consultation is not possible due to lack of trained dietitians in practical proximity. Telehealth may be an appropriate solution. In recent years, telehealth has emerged as a mainstream tool to access healthcare remotely^{82,83} and recent experience has indicated that guidance through the FODMAP diet by a dietitian online is both feasible and successful (personal observations). However, limited internet access and/or technical skills may prevent some patients from engaging in telehealth.

(2) Availability of dietitians is limited: Dietary consultation/education is a time-consuming process (as outlined above) and, given the prevalence of IBS in the community, too few dietitians may be available to manage the patient load. In this setting, group education sessions on the FODMAP diet is an alternative that may be as effective as one-on-one counselling in reducing IBS symptoms in 54-60% of selected participants, assuming they are pre-screened for suitability (thus excluding patients with atypical symptoms, complex health issues, and/or language barriers).⁸⁴ However, relevant considerations include that there is limited capacity to individually assess and tailor advice to patients in a group setting.

Therefore, in practice, one-on-one counselling should be available alongside group dietetic education, so that patients unsuitable for group education can access the individualized dietetic care they need.

(3) Delivery of FODMAP dietary education by other health professionals: There is no impediment to other health professionals who are properly trained in the FODMAP strategy delivering this diet, although less evidence supports this approach and efficacy data are more mixed.^{41,85} Suitable health professionals may include GI nurses or gastroenterologists. For example, one study reported that participants guided by IBS and FODMAP-trained nurses reduced their intake of FODMAP-containing foods,⁸⁵ while others reported improved quality of life and IBS symptoms.^{41,86} Gastroenterologists may also successfully deliver the diet, with 1 observational study showing that patients with IBS who followed a gastroenterologist-taught FODMAP diet experienced improved IBS symptoms, with apparent ongoing adherence. The gastroenterologist in this study clearly followed a protocol that would have required considerable time and training before such an intervention was made available. Other aspects regarding assessment were not addressed. The learnings from this study are that the doctor (or other health professional) can successfully deliver a FODMAP diet, but that training on how to do so successfully would be needed. Such education is readily available on-line, as outlined above for dietitians wishing to up-skill.⁸⁷

(4) Self-guided approach: Across the world, this seems a common approach, although the success this strategy is suboptimal according to the limited study of such outcomes.²² Challenges include identifying quality information amidst the masses of inaccurate information available online, and patients are unlikely to mitigate the risks of this diet, as outlined above. While printed diet sheets may be used as a guide, these are often overly simplistic, lacking personalization and nothing but food lists of high and FODMAP foods of questionable accuracy. More detailed guidance on how to follow the 3-phase FODMAP diet is available in books, booklets and digital applications, such as the Monash University FODMAP Diet app, which also provides up-to-date information about the FODMAP content of food. An online course for patients was designed by the Monash University FODMAP team to supplement and reinforce professional advice, and potentially may be used where professional coaching is not available. The success of this course in enabling people to independently follow the 3 stages of the FODMAP diet has not undergone formal evaluation, but at least the information is from a reliable source.

(5) Utilizing specialised food delivery services: The use of

ready-made meals delivered to your home has become popular when weight loss is the goal in those with the means to pay. Similarly, services that deliver low-FODMAP meals are available in Australia and the United States and provided by a range of companies. They offer a convenient means of determining the symptomatic success of FODMAP restriction and potentially make the reintroduction phase easier. Ideally however, they would be accompanied by dietetic education to upskill the patient in appropriate food selection and to ensure a suitable diet that both provides symptomatic relief and mitigates risks of nutritional inadequacy and disordered eating practices is established for the long-term. Furthermore, symptoms can still occur with the consumption of these ready-made meals, particularly with those that are not certified for FODMAP content.

