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Dietary management of irritable bowel syndrome: considerations, challenges and their mitigation

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Contributions

KW and HS planned the review. All authors shared equally in writing sections of the review. KW synthesised and edited the review. All authors provided critical comment and approved the review for publication.

Conflicts of Interests

KW has received research grants related to diet and gut health and disease from Almond Board of California, Danone, and International Nut and Dried Fruit Council and has received speaker fees from Danone and Yakult. KW is the holder of a joint patent to use volatile organic compounds as biomarkers in irritable bowel syndrome (PCT/GB2020/051604) for which there is currently no product on the market. In the event of commercialisation into a product, the institution and inventor would receive royalties. KW receives royalties from Wiley Publishing in relation to an academic textbook on nutrition and dietetics in gastroenterology.

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Abstract

Diet is a cornerstone in the management of irritable bowel syndrome (IBS). There is evidence of effectiveness across the spectrum of dietary management strategies, including some supplements (e.g. specific fibres), foods and whole diets (e.g. low FODMAP diet). Whole diet interventions, in particular those that restrict intake, can be challenging to deliver effectively and safely. Factors to consider include patient demographics, food cost and availability, and the acceptability of dietary management, and its impact on foodrelated quality of life. There is concern regarding a potential role of restrictive whole diet interventions in eating disorder risk. The optimal approaches to delivering dietary management in the healthcare setting are unclear. The aim of this review is to summarise the clinical evidence for dietary management of IBS, to discuss the challenges, burdens and risks of dietary management and to propose how these should be mitigated and minimised in clinical practice.

Keywords

Irritable bowel syndrome; disorders of gut-brain interaction; diet; dietitian; FODMAP.

Search strategy and selection criteria

References for this review were identified through searches of PubMed with search terms including combinations of 'irritable bowel syndrome', 'diet', 'nutrition', 'challenges', 'education', 'psychology' and 'eating and feeding disorder', from database inception with a final search date of 8th May 2024. Articles were selected without any restriction on date, although those most relevant to the review and to current clinical practice were prioritised. Additional articles were identified through searches of the authors' own files. Only papers published in English were reviewed. The final reference list was generated on the basis of relevance to the broad scope of this review, and based upon study originality and rigour, with the understanding that evidence for clinical efficacy can come from multiple quality clinical trials, whereas evidence of application to practice may be from lower quality studies, and therefore the 'best available evidence' was used where possible. Where insufficient studies were available, the combined expertise of the authors' was used to comment on challenges and solutions in clinical practice.

Introduction

Irritable bowel syndrome (IBS) is a disorder of gut-brain interaction (DGBI) with a global prevalence of 4.1%¹ characterised by recurrent abdominal pain associated with a change in either stool frequency or consistency. ² IBS pathophysiology is incompletely understood but involves altered gut physiology via the gut-brain axis, including altered gut microbiome and motility, as well as heightened visceral sensitivity to luminal content. ² Although not life threatening, IBS is not a benign disorder. Compared with healthy controls, people with IBS report impairments across all domains of health-related quality of life³ and anxiety and depression have been reported in 23%.⁴ Management of IBS can include symptom-directed pharmacotherapy ⁵ and psychological management of the gut-brain axis.⁶

Diet has become a cornerstone of IBS management, driven by an increase in research supporting its use and the preference among patients for non-pharmaceutical strategies to alleviate symptoms. ⁷ Although diet may be viewed as a low cost, low burden, low risk intervention there are challenges that clinicians should consider prior to recommending dietary management in IBS. The aim of this review is to summarise the clinical evidence for dietary management of IBS, to discuss the challenges, burdens and risks of dietary management and to propose how these should be mitigated and minimised in clinical practice.

Current evidence for dietary management

Many patients with IBS attribute symptoms to components of their diet. ⁸ Dietary management can occur across a spectrum ranging from supplements (sachets, capsules, e.g., fibres, prebiotics), foods (increase or decrease in quantity or modification in type of one or two foods) or whole diet interventions (increase or decrease in quantity or modification in type of multiple food groups). The evidence for these is summarised in **Table 1** and summarised below.

Table 1 should be inserted close to here

Dietary fibres are naturally occurring, extracted, or synthetic carbohydrate polymers that are not hydrolysed by endogenous enzymes in the small intestine of humans, and consist

of ≥ 10 monomeric units (with the option of ≥ 3 monomers as agreed by national authorities). ¹³ Fibres can be described as soluble or insoluble, although categorisation based upon other physicochemical characteristics (e.g., viscosity or fermentability) is more relevant to their functional effects in the gut. ¹⁴ Fibre may have beneficial effects in IBS arising from increasing stool bulk, accelerating gastrointestinal transit and gut microbiota modulation. ¹⁴ The majority of clinical trials of fibre in IBS use dietary supplements. In a meta-analysis of 14 RCTs, ispaghula husk (psyllium), a viscous, and partially fermentable fibre, was of global benefit in IBS, but bran was no better than placebo (**Table 1**). ⁹ Best practice recommendations, based upon expert opinion only, advise fibre supplements commence at low dose and increased slowly to optimise tolerability; e.g., increase by 3 g/d every 2 week. In a trial of high fibre breakfast cereal and two apples per day (food intervention) compared with a low fibre diet, symptoms decreased in both groups but with no significant differences between the two. ¹⁵

Prebiotics are non-digestible, fermentable food components stimulating growth or activity of particular gut microbiota selectively that confer health benefits to the host. ¹⁶ Examples include inulin, oligofructose, and galacto-oligosaccharides, and are found in foods such as chicory, alliums, artichokes, and pulses, although all trials using prebiotics to improve symptoms of IBS use supplements rather than food or whole diet interventions. ¹⁶ In a meta-analysis of 11 RCTs of prebiotic supplements in IBS (or other functional bowel disorders) no significant differences were found between prebiotics and placebo in terms of responder rates or effect on symptom scores. ¹⁰ However, there was heterogeneity between studies and too few RCTs to ascertain whether a particular prebiotic was beneficial.

