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The Low FODMAPS Diet and IBS: A Winning Strategy

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Abstract

Background: Irritable bowel syndrome (IBS) is a common functional disorder characterized by abdominal discomfort and altered bowel habits. IBS can be a debilitating disorder affecting quality of life. Food intolerance is a common complaint among IBS patients and the relationship between diet and abdominal symptoms is well recognized.

Objective: Given the growing body of evidence and interest in dietary modifications in the management of IBS, we will review the current literature supporting a diet low in fermentable carbohydrates, discuss methods to assess dietary history, and integrate dietary modification strategies into clinical gastroenterology or primary care practice.

Conclusion: Recent evidence supports that dietary manipulation, including a diet low in fermentable carbohydrates, can be beneficial in patients with IBS. We believe that a time investment in dietary counseling is paramount to symptom moderation and quality of life in this population. Physicians should become knowledgeable regarding dietary assessment and counseling in the context of IBS.

Keywords: IBS; Diet; Low FODMAP; Food diary

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Introduction

Irritable bowel syndrome (IBS) is a common functional disorder characterized by abdominal discomfort and altered bowel habits traditionally categorized into subtypes based on predominant symptoms: constipation (IBS-C), diarrhea (IBS-D), mixed (IBS-M) and unclassifiable (IBS-U). It is a common disorder with a global pooled prevalence of 11.2%. The lowest prevalence is in Southeast Asia at 7.0%, and the highest is in South America at 21.0% [1]. There is a higher prevalence of IBS in females compared to males [1].

Although the majority of patients have mild symptoms, approximately 30% of patients seek medical attention and specialist consultation. IBS can be a debilitating disorder affecting quality of life. A study in the United Kingdom (UK) by Akehurst et al. [2] showed that patients with IBS score poorly in all dimensions in the health-related quality of life questionnaire and on average cost the National Health Service 123 UK pounds (95% confidence interval: 35 UK pounds to 221 UK pounds, 1999 values) more per year than the controls matched for age, sex and social characteristics. The economic burden in the United States estimates a direct cost related to IBS around $619 USD annually, and the subgroup with severe symptoms requires up to $1743 USD annually [3]. The average number of days off work per year due to IBS ranged between 9-22 days. Despite being a benign disorder, the impact of IBS is tremendous and is evident by poor quality of life and reduced productivity [4]. The pathogenesis of IBS is likely multifactorial, and it is unlikely that a single unifying mechanism underlies all cases of IBS. However, elements which are commonly seen in IBS patients include altered bowel motility, visceral hypersensitivity, or psychosocial issues. All of these components may affect or be affected by the gut microbiome and dietary choices.

The main approaches to control symptoms have centered on pharmacological and dietary strategies. Historically, dietary optimization has focused on fiber supplementation, with mixed results regarding efficacy compared with placebo [5]. Fiber supplementation had fallen out of favour until a large randomized controlled trial designed to determine the effectiveness of increasing the dietary content of soluble fibre (psyllium) or insoluble fiber (bran) in IBS was published [6]. Results from this study confirmed reduced symptom severity in patients receiving psyllium fiber, with early dropout in the recipients of bran, related to worsening symptoms of IBS. Subsequently, a systematic review of fiber in IBS was published, including 14 randomized controlled

trials, and 906 patients that had evaluated fiber in IBS. There was a significant benefit of fiber in IBS that was limited to soluble fiber.

Until the last decade, many of the published dietary studies in the context of IBS have been of limited methodological quality, lacking validated outcome measures. Despite this, the British Dietetic Associated published evidence based-guidelines for the dietary management of IBS in 2012 which systematically reviewed key aspects of the dietary management of IBS, with the aim of providing evidence-based guidelines for use by registered dietitians [7]. Three lines of dietary management for IBS emerged. These included clinical and dietary assessment, advanced dietary interventions to improve symptoms based on fermentable carbohydrates and probiotics, and elimination and empirical diets. In this review, the authors concluded that there was a need for adequately powered and well-designed randomized controlled trials.

The low fermentable oligo-, di-, and monosaccharides and polyols (FODMAP) diet is arguably the first diet to show promise in improving symptoms in IBS. Given the growing body of evidence and interest in dietary modifications in the management of IBS, our objective is to review the current literature supporting the low FODMAP diet, and to discuss strategies for the implementation of the low FODMAP diet in the outpatient gastroenterology clinic setting.