Culturally-appropriate FODMAP Diets

Potential benefits of the FODMAP diet for patients with IBS appear to stretch across all continents, with the exception of Africa from which there have been no reports. RCTs of the FODMAP diet have been conducted in Australasia, North America, Europe, Middle East, some countries in Asia,^{42,88-90} although the number of studies is limited. Uncontrolled observations have suggested efficacy of the FODMAP diet in Central America⁹¹ and association of high FODMAP foods with symptoms have been made in South America.⁹² It does appear that the moderate intake of FODMAPs (sufficient to enable the benefits of their restriction to manifest) stretches across most cultures, with the exception of Japan where efficacy of the diet has yet to be reported, and an association study of perceptions of the relationship of specific food intake and lower GI symptoms suggested that FODMAPs were not a problem, although such interpretation of the findings was highly speculative.⁹³ Table 3 outlines staple high-FODMAP and low-FODMAP alternatives of different cultural diets including Western, Mediterranean, Middle Eastern, East Asian, and South Asian diets. More data are needed for African, Asian, Middle Eastern, and South American diets.

Despite evidence revealing its efficacy, there are challenges in implementing the FODMAP diet into different cultures. Some cultures hold specific food beliefs that can differ from the FODMAP diet. For instance, Chinese Food Therapy classifies foods based on the perceived reaction they have in the body and recommends treating GI conditions using Traditional Chinese Medicine, which may not align well with FODMAP principles.¹⁰³ Additionally, in many cultures, such as South Asian, it is not common to mea-

sure ingredients and portion sizes, and meals are commonly served with side dishes that are shared amongst a table.⁹⁴ This can make it difficult to measure an individual's consumption of FODMAPs. Also, detailed review of food content in South and East Asia have revealed many foods of unknown FODMAP content.^{94,95} Some foods that are staples in Asian cuisine are high in FODMAP content, such as garlic and legumes/pulses, which can make it challenging to adequately implement the diet. However, strategies such as using garlic alternatives eg, chives, ginger or garlic-infused oil rather than whole garlic can be applied.⁹⁵ Additionally, both food processing and cooking methods have been shown to alter the FODMAP content of foods,¹⁰⁴ which may be a useful strategy to reduce the effects of some high FODMAP foods. For example, the use of legumes in condiments are prevalent in Asian cooking and may have reduced FODMAP content, such as fermented beans, depending on the length and type of fermentation process utilised. Alternatively, a trial-and-error approach to test for individual tolerance can be used for recipes that utilize ingredients whom FODMAP content is uncertain. Such region-specific differences require ongoing research and thought.

Implementing the Diet When the FODMAP Content of Food is Unknown

The success of the FODMAP diet strategy is contingent on patients and clinicians having access to accurate FODMAP composition data, derived from laboratory analyses using well established techniques.^{96,97} Monash University has a large database describing the FODMAP content of food, made accessible via the Monash University FODMAP Diet app. While Monash University has sourced and tested food from all over the world, the majority of food listed in the app are from Western nations, including Australia, Europe and the United States, with a smaller fraction of food sourced from Asian countries.

Despite this, some foods listed in the Monash App are common to both Asian and Western countries, many of which can be consumed in a low FODMAP serve. Examples include breads and cereals such as rice and rice noodles; fruits such as durian, dragon fruit, and pawpaw; vegetables, legumes and nuts such as bok choy, tofu, and peanuts; herbs and spices such as curry leaves and saffron; and dairy/alternatives such as soy milk. Foods containing minimal carbohydrates will also have little in the way of FODMAP content. Examples include protein-rich foods such as plain red meat, fish, poultry and eggs, and fats and oils such as peanut oil, sesame oil, and ghee.