Fermented foods are made through desired microbial growth and enzymatic conversions of food components. ¹⁷ Common examples include kefir, kombucha, sauerkraut and kimchi. In a pilot RCT of pasteurised versus unpasteurised sauerkraut in IBS, both led to a significant improvement in symptom scores, with no difference between groups. ¹⁸ In another trial of three types of kimchi, again IBS symptoms improved in all three arms, but with no difference between groups. ¹⁹ Therefore, currently there is no evidence of additional benefit of fermented foods over unfermented versions in IBS.

Green kiwifruit have been evaluated in people with constipation-predominant IBS (IBS-C) due to its laxative-enhancing components (e.g. fibre, raphides). Two RCTs of kiwifruit (2 per day), both reported increases in stool frequency but no differences compared with either placebo capsule or psyllium. ^{20,21}

Whole diet interventions have also been tested in IBS. British Dietetic Association (BDA) / National Institute for Health and Care Excellence (NICE) first-line dietary advice for IBS recommends eating regular small meals, and reducing caffeine, fizzy drinks, and fatty foods²². Although often used as a comparator intervention in dietary trials in IBS, ¹¹ BDA/NICE dietary advice has never itself been compared with a control intervention, hence, direct evidence of a benefit in IBS is lacking. Another whole diet intervention studied in IBS is the Mediterranean diet characterised by high intakes of wholegrains, fruits, vegetables, legumes, extra virgin olive oil, fish and low intakes of red meat and processed food. A 4-week non-randomised three-arm trial in 42 people with IBS²³ and an unblinded feasibility trial in 59 people with IBS (together with mild/moderate symptoms of depression or anxiety) ²⁴ have been conducted, both reporting high levels of adherence and improvement in global and individual gastrointestinal symptoms. Adequately powered RCTs of the Mediterranean diet are required in IBS.

Fermentable oligosaccharides, disaccharides, monosaccharides and polyols (FODMAPs) induce symptoms in many people with IBS. ²⁵ FODMAPs are present in specific fruits, vegetables, legumes, and some polyols are used as artificial sweeteners. Unabsorbed fructose, polyols, and lactose can increase small intestinal water and fructans and galacto-oligosaccharides, which are indigestible, undergo colonic fermentation. A low FODMAP diet consists of three phases: FODMAP restriction for 4 to 6 weeks, reintroduction of individual FODMAP-containing foods to assess tolerance, and personalisation, to create a modified FODMAP-containing diet based on tolerance to foods identified in the second phase. ²⁶ Several RCTs have compared efficacy of the first phase of the diet with interventions including BDA/NICE dietary advice, ²⁷ habitual diet, ²⁸ or sham diet. ²⁹ In a meta-analysis of seven trials, a low FODMAP diet was superior to control in IBS, but there was no significant difference in trials using an alternative whole diet intervention, as opposed to studies that compared low FODMAP diet with habitual diet. ¹² In a network meta-analysis of 12 trials, low FODMAP diet ranked first for IBS *versus* a range of control

interventions, with BDA/NICE dietary advice second, although the latter was not superior to any control interventions. ¹¹ Subsequent to this network meta-analysis, a randomised trial in 294 people with IBS demonstrated that a low FODMAP (plus BDA/NICE dietary advice) and low carbohydrate diet both resulted in greater response rates than optimised medical treatment, with drug selection based on predominant symptom reported by the patient, although comparisons with drug therapy were only made for 4 weeks. ³⁰ Use of the low FODMAP diet in conjunction with food supplements has been investigated, demonstrating similar or improved effectiveness with the coadministration of probiotics²⁹, prebiotics³¹, fibre³² or glutamine³³, compared with low FODMAP diet alone.

Instead of a strict low FODMAP diet, in practice some health professionals use a less restrictive low FODMAP diet in the first instance in which only selected FODMAPs or high FODMAP foods are restricted (sometimes referred to as 'FODMAP light' or 'FODMAP gentle'). A framework for how this approach can be applied in practice has been proposed. ³⁴ A small double-blind feeding study has demonstrated a 'FODMAP light' diet (restricted only in fructans and galacto-oligosaccharides) leads to a 63% response rate compared with 63% in those receiving a full low FODMAP diet. ³⁵ An RCT conducted in primary care, smartphone-based FODMAP-lowering dietary education (simplified version of the strict low FODMAP diet), was superior to an antispasmodic drug as first-line treatment for IBS. ³⁶

