Diet and Irritable Bowel Syndrome
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Abstract and Introduction

Abstract

Purpose of review Those who suffer from irritable bowel syndrome (IBS) have long reported the frequent precipitation of their symptoms in relation to food ingestion and have often been convinced that certain foods were especially problematic. However, until very recently, research on the responses to food or individual dietary constituents, in IBS, has been scarce. This review addresses recent literature on diet and IBS.

Recent findings The complexity of food–symptom interactions in IBS is being revealed in recent and ongoing research. Such studies have revealed the variable effects of fibre in IBS and the susceptibility of IBS individuals to the ingestion of poorly digested and absorbed carbohydrates. The latter has led to the widespread adoption of the low-fermentable oligosaccharides, disaccharides, monosaccharides and polyols (FODMAPs) diet. Less certain is the role of another widely adopted dietary strategy, gluten restriction. Diet–microbe interactions are critical to the homeostasis of the gut microbiome in health and may well be disturbed in disease; enthusiasm continues, therefore, for the use of probiotics in IBS.

Summary Food is a common precipitant of symptoms in IBS and recent research has focused on the role(s) of individual dietary constituents in IBS and on fibre, FODMAPs, gluten and probiotics, in particular. Each may have a role in certain IBS sufferers.

Introduction

Irritable bowel syndrome (IBS) is a chronic functional gastrointestinal disorder characterized by abdominal pain or discomfort associated with abnormal bowel habit in the absence of any currently detectable structural, physiological or biochemical abnormalities of the gastrointestinal tract. In the absence of a reliable or a validated biomarker, IBS is defined on the basis of symptoms according to one of several diagnostic systems. Most common amongst these are the Rome criteria, which have now gone through three iterations; pending the outcome of the fourth set of such deliberations, Rome III diagnostic criteria remain the benchmark for the diagnosis of IBS in clinical research. According to Rome III, IBS is defined by the presence of ‘recurrent abdominal pain or discomfort for at least 3 days per month in the past 3 months, associated with 2 or more of the following: improvement with defecation, onset associated with a change in the frequency of stool or onset associated with a change in the form or appearance of stool’.[1] Bloating, distension and fatigue are also commonly featured in IBS and overlap with other functional gastrointestinal disorders is the rule rather than the exception. IBS symptoms are common in the general population and, in a minority of sufferers, exert a significant negative impact on quality of life, work, education and family life. Consequently, IBS is responsible for imparting considerable morbidity as well as a significant economic burden, throughout the world and in Western society, in particular.[2–5] Despite these costs to society and the individual and decades of clinical and laboratory investigations into the pathophysiology of IBS, our understanding of IBS remains incomplete and its treatment, therefore, somewhat unsatisfactory.[6] IBS is undoubtedly a heterogeneous disorder and may, indeed, encompass a number of distinct entities. It comes as no surprise, therefore, that over the years a number of factors have been proposed as relevant to the etiopathogenesis of IBS and its various symptoms. Over the years, these have ranged from genetics to gut dysmotility, visceral hypersensitivity, altered brain processing of visceral signals and abnormal psycho-neuro-endocrine and hypothalamic-pituitary-adrenal responses.[7,8] Along the way, the frequent association of IBS with anxiety and depression has often led to the latter acting as confounding variables in IBS research. In an attempt to introduce some uniformity to the field, the paradigm of the brain-gut axis emerged as a unifying concept,[9] with various manifestations and/or presentations of IBS being seen to
locate themselves on one or other point along this axis. Accordingly, in some individuals, their symptoms may be largely of central origin, in others, more peripheral/gut-located factors may predominate. Indeed, of late, research in IBS has to a significant extent focused more on a number of putative peripheral factors, and progress in this area has been facilitated by advances in our understanding of the enteric nervous system, the gut microbiome, mucosal immune responses, epithelial barrier function and epithelial secretory mechanisms. Indeed, abnormalities in the gut microbiome,[10,11] the host immune response, the epithelial barrier, intestinal secretion,[12] as well as systemic immune mediators[13] have been variably identified in IBS individuals, subgroups thereof or experimental models, and novel therapeutic strategies developed accordingly. Unfortunately, few of these have, as yet, led to effective and targeted treatment strategies for IBS sufferers.[14] Most recently, and belatedly, the important role of the ubiquitous interloper into the gastrointestinal environment, food, has begun to be recognized and serious research efforts devoted to understanding its role in IBS and to the development of dietary approaches to the management of IBS.

