

The Application of a Low FODMAP Diet in Irritable Bowel Syndrome

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Abstract. Irritable Bowel Syndrome (IBS) is a common functional bowel disease that has a high morbidity worldwide, and the conventional interventions are not usually effective in addressing the dietary triggers. This work thoroughly examined the classification and pathogenesis of FODMAPs, assess the clinical effectiveness of low-FODMAP diets as a stand-alone treatment and its integration with probiotics, antidiarrheals, spasmolytics and psychological therapies of the IBS, and further developed customized and targeted dietary modification interventions, which balance symptom management and nutritional requirements of special populations such as children, the elderly, pregnant women and diabetic patients with complicated IBS through integration of the physiological properties and nutritional preferences of the respective populations. Findings indicated that the low-FODMAP diet alone demonstrated a total symptom-reduction rate of 71 per cent in patients with IBS regions and that multi-modal interventions were even more effective and prevented relapse. The low-FODMAP diet is non-pharmacological, safe and effective in reducing IBS, and tailored schemes (depending on population factors) are favorable towards the promotion of the dieting in clinical settings.

Keywords: Irritable Bowel Syndrome (IBS), Low FODMAP diet, Dietary intervention, Symptom relief, Special populations.

1. Introduction

IBS is a widespread functional bowel disease in clinical practice with the main symptoms being chronic recurrent pain and bloating of the abdomen in general and in most cases the abnormal bowel habits and stool are altered. The development of symptoms is closely associated with diet, emotions and changes in gut microbiota and the pathogenesis consists of many different aspects, including abnormality of intestinal motility, dysbiosis of microbiota and loss of gut axis in the brain, which significantly worsens the quality of life of patients. Currently, the disease has great disease burden in the globe. The prevalence rate among women is higher than among men. The group of high incidence is engulfed by young and middle-aged individuals. The disease has a high incidence rate, which has been on the rise over the past years; this is due to the changes in lifestyle and structure of the diet that imposes great clinical and social pressure to the medical system.

Currently, the common clinical approach of the mainstream to IBS intervention is symptomatic pharmacotherapy with antispasmodic and antidiarrheal agents, intestinal microbiota controllers, and lifestyle changes. But such intervention measures can merely alleviate symptoms and are not easily able to intervene accurately using the prism of dietary motivations. There are still patients with issues of ineffective efficacy, frequent symptoms, or drug tolerance to fit the clinical requirement of secure, protracted, as well as precisely directed IBS intervention plans.

As clinical research acquired a profounder basis, the role of diet as an important determinant of the symptoms of IBS has gained popularization, and the dietary intervention has become a significant supportive strategy of conventional IBS treatment. The low FODMAP diet is associated with the most recent method of clinical intervention of IBS since it has a highly targeted nature. FODMAP is a short chain carbohydrate, which is easily fermented and cannot be digested and absorbed easily. Intestinal bacteria can ferment it to give off gas or cause high intestinal osmotic pressure leading to the development or aggravation of intestinal symptoms of IBS. The diet low in FODMAP has the potential to minimise the irritation of the intestines and clinical presentation of patients by limiting the consumption of the said foods. Several randomized controlled trials and meta-analyses have

indicated that the low FODMAP diet has a significant effect on the symptoms of bloating, abdominal pain, and abnormal bowel movements in IBS, and the evidence level is high [1-3].

This paper also searches the gist attributes and pathogenesis of FODMAP, evaluates the clinical effectiveness of the low FODMAP diet in isolation, or in association with probiotics, antidiarrheals, antispasmodics, psychological intervention and other measures, on IBS in a systematic way, and explains the practicability of this diet program in children, the elderly, pregnant women, diabetes patients with IBS and other special population, and develops specific diet modification regimen, with aims of providing scientific theoretical background and clinical practice guide to the standard diet intervention of IBS.

2. Key Properties and Features of Classification of FODMAP

Short chain fermentation carbohydrates have an abbreviation of FODMAP. The biological feature of these parts is that they are not readily digested and absorbed by human digestive tract. Once absorbed into the colon, they are readily fermented by the intestinal microbiota to generate gas, or they can lead to water retention in the intestinal lumen through raising the intestinal osmotic pressure and hence core symptoms of abdominal pain and bloating are induced/exacerbated in IBS patients. FODMAP mainly comprises four major elements, which include the fructose, lactose, fructooligosaccharides, and polyols. Fructose individual absorption is greatly different, lactose requires the intestinal lactase enzyme to be digested before absorption can occur, fructooligosaccharides are indigestible oligosaccharides and are significant in the fermentation of intestinal microbiota, and polyols are either naturally present in fruits and in artificial sweeteners and are poorly absorbed in the intestine. These principles of low FODMAP diets have been elucidated by the basic research performed by Shepherd SJ and Gibson PR with respect to intestinal metabolic pathways and symptomatic mechanisms of four types of FODMAP components, which offer valuable theoretical justification to the clinical use of low FODMAP diets [4].