Wheat- or gluten-restricted diets have also been trialled in IBS. Wheat avoidance due to perceived gastrointestinal side effects is reported by up to 7% of the general population. ³⁷ Up to 25% of people with IBS report wheat products provoke symptoms. ³⁸ The component of wheat that may trigger gastrointestinal symptoms is unclear, but could include proteins, such as gluten or amylase-trypsin inhibitors, or FODMAPs, as wheat contains fructan. In one trial of people with IBS who reported symptom improvement on a gluten-free diet, blinded gluten challenge did not increase symptoms more than placebo³⁹, suggesting reducing fructan may explain the benefit of a gluten-free diet. A prior meta-analysis identified only two RCTs of a gluten-free diet in IBS, randomising responders to gluten-free diet to either continue or have their diet spiked with gluten. ¹² Although both trials demonstrated a significant benefit individually, when data were pooled the effect was not significant due to heterogeneity. A more recent trial in IBS

comparing a gluten-free diet with BDA/NICE diet advice or a low FODMAP diet found no significant difference between the three interventions.⁴⁰

Supplements, foods and whole diet interventions in IBS in practice

In general, data from systematic reviews suggest that effect sizes for studies of supplements (e.g. fibre, prebiotics) are relatively small, but for some whole diet interventions (e.g. low FODMAP diet) are seemingly larger (**Table 1**). Although there may be convincing mechanistic rationale for some whole diet interventions, this pattern may be the result of fewer and sometimes smaller trials, with greater challenges of blinding and thus tendency for positive findings compared with control or comparator groups⁴¹, and greater potential for publication bias.

There are advantages and disadvantages of different dietary approaches, ranging from high precision and low dietary impact of supplements to lower precision and higher dietary impact of whole diet interventions (**Figure 1**). Other issues relate to patient experience including acceptability, feasibility, and cost, all of which may impact adherence, safety and clinical effectiveness. For example, in comparison to supplements that may require taking only one or two sachets per day, whole diet interventions can be more challenging as they require extensive and sometimes complex changes to shopping, cooking, and mealtimes in the home, and reducing or changing social eating behaviours. Eating habits are influenced by a wide range of internal factors (e.g., age, sex, gender, socio-economic status, religion and culture, previous dietary experiences) and external factors (e.g., family preferences, food cost and availability, advertising). Some of these factors and their relevance to dietary management of IBS are addressed in the following sections.

Figure 1 should be inserted close to here

Demographic characteristics and diet management in IBS

Sex and gender are important considerations in the assessment and management of IBS. There are sex differences in how individuals experience IBS. For example, females have lower thresholds for visceral pain perception, are more likely than males to disclose symptom to others, to seek healthcare for their symptoms, ⁴² and to change their diet to

manage symptoms. ⁴³ Sex and gender should be incorporated into the dietetic consultation as they have implications for nutrition assessment (e.g., sex-specific calculation of energy requirements) and approach to counselling (e.g., health beliefs, food choice, and eating behaviour can vary by sex and gender). ⁴⁴ Although there are data to suggest females are more likely to be provided lifestyle advice from physicians for their IBS than males, ⁴⁵ no studies have evaluated whether there are sex or gender differences in symptom responses to dietary management.

Age is also a key demographic variable to consider in dietary treatment of IBS. Although restrictive diets can be feasible, safe, and effective in older individuals with gastrointestinal symptoms, ⁴⁶ they should generally be recommended with caution due to altered nutritional requirements and risk of malnutrition in this group.

Education level and health literacy may influence understanding of verbal and written information and subsequent ability to adhere to dietary advice, although the association of these with diet adherence and symptom outcomes from dietary management has not been studied in IBS. Clinicians are recommended to use clear, jargon-free language and create and provide written resources that meet the literacy needs of each patient.

Ethnicity, culture, and religion are key considerations in the dietary assessment and treatment of people with IBS. These factors can hold strong influence on food choice, eating behaviours, the intrinsic values assigned to food(s). For example, ancient medicinal practices, such as traditional Chinese medicine (e.g. 'cold' or 'hot' foods), may be a key component of a patient's self-management strategies and must be considered when personalising dietary advice. Cultural and religious festivals and traditions also shape dietary behaviours, through the consumption of symbolic meals and changes to the way food is served, and as a result of periods of fasting (e.g. Islam) followed in some circumstances by over-eating or periods of restricting quantity of foods and frequency of eating (e.g. Orthodox Christians). In some cultures, staple foods or food groups can be high in symptom triggers (e.g. onion, legumes are high in some FODMAPs), but there are few studies of FODMAP content of foods commonly eaten by diverse ethnic groups. Although efficacy trials have demonstrated benefit of the low FODMAP diet in non-Western populations^{47,48} more research is needed to confirm effectiveness and feasibility

across a range of populations. One potential solution for those consuming a diet naturally high in FODMAPs is to use a 'FODMAP light' approach. ³⁴ All clinicians working in IBS are recommended to strive for 'cultural competence' (i.e., attaining the skills that lead to effective communication across cultures), and this will also involve improved cultural diet knowledge.

Food cost and availability

Cost and availability of treatment are two major, and related, determinants of acceptability and adherence. There are very limited data on the socioeconomic status of people with IBS. Food insecurity, defined as 'the lack of regular access to enough safe and nutritious food for an active and healthy life due to unavailability of food and/or lack of resources to obtain food', ⁴⁹ is sensitive to geopolitical economic fluctuations, and is known to be common in both inflammatory bowel disease and mental illness (which commonly co-occur with IBS). Therefore, although data on food insecurity is currently not available in IBS it is likely prevalent, and clinicians should consider whether it might be a barrier to implementing supplement, food, or whole diet interventions.