### Food, Diet and Irritable Bowel Syndrome

IBS sufferers clearly identify that eating is one of the most common precipitants of their symptoms[15,16,17] and food-related symptoms impact significantly on quality of life.[16] Indeed, the precipitation of symptoms immediately or soon after eating is a distinguishing feature of IBS and has been shown to permit its separation from another common functional disorder, chronic constipation.[16] In the absence of much in the way of good clinical science, IBS sufferers have been prey to various ‘tests’ and remedies of doubtful provenance that link IBS to any one of a host of ‘allergies’ and intolerances. Such medically unsupervised or individually concocted diets may not only be of little benefit but may also be so restrictive as to expose the individual to the risk of serious nutritional deficiencies.[19] It is important to note that true food allergies are uncommon in IBS.[20] Thus, although the prevalence of true food allergies in Western societies is between 1 and 3% in adults, surveys of gastrointestinal clinic patients found that 30–50% believed that their symptoms represented food allergy or food intolerance.[20] Immune responses to food in IBS may be much more subtle, however. Thus, Fritscher-Ravens et al.[21] have thrown new light on interactions between food antigens and IBS. They studied 36 IBS patients with suspected food intolerance and 10 controls using confocal laser endomicroscopy and demonstrated, in response to intraduodenal instillation of food antigens, ultrastructural changes in 22 of 36 patients but none of controls. Such changes included an increase in intra-epithelial lymphocytes, formation of epithelial leaks/gaps and widening of intervillous spaces. These responses were rapid (within 5 min) and also predicted a subsequent response to an exclusion diet. These findings are reminiscent of earlier findings in relation to gluten in IBS wherein conventional serology was negative but celiac antibodies were detected in duodenal fluid samples,[22] suggesting that food ‘allergic’ responses in IBS may be largely mucosal rather than systemic.

Are there other explanations for food-related symptoms in IBS? A number of factors deserve consideration, which are listed below:

1. True food allergy;
2. The physiological response to food ingestion;
3. Impact of certain molecules contained in the diet;
4. Intolerance to food(s);
5. Interactions with the microbiota;
6. Psychological reactions.

Of these, an exaggerated physiological response to food is the most time honoured with an abnormal/accentuated gastro-colonic motor response to food ingestion described several decades go.
Although there is experimental evidence to suggest that dietary levels of individual molecules, such as tryptophan, may influence both central and peripheral symptoms in IBS and related disorders, the relevance of such findings to the dietary management of IBS is unclear. Recent data would suggest that, although only 11–27% of patients can accurately identify the presumed offending food when re-challenged in a double-blind manner, many food-related IBS symptoms appear to represent food intolerance rather than allergy.

Although a tremendous range and variety of foods have been incriminated in dietary surveys, some culprits have emerged with some consistency and include wheat, fruit and vegetables, findings that may come as somewhat of a surprise given our traditional insistence on the inclusion of these foods in dietary recommendations for IBS. Indeed, diet and lifestyle modification, which included fibre supplementation along with symptomatic pharmacological agents and, where appropriate, psychological interventions, have been the bulwark of IBS management. It is now abundantly evident that diet, in both the short-term and long-term, is a significant modifier of the microbiome. Metabolic interactions between components of the diet and products of digestion will alter the luminal environment through changes in short-chain fatty acids, gases and bile acids, for example; each of these can alter gut function and generate symptoms. Finally, food ingestion has profound psychological and social implications. Thus, the individual who, on a previous occasion, experienced profound and embarrassing urgency in a restaurant will forever be gripped with fear when confronted with a similar situation and may, therefore, forego all such social activities.

It is abundantly evident that the role(s) of food, in general, and of food components, in particular, is complex and may vary considerably in various IBS populations and even between individual IBS patients. At this stage, it does not seem possible to clinically define those who are food sensitive/intolerant and are likely to respond to a particular strategy. Several have, nevertheless, been introduced into the management of IBS sufferers and will be assessed in the remaining sections of this manuscript.