Table 3. Staple Fermentable Oligo-, Di-, Mono-saccharides, and Polyols-containing Foods Across Different Cultural Diets

FODMAP diets	Galacto-oligosaccharides	Fructo-oligosaccharides	Excess fructose	Lactose	Polyols	Staple low FODMAP foods
Western diet ⁹⁶⁻⁹⁸	Lentils Chickpeas Broad beans Kidney beans Pistachio Almonds	Wheat Onion Garlic Spring onion Pomegranate Watermelon Zucchini	Banana Mango Watermelon Honey Jam	Cow's milk	Sweet potato Avocado Mushroom Watermelon Eggplant Apple	Rice Peanuts Tomato Fish/meat/chicken Cucumber Spinach Red capsicum Potato
Mediterranean diet ^{99,100}	Lentils Chickpeas Broad beans Kidney beans Pistachio Almonds	Wheat Onion Garlic Pomegranate Watermelon Zucchini Pistachio	Watermelon Fig Honey	Cow's milk	Mushroom Watermelon Eggplant Green capsicum	Peanuts Tomato Fish/meat/chicken Cucumber Spinach Red capsicum Olives Olive oil Potato Wine
Middle Eastern diet ^{101,102}	Lentils Chickpeas Broad beans Kidney beans Tahini Pistachio	Okra Wheat Couscous Bulgur Onion Garlic Spring onion Dates Pomegranate Watermelon Zucchini Molasses	Banana Mango Watermelon Molasses Fig	Cow's milk Goat's milk	Watermelon Eggplant Green capsicum	Pumpkin seeds Sesame Rice Peanuts Tomato Fish/meat/chicken Spinach Pine nuts Cucumber Red capsicum Olives Olive oil Ghee Camel's milk
East Asian diet ^{93,95}	Lentils Chickpeas Soy bean milk Soy beans Bitter melon Silken tofu Wasabi Taro	Jackfruit Silken tofu Onion/shallot Garlic Wheat Watermelon	Banana Mango Jackfruit Watermelon Nashi pear	Cow's milk	Wasabi Mushroom Watermelon Coconut Nashi pear	Soy protein milk Mung bean Rice Rice noodles Peanuts Sesame Soy sauce Fish sauce Hard tofu Bok choy Guava Plantain Durian Fish/meat/chicken Rice bran oil
South Asian diet ⁹⁴	Lentils Chickpeas Beetroot Soy bean milk Almonds Silken tofu	Onion/shallot Wheat Beetroot Okra Spring onion Dates Pomegranate Silken tofu Watermelon	Banana Mango Jackfruit Watermelon	Cow's milk Goat's milk	Sweet potato Avocado Coconut Watermelon Eggplant	Soy protein milk Rice noodles Pumpkin seeds Sesame seeds Peanuts Tomato Fish/meat/chicken Ghee Hard tofu

FODMAP, fermentable oligo-, di-, mono-saccharides, and polyols.

The FODMAP diet differs markedly in different geographic locations, so dietitians must use the available food composition data to construct nutritionally adequate, culturally appropriate FODMAP diets. Where food composition data are lacking, dietitians can take one of two approaches. The first approach would be to assume foods with unknown FODMAP content are suitable to consume and only restrict foods known to be high in FODMAPs initially. Restriction of foods with unknown FODMAP content would only be needed if symptom response is inadequate. The second approach would be to initially restrict both foods known to be high in FODMAPs and foods of unknown FODMAP content. The usual reintroduction approach can be used to determine tolerance of foods with known FODMAP content.¹⁷ For foods of unknown FODMAP content, a “test to tolerance” approach can be used, whereby the patient would wait until symptoms are well controlled, then include a small amount (about one-third usual serving size) daily for 3 days. If the food is tolerated it would be considered suitable to include for that individual.

Conclusion

The structure of, and considerations around implementing the FODMAP diet are now well described and understood. While the diet has consistently shown improved IBS outcomes across clinical studies, it is important to acknowledge the essential role of dietitians in implementing, tailoring and managing the diet to achieve the best patient outcome. Dietitians are indispensable members of the GI multidisciplinary team, and more attention should be given to creating an internationally recognised accreditation for GI-specialized dietitians. In limited scenarios where dietitian access or availability is lacking, a combination of approaches may be considered including telehealth or group education with a dietitian, utilisation of accurate FODMAP resources, or undertaking specialized training for non-dietetic health professionals. Whichever approach is used, care should be taken to mitigate any risks arising with long-term use of a FODMAP diet.

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