Specialty food products required in some whole diet interventions for IBS are costlier and less available than standard options. For example, gluten-free foods used in the gluten-free diet, wheat-free diets, and low FODMAP diet are considerably more expensive. A report from the UK revealed gluten-free bread was four times more expensive than regular bread and a gluten-free diet was 20% more costly than a standard weekly shop. ⁵⁰ Similar data reports gluten-free versions of wheat-based foods were up to five times more costly than standard counterparts. ⁵¹ Unfortunately, full economic analyses are rarely performed in clinical trials of dietary management. In one 4-week RCT comparing three whole diet interventions, 82% of patients reported that a low FODMAP diet and gluten-free diet was more expensive than usual diet. ⁴⁰ Data from a long-term follow-up study demonstrated very similar results in which most patients reported the low FODMAP diet was more expensive than usual diet. Meanwhile, 6 months after commencing low FODMAP diet, three quarters of patients considered their diet to be more expensive than previously.⁵² Despite this, dietary management is still cheaper than many drugs, although in healthcare systems where access to prescription medication is

free, subsidised, or covered by insurance, the cost of whole diet interventions is borne by the patient.

Despite the lack of data to date, it is likely that the additional cost associated with dietary management of IBS, as well as follow-up for medical or dietetic consultations that incur cost, will be prohibitive for at least some individuals. This must be considered during diet assessment and counselling process.

Acceptability and food-related quality of life

Changing eating habits is not simple and may require considerable lifestyle alterations for the patient, including changes in shopping location and brand selection, learning about food composition and product identification, and changing methods of food preparation, all of which can impact acceptability of food and whole diet intervention.

Numerous studies have measured the acceptability of diet interventions in IBS. In a longitudinal follow-up of 103 patients with IBS in the UK, compared with habitual diet at baseline, the low FODMAP diet did not result in differences in individuals being able to shop at their usual supermarket or that the diet required extra time to shop and cook. ⁵³ The latter are in contrast to a study in Italy that reported the low FODMAP diet took greater time for both shopping and cooking. ⁵⁴

People do not solely eat food because of its nutritional or organoleptic properties (taste, smell, appearance) but also because of its wider social and psychological roles. These include using food as a reward, a coping mechanism, and as a means of interacting and celebrating with family and friends. The extent to which these psychosocial roles of food, eating, and drinking bring enjoyment to peoples' lives is termed food-related quality of life (FRQoL).⁵⁵

People with IBS have been shown to have poorer FRQoL than healthy individuals and even individuals with chronic disease. In a survey of 80 people with IBS, ⁵⁶ lower FRQoL scores were reported than for patients with inflammatory bowel disease, ⁵⁷ and compared with historic data for people with asthma and healthy controls, ⁵⁶ with symptom severity being a major associated factor. There was an association between greater (multiple) use of

therapeutic diets and poorer FRQoL in IBS, although this was not statistically significant following adjustment for confounders. ⁵⁷

Acceptability and FRQoL have rarely been measured in clinical trials of whole diet interventions. However, in the previously discussed clinical trial, ⁵⁸ BDA/NICE diet was considered 'less time consuming to shop' and other relevant domains compared with a gluten-free or low FODMAP diet. Although there were patterns suggesting higher FRQoL in the BDA/NICE diet group, values only approached statistical significance in two domains ('food and meals are positive elements of my life'; 'I am generally pleased with my food'). ⁵²

FRQoL has been measured in some clinical evaluations following whole diet interventions, with conflicting findings. In a survey of 155 people with IBS in the UK after dietary advice for a low FODMAP diet, only 56% agreed that 'food and meals are positive elements of my life'. ⁵² In contrast, another study in the UK reported no impact of the low FODMAP diet on FRQoL⁵³ while a study in Italy reported FRQoL improved in most patients after the low FODMAP diet. ⁵⁴

Changing eating habits, which may have taken decades to develop, is highly complex, and clinicians should consider, assess, minimise, and mitigate the potential challenges of whole diet interventions prior to recommending them in people with IBS, and some practice suggestions for how these should be addressed are provided in **Box 1**, noting that on many occasions these may require support from a dietitian.

Box 1 should be inserted close to here

Eating disorders in IBS, and association with dietary management

Eating disorders are of particular relevance to the psychological considerations of dietary management in IBS. Symptoms of eating disorders lie along a spectrum of behavioural, cognitive, and emotional symptoms. Behavioural symptoms include dietary restriction (i.e., inadequate energy intake, limited dietary variety, long periods without eating), binge eating (i.e., feeling a sense of loss of eating control while consuming a large amount of food), and compensatory behaviour (e.g., self-induced vomiting, laxative misuse,

excessive exercise). Cognitive and emotional symptoms may include spending excessive time and mental energy preoccupied by thoughts about eating (e.g., obsessive focus on health related to eating, rules about what one should or should not eat) or thoughts about body weight or shape, significant fear regarding eating or specific foods (e.g., fear of weight gain, fear of gastrointestinal consequences), or significant guilt or shame around eating. Some individuals may only experience quality of life impacts, while others also experience health consequences (e.g., significant weight loss, nutrient deficiencies,) some of which are irreversible (e.g., bone mineral density loss).