3. Low FODMAP Diet Application

3.1. Fructose on IBS and Dietary Restriction Effect

Fructose is a universal cause of diarrhea, abdominal pains and bloating in patients of IBS, particularly in excess of it, or when the intestinal absorption is abnormal, then the symptoms are more severe. The study by Manzonei et al. established that the extent of symptoms among IBS patients with fructose malabsorption is positively related to fructose intake, and a high fructose diet restriction has the ability to normalize the intestinal osmotic pressure in patients [5]. The use of fructose, a crucial source of energy to human body, should not be overly limited in clinical practice, particularly to adolescent patients with IBS. Although the symptoms are being enhanced, there is need to strike a balance between the amount of energy needed to support their growth and development.

3.2. Effect of Lactose on IBS and Effects of Dietary Restrictions

Lactose is a significant compound causing abdominal pain, bloating, and diarrhea among the patients of the IBS. It has been found that a sizeable number of patients with IBS the world over experience lactase deficiency, and specific restrictions of the dairy products can raise the symptom-relieving frequency of affected individuals by over 60 percent [6]. Nevertheless, the limitation of dairy products through the long term can simply result in the lack of calcium in the patients that may precondition the loss of the bone density. Hence, symptom control and calcium nutrition supplementation has to be balanced in clinical use.

3.3. Pectin Effect on the IBS, Dietary Restriction Effect

Fructan may potentially cause severe aggravation of abdominal distension and discomfort in the patients of IBS. The *in vitro* experiments and clinical studies conducted by Costabile A et al. discovered that pectin had the potential to stimulate the growth of intestinal gas producing bacteria, stimulate the amount of intestinal gas and also worsen the symptoms of abdominal distension among IBS patients [7]. Nevertheless, fructooligosaccharides, being a crucial nutritional fuel of gut probiotics, must not be subjected to permanent limitations in clinical practice, which will tend to reduce the diversity of the gut microbiota, reduce the number of probiotics and affect the functioning of the gut barrier. There is need to establish an appropriate tradeoff between symptom relief and gut microbiota balance.

3.4. Polyols Effects on IBS and Effect of Dietary Restriction

In clinical findings by B a umler et al. it was found that on a small portion of intake of sorbitol, the symptoms of the IBS can be aggravated. Most patients will have diarrhea and bloating after taking a single intake of a specific dose of sorbitol. The level of symptom relief of the patients can be 62% as soon as fruits and artificial sweeteners that include sorbitol are limited [8]. The dose-response analysis of Muir JG et al. revealed great interpersonal variations in the laxative impact of polyols and select susceptible classes can have intestinal malfunction on minimal levels of sorbitol usage [9]. Polyols are common, however, in natural foods. In this case, a thorough limitation in clinical practice will help to compress the variety of diet options available to patients, decrease their quality of life, and can lead to decreased intake of dietary fibers as well. As such, the restriction scale needs to be moderately controlled, minimize the symptoms progress with the guarantee that patients live quality lives.

3.5. Clinical Application Effect of Low FODMAP Diet.

The use of low FODMAP diet is sufficient in the overall and specific reduction of IBS symptoms through simultaneous restriction of four high FODMAP ingredients. The regimen does not presuppose the use of medication or other intervention techniques and is safer. It is among the desirable first-line treatment of IBS in patients.

Multicenter randomized controlled trials carried out in the country have established that low FODMAP diet adoption alone reports significant clinical improvement effect on diarrhea, constipation, and mixed IBS with significantly greater symptom improvement rate than conventional diet control group. Concurrently, it can be used successfully to minimize the severity of symptoms of patients and increase their quality of life score [10]. This diet is generally safe and only a small number of patients have minor side effects during the course of the intervention which can be corrected upon dietary modification. No critical issues, including nutritional deficit and extreme imbalance in gut microbiota have been reported, and this fact has been confirmed by the international multicenter studies [11]. Besides, FODMAP low diet plan formulated alongside Chinese dietary system has demonstrated greater patient compliance to diet in clinical settings that is more supportive to the long run promotion and implementation of the diet plan in China.