Efficacy of a Low-FODMAP Diet in IBS – A Review of the Literature

In IBS, there is an impaired absorption of carbohydrates and upon entry of these carbohydrates into the distal small bowel and colon, fermentation occurs, producing intestinal gas. FODMAP carbohydrates also act as osmotic agents, which draw water into the lumen, leading to increased gut distention and symptoms in those with visceral hypersensitivity [8, 9].

FODMAPs are poorly absorbed short-chain carbohydrates. Examples of high FODMAP containing foods include fructans (wheat, onions, garlic), galacto-oligosaccharides (mammalian milk, legumes, seeds), lactose (mammalian milk, yogurt, butter), fructose (fruit, sweeteners) and polyols (artificial sweeteners, fruits) [9]. Fermentable carbohydrates have been shown to increase osmotic load in the small intestine [10, 11] as well as colonic H_2 production [12] Increased gas production and visceral hypersensitivity contribute to the sensation of bloating and IBS symptoms [13]. Due to the increased osmotic load, colonic gas production and subsequent intestinal bloating and cramping, it has been reasonable to infer that a diet low in FODMAPs may result in an improvement of these symptoms.

Six randomized controlled trials have been published that examine the effects of a restricted fermentable carbohydrate diet on IBS symptoms. The first study was a single-blinded, crossover intervention trial that assessed 15 healthy subjects and 15 subjects with IBS [12] Subjects had to consume either a low (9 g/day) or high (50 g/day) FODMAP diet for 2 days. Both healthy volunteers and patients with IBS produced higher levels of hydrogen while on the high FODMAP diet compared to the low FODMAP diet, as measured by a hydrogen breath test. Symptom scores during the low and high FODMAP diet were assessed according to a self-rating Likert scale where 0 = no symptoms and 3 = severe symptoms. A composite IBS symptom score was significantly higher for IBS patients during the high FODMAP diet (median 6; range 2-9) than during the low FODMAP diet (median 2; range 0-7). In healthy volunteers, the composite score was also higher during the high compared to low FODMAP diet, but the severity was less (median 3 (range 0-5) vs. 1 (0-4)). Moreover, lethargy abdominal pain, abdominal bloating, flatus production, nausea, and heartburn, as measured by a daily questionnaire, were the most frequent symptoms provoked by the high FODMAP diet in patients with IBS in contrast to only flatus production experienced during the high FODMAP in healthy volunteers.

The second randomized, controlled trial assessed the impact of fermentable carbohydrate restriction on luminal microbiota, short-chain fatty acids and gastrointestinal symptoms in 41 patients with IBS [14]. Patients were randomized to a restricted FODMAP diet or their habitual diet for 4 weeks. Symptoms, stool output and dietary intake were recorded for 1-week at baseline and 1 week at follow-up. Additionally, a stool sample was collected at baseline and follow up for analysis of microbiota, short chain fatty acid and pH. In the intention-to-treat analysis, significantly more IBS patients on the restricted FODMAP diet reported adequate control of symptoms (13/19, 68%) compared to those on their habitual diet (5/22, 23%; $P = 0.005$). Total luminal bacteria did not differ between the two groups, but there were lower concentrations and proportions of bifidobacteria ($P < 0.001$) in the restricted FODMAP group.

The third RCT compared a low FODMAP diet to a normal Western (Australian) diet [15]. It was a single-blinded, crossover trial that studied 30 patients with IBS and 8 healthy controls (matched for demographics and diet). Participants were randomized to either a low FODMAP or typical Australian diet for 21 days, followed by a washout period of at least 21 days and then switching to the other diet. Subjects with IBS had lower overall gastrointestinal symptom scores as assessed using a visual analog scale while on the low FODMAP diet compared to the Australian diet (22.8 vs. 44.9). Gastrointestinal symptoms were minimal and unchanged in the healthy controls.

The fourth RCT assessed the efficacy of a low FODMAP diet compared to a normal Danish / Western diet [16]. Forty-two patients were allocated to the low FODMAP group and 40 to the Danish control diet. A significant reduction in the IBS severity score system from baseline to week 6 was observed in the low FODMAP compared to the control group. However, a significant improvement in the quality of life in patients allocated to the low FODMAP group was not observed compared to the control group. The largest benefit was in patients with IBS-D subtype, although the authors of this study speculated that lack of power explained the non-significant findings of IBS-C sub-type.