Broadly speaking symptoms are classified into four disorders (*DSM-5*): anorexia nervosa; bulimia nervosa; binge-eating disorder; and avoidant/restrictive food intake disorder (ARFID). ⁵⁹ A category of "other specified feeding or eating disorder" is used when symptoms do not meet full criteria for one of these. In addition, orthorexia nervosa, an obsessive focus on health related to eating that is not driven by body weight/shape concern, has more recently been described, although there is no consensus on the diagnostic criteria.

There is little available prevalence data on eating disorders in IBS. A summary of studies is provided in **Table 2**, from which it can be seen that in adults with IBS, the prevalence of current *possible* eating disorder measured using a screening tool was estimated to be between 2% and 29%, whereas lifetime history of *diagnosed* eating disorder was between 9% and 17%. ⁶⁴⁻⁷¹

Table 2 should be inserted close to here

A population-based study in Taiwan reported that among 22,356 adults clinically diagnosed with IBS, 0.02% later received a diagnosis of anorexia nervosa, however this was limited by use of clinician-coded ICD-9-CM diagnoses. ⁷¹ This study also showed a seven-fold increased risk of anorexia nervosa in adults with IBS compared to healthy controls (1.95% vs, 0.39% per 100,000 person years, respectively) ⁷¹, although a smaller case-control study in India showed no significant difference between adults with IBS compared to controls (1.6% vs. 1.0%).⁷⁴ Intriguingly, a recent genome-wide association study showed significant genetic overlap between IBS and anorexia nervosa, suggesting

possible shared aetiology. ⁷⁵ Only one study reported the prevalence of ARFID in adults with IBS but diagnosis was limited to medical chart information. ⁶⁶ Although there is no consensus on the diagnostic criteria for orthorexia nervosa (i.e., obsessive focus on health related to eating, not driven by body weight/shape concern), ⁷⁶ no studies have reported on its prevalence in IBS. Overall, eating disorders manifest in relatively high numbers in people with IBS, with prevalence ranging between approximately 2% and 29%. It is unclear if true eating disorder rates are higher than general population estimates (~8%),⁷⁷ as studies in IBS are limited by methodology, including no studies with a structured clinical diagnosis for an eating disorder.

In view of these data, a subset of individuals with IBS seeking dietary management may have previously had, currently have, or be at risk for an eating disorder. Some have hypothesised that whole diet interventions consisting of extensive dietary restriction in IBS may put some individuals at risk for the onset of an eating disorder. ^{78,79} Any such relationship between IBS-related dietary restriction and eating disorders is complex, and may be causal, consequential, or coincidental, as illustrated in **Figure 2**. Firstly, IBS dietary restriction may be a *cause* of the development of an eating disorder due to intensive focus on food choice (label and menu reading, categorising foods into 'good' and 'bad') and food restriction. Second, an existing eating disorder may underlie the drive to follow an IBS-related dietary restriction, and the eating disorder is therefore a primary motivator, and dietary restriction is the *consequence*. Third, IBS dietary restriction and an eating disorder may be entirely a *coincidental*, whereby the dietary restriction is driven by desire to manage IBS symptoms.

Figure 2 should be inserted close to here

It is challenging to investigate the relative contribution of IBS dietary restriction as a cause, consequence, or coincidence to eating disorders, and there may be combined contributions in individuals and in populations. To our knowledge, there are no RCTs measuring the effect of a restrictive whole diet interventions that also measured risk of eating disorder development. However, one observational study of 233 adults with IBS found those who screened positive for a possible eating disorder (23% via the Sick, Control, One stone, Fat, Food; SCOFF screening tool)⁶⁰ prior to starting group sessions for

the low FODMAP diet had a significantly higher rate of diet adherence at 6-week followup, compared with those who did not screen positive (57% vs 35%).⁸⁰ In another observational study of 31 people with IBS attending group sessions for the low FODMAP diet, the frequency of positive screens for a possible eating disorder (SCOFF screening tool) did not change from baseline to end of the restriction phase (7/31, 23% at both timepoints), suggesting that the low FODMAP diet may not increase rates of eating disorders.⁸¹ However, these studies are limited by short follow-up period, reliance on a screening tool to detect possible eating disorders that has not been validated in IBS, and lack of information on nutritional status and FRQoL, for which future research is needed.

Despite the lack of data on the temporal nature of eating disorders and IBS dietary management, practitioners should be aware of the potential for development or exacerbation of an eating disorder when considering restrictive whole diet interventions in IBS. Whole diet interventions, if implemented as intended, are not necessarily the problem. The risk is that a *subset* of patients may become excessively restrictive beyond the intervention (e.g., restrict more foods than required, unable to progress beyond the restriction phase of the low FODMAP diet). However, there is not yet evidence to identify which patients are at risk or how to mitigate risk.

We make the following clinical practice recommendations, with the caveat that none are, as yet, robustly tested in integrated care of IBS, and provide links to resources for their implementation (**Box 2**). An eating disorder diagnosis can only be made by a clinician or with a diagnostic interview. However, health professionals should screen for pre-existing eating disorder symptoms prior to initiating an intensive dietary restriction and monitor for changes after diet initiation. Eating disorders can be screened using the SCOFF questionnaire with positive responses to ≥ 2 items prompting consideration of an eating disorder; ⁶⁰ however, a positive screen based on the item 'would you say food dominates your life' may over-pathologise patients. ARFID can be screened using the Nine-Item ARFID Screen (NIAS), ⁸² validated in eating disorders, ⁸³ although not in IBS. As the SCOFF is validated for non-ARFID eating disorders, both a SCOFF questionnaire for eating disorders and an ARFID screening tool are recommended when feasible. The Fear of Food Questionnaire is a newer measure validated in adults with IBS but does not yet have validated screening cut-offs.