**Fibre and Bulking Agents**

For decades, fibre and fibre supplements (bulking agents) were the mantra in the management of IBS. Synthetic and naturally occurring fibre supplements such as psyllium, calcium polycarbophil, bran and ispaghula husk have been examined extensively and were found to increase stool frequency, improve stool consistency and accelerate transit, thereby serving as attractive options in the therapy of constipation-predominant IBS. Interpreting the clinical benefits of fibre has been more challenging. Although fibre and fibre supplements, in general, seem to help constipation, some studies reported the exacerbation of symptoms, and bloating, in particular, in response to fibre. However, most of the studies involving these agents have been small and have contributed to conflicting results in a number of meta-analyses. In general, and, as confirmed in the most recent systematic review and meta-analysis, soluble fibres (psyllium, calcium polycarbophil, ispaghula) are effective in IBS, whereas bran does not appear to be of benefit. Despite earlier claims to the contrary, this latest review did not uncover any evidence of harm from this intervention. Fibre appears therefore to have a limited and formulation-dependent role in IBS.

**Fodmaps (Fermentable Oligosaccharides, Disaccharides, Monosaccharides and Polyols)**

Short-chain carbohydrates are poorly absorbed by the gastrointestinal tract. Via their osmotic effects in the intestinal lumen, rapid fermentation by gut bacteria to short-chain fatty acids (SCFAs) and associated gas production, these molecules can impact significantly on colonic function. By stimulating the release of serotonin from the intestinal mucosa, high-amplitude, propagated colonic contractions are initiated leading to accelerated intestinal transit, further contributing to the exacerbation of symptoms in patients with IBS. IBS patients and some clinical studies, indeed, noted that foods that are now included in the FODMAP category exacerbated their symptoms, but as many of these foods included fruits and vegetables, regarded as essential constituents of a ‘healthy’ diet, they persisted to ingest the offending items. On the basis of
evidence that the restriction of such carbohydrates could alleviate symptoms,[31] formal controlled trials of low FODMAP diets, albeit involving small patient numbers, went on to document their beneficial impact on many of the cardinal symptoms of IBS, including that most resistant of symptoms, bloating.[32] This dietary approach to IBS has been widely employed, but it must be stressed that this diet is not easy to implement and proves difficult to maintain, for some. Given the role of SCFAs and other products of FODMAPs in colonic homeostasis, defining the long-term consequences of this diet on the microbiome and colonic integrity will be important.[30,33]

Diets based on the exclusion of individual FODMAPs have received less attention of late despite past enthusiasm for the exclusion of lactose, fructose and sorbitol in IBS. One recent study confirmed the benefits of fructose exclusion for some patients and also the lack of predictability of a fructose tolerance test.[34]

Gluten

On the basis of patient reports, as well as clinical studies, there has been a suspicion for some time that some individuals with IBS who clearly did not have celiac disease appeared to be sensitive to or intolerant of gluten-containing food and the term nonceliac gluten sensitivity has been acknowledged by experts in the field.[35,36] That gluten might play a role in IBS-like syndromes is supported by the symptomatic overlap between IBS and celiac disease[37–41] as well as the precipitation of their typical symptoms in IBS individuals when exposed, in a blinded fashion, to gluten.[42–44] In one of these studies, gluten-related disturbances in gastrointestinal function were also documented and those IBS individuals harbouring the human leukocyte antigen (HLA) haplotypes associated with celiac disease were more susceptible to the effects of gluten.[44] The pathogenesis of gluten-related (or more correctly, perhaps, wheat-induced) symptoms in IBS and the benefits of a gluten-free diet remain unclear. Although some studies suggest benefits from gluten restriction,[45] other studies found little additive benefit for gluten restriction over and above that conferred by a low FODMAP diet.[46] The latter finding suggests that it is the fructan component of wheat (a FODMAP) and not gluten that is the guilty party in wheat sensitivity in IBS. Limited results from formal testing of the immune response to gluten in IBS would support a nonimmune basis for nonceliac gluten sensitivity.[47] The role of a gluten-free diet in IBS remains unclear.