The fifth RCT sought to determine the efficacy of a low FODMAP diet in 33 children with IBS [17]. Children fulfilling the Rome III IBS definition were randomized to a low FODMAP diet or a typical American childhood diet. Gastrointestinal symptoms were assessed with abdominal pain frequency as the primary outcome. Less abdominal pain occurred during the low FODMAP

diet compared to the traditional American diet. Responders in this study had enriched gut microbiota with greater saccarolytic metabolic capacities.

The final RCT assessed the effects of a diet low in FODMAPs compared to traditional dietary advice in a RCT of patients with IBS [18]. In this study 38 subjects were randomly assigned to 4 weeks of low FODMAP diet, while 37 subjects were randomized to a traditional IBS diet, with emphasis on regular meal patterns, avoidance of large meals, reduced intake of fat, insoluble fibers and caffeine. The severity of IBS symptoms was significantly reduced in both groups during the intervention compared to baseline. The authors concluded that combining elements from low FODMAP diet and traditional dietary advice may result in further reduced symptoms of IBS.

While not randomized, a seventh controlled trial has been published investigating whether a low FODMAP diet was effective for symptom control in IBS patients compared to standard dietary advice [19]. This study assessed 82 consecutive patients with IBS who returned for a follow-up outpatient dietitian visit over the 9-month evaluation period. More patients in the low FODMAP group reported satisfaction with symptom response compared to the standard group (76% versus 54%, P = 0.038).

Multiple uncontrolled studies, both retrospective and prospective, have also supported a reduction in various gastrointestinal symptoms in IBS patients on a restricted fermentable carbohydrate diet [20-23]. Ostgaard et al. [21] investigated the diet and quality of life of patients with IBS at baseline, in addition to the effects of guidance on diet management on changes in food intake, quality of life and symptoms. Using a food frequency questionnaire, IBS patients were noted to make a conscious choice to avoid certain food items, many of which were high FODMAP containing foods. Some IBS patients compared with control were also noted to consume higher amounts of FOMAP rich foods. Following dietary guidance, intake of FOMAP rich foods was lower resulting in improved quality of life and symptoms. Mazzawi et al. [22] investigated the impact of dietary guidance on symptoms, quality of life and habitual diet in 46 patients with IBS. Each patient received 3-45 minute personalized diet counseling sessions which emphasized the low FODMAP diet. Quality of life improved significantly following dietary guidance sessions, in addition to a significant decrease in symptom severity. Moreover, there was no difference in intake of calories, fiber, protein or fat following dietary guidance.

Limitations of the published literature include inadequate information on the IBS sub-classification of patients studied. In addition, study duration of the RCT's varied potentially acting as confounding factor within the results. The RCT duration ranged from 3-6 weeks, with the majority of research suggesting that the greatest difference in severity of gastrointestinal symptoms to occur within 7 days of dietary adherence. Arguably, the differing trial periods in the published studies may not be clinically relevant given that symptom relief is observed early on following dietary adherence.

Most studies were single-blinded studies, with limited information on randomization techniques and dropout rates. It is frequently difficult to blind food intake in controlled feeding studies, and controlled intake can lack reflection of 'real-life' eating patterns, lacking generalizability [24]. Despite these limitations in dietary research, there is emerging evidence to support that a restricted FODMAP diet offers symptomatic benefit for patients with IBS.

As with any other therapy, potential negative consequence of the intervention must be assessed, and with the low FODMAPS diet, these may include the impact on the gut microbiome, and the nutritional implications of a restrictive diet. Recent work has investigated the microbiological sequelae of dietary restriction of the low FODMAP diet. Reduction in fecal Bifidobacterium was observed, an effect most likely due to the reduced availability of dietary fructans for bacterial fermentation in the GI tract [25]. The health benefits of bifidobacteria are well established, therefore, the decline in fecal bifidobacteria deserves further investigation. Whether the reduction in luminal bifidobacteria as applied to the 6-8 week recommended dietary trial period has any long term implications is unknown. It is unknown whether this microbiota related changes are acute or chronic. In addition, at present it is also unknown whether reduction in bifidobacteria persists once fermentable carbohydrates are reintroduced.

Dietary history in clinical practice

The low FODMAP diet ideally should be implemented and continued with the supervision of a registered dietitian (RD) to ensure compliance, and optimize education on suitable food alternatives to minimize possible nutritional deficiencies. The trial period should be followed by gradual food introduction to individual tolerance to increase dietary variety, ensure nutritional adequacy and have minimal impact on intestinal microbiota [26]. However, the high prevalence of IBS may preclude a formal timely RD assessment for every patient. Consequently, understanding the habitual diet may be the first step to successful dietary management of IBS for the treating gastroenterologist.