Box 2 should be inserted close to here

In many clinical settings, it is impractical to implement eating disorder screening tools with all patients. Beyond screening tools, measuring actual food intake (via 24-hour recall or usual diet history) to evaluate eating patterns and flexibility may be considered. Further, red flags may include significant unintentional weight loss during restrictive whole diet interventions, or screening for risk of malnutrition (e.g. Malnutrition Universal Screening Tool⁸⁴). Further detailed recommendations for eating disorder assessment in gastroenterology patients are available, ⁶¹ and some are also provided in **Box 2**.

When a clinician identifies a patient with a possible eating disorder, referral to eating disorder specialists should be considered. It is acknowledged that access to evidencebased eating disorder care can be challenging, with complex systemic and structural barriers. For example, within public healthcare systems there may be long waiting lists for community eating disorder services (e.g. including survey data from England and Scotland⁸⁵, while in private healthcare systems financial barriers among patients have been reported (e.g. in the United States⁸⁶). Even when care is received, not all clinicians/programs engage in evidence-based practice⁸⁷ We encourage gastroenterology clinicians to identify local referral options in their communities, as not referring a patient for further evaluation may decrease the chance that the patient ever receives eating disorder care⁸⁸ When a dietary approach is considered in patients with IBS and a possible eating disorder, approaches to consider include supplements (e.g., probiotics, fibre supplements) and whole diet interventions that are not excessively restrictive such as the BDA/NICE dietary advice, Mediterranean diet, ²⁴ or FODMAP-light approach³⁴ could be considered.

Delivering IBS dietary management in practice

Selecting, counselling, and monitoring a patient with IBS who is embarking on dietary management requires consideration of a complex array of factors, including clinical effectiveness, targeting the symptom most burdensome, personalising the intervention to minimise and mitigate the challenges discussed. Dietary intervention can be initiated and managed by the patient themselves, by a health professional (either non-dietitian or dietitian), or in an integrated care environment. The evidence from the preliminary literature regarding each of these approaches is discussed.

Patient-initiated and self-managed dietary management in IBS

People with IBS regularly self-manage their own condition, either in the absence of a diagnosis or following discharge from physician management in primary or secondary care. Self-management is an important component of chronic disease care and emphasises the role of the patient in managing their own health. Self-management is important in IBS, due to the high prevalence and chronicity of symptoms.

Self-management using supplements is common of IBS. Use of herbal supplements has been reported in 15% of people with IBS in the US. Nutrient supplements (e.g. magnesium) ⁸⁹ and microbiome-targeted supplements such as probiotics are also popular. ⁹⁰ Many supplement users with IBS start supplements without support.

Self-management of whole diet interventions can be more challenging as, depending upon the intensity of the intervention, it can be inherently more complex to understand, implement, and maintain. Less complex whole diet interventions, such as the BDA/NICE diet, can be undertaken through self-management using online resources (**Box 2**) with or without support from a healthcare professional.

Several studies have evaluated the success of self-management of more complex whole diet interventions in IBS. In a Canadian survey of 80 patients with IBS using a low FODMAP diet, fewer patients self-managing their diet achieved the therapeutic FODMAP target (31%) compared with those receiving dietetic support (72%).⁹¹ Similarly, many individuals report barriers to self-management with a gluten-free diet. Although not in IBS, 22% of people with coeliac disease cited non-referral to a dietitian as a barrier to adherence to a gluten-free diet, with greater odds of poor or average adherence.⁹²

Many resources are available to support people with IBS following a whole diet intervention, but few have been evaluated formally for effectiveness. In a small study of a novel artificial intelligence mobile app to support the low FODMAP diet, 14 people with IBS reported a greater improvement in quality of life compared with 11 standard education controls. ⁹³ In another study of people with self-reported gut symptoms, including IBS, using a mobile app-supported self-management for the low FODMAP diet, analysis of 11,689 users showed reductions in prevalence of abdominal pain, and bloating. ⁹⁴ Finally, in a randomised trial in 51 people with IBS in the UK, although mobile app and written information reduced symptoms in some people, written advice was less effective than 1:1 dietary advice from a dietitian. ⁹⁵ It is possible that mobile applications in conjunction with support from healthcare professionals will elicit higher engagement and greater effectiveness than self-management alone.

Self-management of whole diet interventions may be possible in IBS, especially with supportive resources (e.g., apps, diet sheets, recipe books) but there are few high-quality trials to measure effectiveness, impact on diet quality, or safety. Understanding who is most amenable to self-management would be a significant advance in better targeting those who are most likely to need, or not need, health professional support.

Health professional (non-dietitian) management of whole diet interventions in IBS

In reality, physicians in primary care and secondary care may have poor access to local dietetic services and therefore may not refer patients with IBS to dietitians. Many gastroenterologists provide dietary advice to patients, but for most consultations this spans \leq 10-minute duration. ⁹⁶ However, in an uncontrolled 6-week study in IBS, low FODMAP dietary advice delivered by a gastroenterologist of 20-30 minutes' duration resulted in improved symptoms, however only 52% reported regular adherence and most cited its complexity as the reason for non-adherence. ⁹⁷ A qualitative study of semi-structured interviews in eight people with IBS reported patients receiving low FODMAP dietary advice from their general practitioner or gastroenterologist found the advice was overly simplistic, lacked individualisation and practical advice. ⁹⁸

Guidelines from the US, UK and Canada recommend dietetic supervision of patients undertaking a low FODMAP diet⁹⁹⁻¹⁰¹. This is to enable personalisation and prevent over-restriction, which is associated with concerns including undernutrition, impaired FRQoL, and psychological risk⁷⁸.