Probiotics, Prebiotics and Synbiotics

As the role of the microbiota in IBS has come to be explored and changes in microbial composition described, in IBS,[48] enthusiasm for therapeutic interventions that could beneficially modulate the microbiota has increased.[49,50] Among these, the food supplements probiotics, prebiotics and synbiotics are of relevance to this review. Data from animal models, as well as clinical research in humans, have revealed a number of properties of probiotics that could be of value in the management of IBS. These include antipathogenic and anti-inflammatory effects, modulation of gut motility and visceral hypersensitivity, restoration of epithelial integrity, as well as altering the microbiome and its metabolic activity.[49–51]

Prebiotics, such as fructo-oligosaccharides and inulin and synbiotics (combinations of prebiotics and probiotics), though less studied, could, by stimulating either the growth or the activity of bacteria that are beneficial to human health, exert similar effects.

Numerous individual studies have attested to the beneficial impact of probiotics (particularly Lactobacillus or Bifidobacterium species) on IBS symptoms and, especially, on bloating, and flatulence.[52] More global effects on overall symptomatology and quality of life have been less frequently documented.[49] That probiotics, in general, are beneficial in IBS was confirmed by a recent meta-analysis,[53] similar benefits could not be confirmed in this study for prebiotics and synbiotics. However, despite the reported benefits of probiotics in IBS, there are many aspects of this approach that remain to be resolved, such as the optimal strain, dosage and treatment duration. The small size and less than optimal study design of many studies
to date precludes, in large part, the development of very specific advice on probiotics, prebiotics and synbiotics in IBS.

**Peppermint Oil**

This antispasmodic, available over-the-counter and in health food stores, acts primarily as a calcium channel blocker, thereby facilitating gastrointestinal smooth muscle relaxation. Shown to be superior to the placebo in a recent meta-analysis, peppermint oil provides short-term relief of discomfort and abdominal pain in IBS.\(^2\) It can, however, exacerbate gastroesophageal reflux, a disorder commonly associated with IBS. Furthermore, it needs to be stressed that the trials demonstrating the benefits of peppermint oil were performed using very specific formulations that may have little in common with preparations on the shelves of supermarkets or health food stores.

**Conclusion**

Formal studies of the role of food and dietary components in IBS have been long overdue and have revealed the complexities of interactions between food, food constituents, the gut and the gut-brain axis, which may lead to symptoms in IBS. Progress has been made and new approaches, such as the low FODMAP diet, offer real benefits to some IBS patients.\(^3\) Studies of food effects and the impact of dietary manipulations in humans are challenging but need to be done to fully reveal the nature of food-related effects in IBS.

**Sidebar**

**Key Points**

- Food is a common precipitant of symptoms in IBS.
- Multiple factors may contribute to the occurrence of symptoms in relation to food ingestion in IBS.
- Although food allergy may not be common in IBS, food intolerance and problems with FODMAPs, in particular, appear to be common among IBS sufferers.
- The status of gluten restriction as a therapeutic strategy, in IBS, is unclear.
- Probiotics, in general, have been shown to ameliorate IBS symptoms.

**References**


   * A comprehensive and authoritative review.


   ** This study emphasizes the high frequency of food-related symptoms in IBS and illustrates their impact on quality of life.


   * A good overview of food and its role in IBS.


** A detailed review of the pathogenesis of food-related symptoms in IBS.


** A very provocative study that uses confocal endomicroscopy to examine directly in vivo the effects of food antigens on duodenal mucosal ultrastructure. A group of IBS individuals who are sensitive in terms of epithelial responses is identified.


* Another illustration of the impact of dietary manipulation on tryptophan levels (and thus on serotonin) on central and peripheral symptoms in IBS.


** The up-to-date comprehensive systematic review (with meta-analyses) on all aspects of the management of IBS.


** The best evidence to date for the efficacy of a low FODMAP diet.


This study demonstrates the sensitivity (in terms of both symptoms and gut function) of some IBS individuals (most notably, those who bear celiac-associated haplotypes) to gluten exposure.


** This study suggests that fructans and not gluten are the mediators of wheat-related effects in IBS and the low-FODMAP and not a gluten-free diet should be the primary strategy.


* A critical overview of the impact of probiotics in IBS.


** A comprehensive review of dietary strategies in IBS.

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