Dietary patterns, quantity of intake and types of foods including FODMAP rich foods may be readily identifiable through a food record review. Consequently, a basic personalized nutrition discussion rooted in dietary patterns and basic tenets of the low FODMAP diet may be efficiently initiated in the clinic setting by the treating gastroenterologist. As such patients are provided with basic knowledge to manage symptoms minimizing further treatment delay, and can be more thoroughly addressed with a RD at the time of nutrition assessment. Methods of dietary assessment include the 24-hour food recall, a food record or food diary, and a Food Frequency Questionnaire (FFQ). There are advantages and disadvantages associated with each method.

The 24 h dietary recall involves an interviewer asking the respondent to quantify the food and beverages ingested over the preceding 24 h. An advantage of this method is that memory of recent intake is more likely to be accurate, allowing for quantities and types of food to be estimated with greater precision [27]. In addition this method is quick to apply in the context of a busy clinical setting. However, there is significant variability in an individual's diet from day-to-day, and so a single day's recordings may not be reflective of an individual's habitual diet.

A food diary is a diet journal that captures the type of food, portion

size and time of food intake. Autobiographical recollection problems and recall biases are avoided if individuals make diary entries in real time [28]. Accumulation of assessments over time increases the reliability of the data and makes the desired measurement more sensitive to treatment effects [29]. Disadvantages of a food diary are that they require individuals to be literate, and the process of recording a food diary can alter intake behavior. Obstacles to accurate food diaries include the time and effort required for frequent data entries [30]. In a study comparing the relative validity of a 3 day food record to a 9 day food record, the 3 day food diary appeared to be acceptable as a dietary assessment tool [31].

Food frequency questionnaires were developed in the 1950s and 1960s to assess habitual food intake over a set period of time [32]. FFQs identify the frequency with which particular foods are consumed, and have the ability to be completed quickly [27]. A FFQ validated specifically for measuring FODMAP intake exists [30] and consists of 297 items and was designed to assess macronutrient and micronutrient intake including FODMAPs, fibre, starch, glycemic index, and glycemic load. While the FFQ is a validated tool, the time involved with completing the questionnaire limits its use in the clinical setting. Integrating a measure of current habitual dietary practices as part of the clinical assessment for the gastroenterologist may allow the clinician to initiate the dietary interventions, while awaiting the RD assessment, which may not be immediately available.

Discussion

Comprehensive dietary approach to IBS

The studies published to date have strengthened the efficacy for the low FODMAP diet in IBS. Arguably, the low FODMAPs diet in the management of IBS is the first dietary intervention with a growing body of literature to support its efficacy. In the clinic setting, a dietary history is important to provide adequate individualized dietary advice. This can usually be achieved in the using the tools described above.

When feasible, a food diary for 3 or 7 days prior to consultation to identify habitual dietary may be of value. Further inquiry into trials of elimination diets, such as wheat, gluten or lactose and effectiveness of these interventions should be elicited. Although, many patients with IBS may have previously tried dietary modifications for symptoms; many dietary elimination practices focus on single food elimination strategies, rather than a combined reduction of foods with a similar functional effect on the gut. As it is the total dose that will dictate the contribution to symptoms, the accumulated intake of FODMAPs over several days is critical in defining how strict an individual needs to be. Traditional dietary advice has been rooted in dietary patterns rather than on specific foods to ingest. These guidelines include recommendations for regular meals and snacks, never too much or too little, and hunger avoidance. In addition, reduced intake of fatty or spicy foods, coffee, alcohol, soft drinks and carbonate beverages are cardinal messages for dietary management of IBS [18]. Through dietary intake assessment, opportunities arise to identify strategies for successful dietary counseling in real time. Assessment of quantity, type of fruits and vegetables, and preparation (cooked, raw, elimination of skin) is important in understanding potential sources of high fructose and insoluble fibres that might be contributing to symptoms. Over representation of dietary insoluble fibre has been associated with deterioration in IBS symptoms [6]. Wheat is arguably the most frequently ingested member of the fructan family, which is highly fermentable and may trigger symptoms. Assessment of the frequency and sources of wheat intake may provide opportunities for symptom improvement through recommendations for lower FODMAP containing foods.

In conclusion, recent evidence has suggested that the low FODMAP diet is beneficial in IBS. Referral to a registered dietitian for the implementation of a low FODMAP diet and subsequent reintroduction of higher FODMAP contacting foods is the best approach to ensure nutritional adequacy and optimize symptoms.

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