Dietitian management of whole diet interventions in IBS

Most supplement interventions are undertaken using self-management, either over-the counter, or prescription, with or without the support of a health professional, whereas almost all research on whole diet interventions is delivered by a dietitian. Dietitians are qualified, and in many countries regulated, health professionals that assess, diagnose, and treat diet and nutritional problems in individuals and populations.

In systematic reviews of two whole diet interventions in IBS, in clinical trials that were delivered through dietary counselling, 11 of 12 trials of the low FODMAP diet¹¹ and both trials of the gluten-free diet were done so by a dietitian. ¹² Meanwhile in a three-arm trial of BDA/NICE diet, low FODMAP diet, and gluten-free diet in IBS, all patients received counselling from a dietitian, and the feasibility study in 51 patients with IBS showed dietitian-managed care resulted in improved outcomes compared with mobile app or written support, although this difference was not statistically significant. ⁹⁵

In addition to RCTs, real-world clinical evaluations of dietitian delivery of whole diet interventions have been conducted, including the one described earlier in which those who received counselling from a dietitian had a lower intake of FODMAPs, were more likely to achieve a FODMAP intake below the therapeutic threshold, and reported greater understanding of dietary instructions, than those instructed by a gastroenterologist, GP, or who used internet sites⁹¹.

Despite extensive clinical trial and real-world evidence of the clinical effectiveness of dietitians in delivering whole diet interventions in IBS, experience in practice is that access to specialist counselling from a dietitian is limited due to long waiting lists or cost and insurance coverage in some private healthcare providers. In a survey of 279 gastroenterologists in the US, 89% believed utilisation of a gastroenterology-specialist dietitian improved success in managing IBS symptoms, yet 78% indicated lack of insurance coverage was a major barrier to referring patients⁹⁶. A survey in England reported that although almost all NHS Trusts (96%) provided general dietetic services for IBS, only half had a dietitian specifically responsible for the delivery of dietary management of IBS specifically, with wide variations in waiting lists for patients¹⁰². These demands for, and variations in supply of, dietetic services have led to innovative ways for patients to access dietetic advice in IBS, including via group and online education.

Group education from a dietitian have been used to deliver low FODMAP dietary counselling. In a study of 55 patients, group education delivered by a specialist dietitian in two 90-minute group sessions resulted in more than 50% reporting symptom response. ¹⁰³ Meanwhile, a study in 263 patients with IBS, 90-minute group education delivered by a specialist dietitian resulted in no difference in symptom responders compared with 101 patients receiving 1:1 dietetic counselling. Healthcare costs were lower for group education (£67 per patient) than for 1:1 counselling (£139) for the same clinical benefit¹⁰⁴ Group education may well be a cost-saving intervention but also enables longer duration of exposure to a specialist dietitian and group education theory, collaborative facilitation, peer support and may provide equal, or potentially improved, outcomes. There are currently no RCTs comparing group and 1:1 consultations for whole diet interventions in IBS ¹⁰⁵

Webinars are online presentations, either recorded or presented live, with the latter allowing interactive content. Webinars of BDA/NICE dietary advice by dietitians (**Box 2**) has led to high levels of satisfaction and reduction in demand for 1:1 specialist dietitian consultation. ¹⁰⁶ Webinars of low FODMAP dietary advice from dietitians (**Box 2**) resulted in a majority of patients reporting adhering to the low FODMAP diet, increases in numbers with adequate relief of IBS symptoms and reductions in all individual symptoms. ¹⁰⁷ Such webinars and other online tools may be used alone as part of self-management, or in conjunction with support from a dietitian.

Combined and integrated care approaches to dietary management of IBS

In addition to dietary management of IBS, there is considerable evidence for non-dietary approaches. ^{5,6} The British Society of Gastroenterology guidelines for IBS recommend commencing with diet and lifestyle advice, and where unsuccessful, management moves onto first line and then second line drugs, followed by brain-gut behavioural therapies. ⁹⁹ A discrete choice experiment in 185 people with IBS supports this approach, with the most preferred treatment being diet (48.1%), followed by pharmacological (29.2%) and brain-gut behavioural therapies (22.7%). ⁷ In reality, many patients undertaking dietary management for IBS will receive concomitant pharmacological (over the counter or prescription) or brain-gut behavioural (self-directed or clinician-managed) therapies. ¹⁰⁸

However, there are few studies investigating dietary management specifically in combination with pharmacological or brain-gut behavioural therapy. Of note, many of the clinical trials of dietary management discussed previously were performed in mixed populations of patients, some of whom were already using pharmacological or brain-gut behavioural therapy. ^{27,29,31,40} In one trial comparing the tricyclic antidepressant amitriptyline versus placebo, both groups were also provided with an information sheet regarding the BDA/NICE diet, with greater effectiveness in the intervention (drug plus diet sheet) than control group (placebo plus diet sheet). ¹⁰⁹ It is recommended that multidisciplinary care is provided to patients with IBS where possible, ¹⁰⁸ and more research is needed to understand for whom and in what combination treatments are delivered.

In view of the varied management options both within and between patients with IBS, studies have investigated the benefit of patients being managed in an integrated care model with access to wide multidisciplinary expertise, including dietitians and psychologists. An RCT in 188 patients with DGBI compared 'standard gastroenterologist-only' management with a multidisciplinary model including gastroenterologists, dietitians, gut-focused hypnotherapists, psychiatrists, and physiotherapists.¹¹⁰ Overall, those in the multidisciplinary model more commonly achieved global symptom improvement prior to clinic discharge (84% vs 57% gastroenterologist-only, risk ratio 1.50, p=0.00045). Of the 85 patients with IBS, more patients participating in multidisciplinary care reported global symptom improvement (85% vs 65% gastroenterologist-only, p=0.044) and more experienced a clinically important reduction in symptoms (66% vs 38% gastroenterologist-only, p=0.017). ¹¹⁰ The significant difference in numbers achieving \geq 50-point reduction in IBS-SSS was maintained during long-term follow-up at 1-year.¹¹¹

Identifying responders to diet interventions in IBS

In view of the potential risks of restrictive whole diet intervention, the potential to identify those most likely to experience clinical benefit would enable targeted dietary advice. However, predictors of response to supplements, foods or whole diet interventions for IBS remain elusive. In terms of clinical phenotype, in an RCT of wheat bran in all IBS subtypes, only presence of constipation at baseline predicted response.¹¹²

Restriction and then double-blind challenge should, in theory, predict who will respond to withdrawal of particular dietary constituents, however patients with IBS do not exhibit symptom improvement specific to the withdrawal of the dietary component, ¹¹³⁻¹¹⁵ suggesting some of the effect is anticipatory.

In one study, based on data from a trial of BDA/NICE diet versus a low FODMAP diet, higher energy intake, lower symptom scores, and lower dysbiosis index at baseline predicted improvement in abdominal pain to both diets, whereas higher baseline oligosaccharide intake predicted response to BDA/NICE dietary advice. ¹¹⁶ Using data from the same trial, response to a low FODMAP diet was predicted by both faecal bacterial profile and severity of dysbiosis at baseline.¹¹⁷ In contrast, in *post hoc* analyses of data from another RCT, baseline faecal microbiota composition was a poor predictor of response to a low FODMAP diet, ¹¹⁸ whereas volatile organic compound profiles classified responders with 97% accuracy. ¹¹⁹ In an observational study, two distinct microbial profiles were identified in IBS and a 4-week open-label low FODMAP diet led to maintenance of a 'healthy' microbial profile whereas the 'pathogenic' profile shifted to resemble the 'healthy' profile. There was a significantly greater decrease in global symptoms scores in those with the 'pathogenic' profile. ¹²⁰ Others have demonstrated the predicted functional composition of the faecal microbiome of responders to a low FODMAP diet is different, characterised by higher abundance of genes relating to methane and fatty acid metabolism ¹²¹ or higher faecal and urinary metabolites at baseline such as higher faecal propionate and cyclohexanecarbolic acid. ¹²² In terms of predictors of response to a gluten-free diet in IBS, HLA-DQ2 expression and coeliac-disease associated serum IgG antibodies have been proposed. ¹²³ Although personalised nutrition offers great potential, methods for identifying patients with IBS most likely to respond to dietary management are at an exploratory stage and cannot yet be implemented easily in clinical practice.

Conclusions

Diet is a cornerstone of IBS management, and this will continue as long as patients are interested in what they eat and how it impacts their symptoms. There are many research gaps to fill, including relatively limited research on food supplements and food interventions in IBS, the optimal methods of delivery of restrictive whole diet interventions, and the effectiveness of non-restrictive whole diet interventions (e.g., BDA/NICE diet, high fibre diet, or Mediterranean diet). Clinicians should be aware of the many internal and external factors that influence eating behaviours and incorporate them into their assessment of patients prior to recommending dietary management. Inappropriate whole diet interventions and/or inadequate monitoring can risk patient safety through poor nutrient intake or food-related quality of life, as well as a possible risk of exacerbation or development of an eating disorder. To further improve dietetic care for IBS, we need improved understanding of other dietary interventions that may benefit patients, together with which interventions work for whom, and how they can be delivered safely and effectively.

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Figure legends

Figure 1 The spectrum of advantages and disadvantages of supplements, foods, and whole diet interventions in irritable bowel syndrome, in the context of patient and clinician experience. Some advantages of food supplements (e.g., low impact on life) can be disadvantages in whole diet interventions (i.e., high impact on life), likewise, some advantages of whole diet interventions (e.g., low medicalisation) can be disadvantages of food supplements (i.e., greater medicalisation). Many of the disadvantages of all interventions can be mitigated by advice and support from a health professional, including for whole diet interventions by a dietitian with expertise in IBS management.

Figure 2. Dietary restriction in IBS may be causal, consequential, and coincidental to an eating disorder. Eating disorders are prevalent in IBS and there are concerns regarding a role of IBS-related dietary restriction in their aetiology. (1) IBS dietary restriction may be a cause of the development of eating disorders due to need for extensive focus on food and food restriction. (2) IBS dietary restriction may be the consequence of a pre-existing eating disorder and the desire to justify the restriction of food intake. (3) IBS dietary restriction and eating disorder may be coincidental and unrelated.