Low FODMAP diet produces a huge intervention impact among IBS patients of different subtypes. This nutritional program is harmless and there is low rate of adverse reaction. Low FODMAP diet plan that fits the local dietary framework could have an enormous contribution on patient compliance along with being more amenable to long-term marketing and usage. A low FODMAP diet shows greater symptom relief in comparison with the traditional dietary interventions and has the potential to positively influence the quality of life of the patients.

Originally published in 1991, it was updated in 2000 and re-issued in 2014 by Oxford University Press (Combination program of low FODMAP diet and other intervention measures).

4. Combined Approach of Low-FODMAP Diet and Other Interventions

4.1. FODMAP Low Probiotic Diet

A precise alleviating effect of Probiotics on IBS symptoms is observed through the restoration of the balance between the microbes of the gut and an increase in the functions of the barrier of the intestinal tracts. In a case of a combination between a low FODMAP diet and probiotics, it has the effect of decreasing symptom precipitation by means of dietary restriction, and restoring and healing gut microbiota through the use of probiotics, creating a synergistic effect. A study by Tursi A et al. identified that low FODMAP diets with Bifidobacterium triple viable capsules may increase the number of favorable intestinal bacteria significantly and the effect of it surpasses that of an individual intervention regime [12]. Nonetheless, joint intervention also has some negative aspects. The conditions of storage of probiotics should be high and there are patients who have low tolerance to probiotics leading to the short-term worsening of abdominal distention. The strategy must be modified to suit the personal responses.

The two combined bear a two-fold effect of control incentives in the diet and mechanisms of regulation and control of microbiota, which can successfully enhance the rates of symptom alleviation and lessen the chances of recurrence. In clinical practice, one should focus on the storage of probiotics and their tolerance in patients and adapt the plan to the specific response of patients to achieve the safety and efficacy of the combined intervention. The collaborative program offers an alternative method to the long-term management of IBS particularly among the IBS patients who have a severe dysbiosis.

4.2. FODMAP Low Diet and Antidiarrheal Medication

Symptomatic medications in the treatment of IBS diarrhea patients, such as antidiarrheal drugs, are able to shorten the rate at which bowel movements occur soon. Nevertheless, the efficacy may decrease with the prolonged use and fails to resolve the issue of diet triggers. Combined with antidiarrheal medication intervention with low FODMAP diet, antidiarrheal medication is able to promptly regulate the acute symptoms, and dietary intervention can prevent the occurrence of symptoms in the long term and enhance the treatment effectiveness of antidiarrheal medication. The research article by Camilleri et al. established that this combination regimen is capable of lowering the dosage of antidiarrheal medications and decreasing the chances of adverse drug reactions [13]. Nevertheless, antidiarrheal preparations can lead to constipation in certain patients, and a low FODMAP diet which is too restrictive of dietary fiber can lead to the development of constipation thus prompting the need to change diet and medication regimens clinically.

This combined initiative provides a balance between acute symptom management and etiological management, which reduce the duration of time that a patient will relieve the symptoms and lower the likelihood of recurrence over time. The following should be taken into consideration in clinical attention to balance the dietary fiber content and antidiarrheal dosage content in the diet, prevention of the danger of constipation and the safety of intervention plans. This combination therapy is preferred as the intervention strategy that can be applied to patients with acute exacerbation of diarrhea predominant IBS.

4.3. Low FODMAP Diet Program was Integrated with Antispasmodics

The Spasmodics may reduce the intestinal smooth muscle spasms and abdominal pain symptoms of IBS patients, but they cannot encourage the symptoms of bloating and abnormal bowel movement. With the intervention of antispasmodic medication combined with low FODMAP diet, the scene of abdominal pain symptoms may be relieved rapidly and the underlying cause of the bloating and abnormal bowel movements will be improved. According to the study conducted by Mearin F et al., a complex treatment of antispasmodics and low FODMAP diet can work together to achieve the optimal regulation of the intestinal motility, which enhances additional pain alleviation in the abdomen [14]. Nonetheless, antispasmodics are associated with such side effects as dry mouth and

dizziness, whereas low FODMAP dietary restrictions can impose a greater mental load on patients. The two can have an impact on treatment adherence, and their patients should be given information about possible precautions before clinical practice.

The synergistic effect of the two was the enhanced abdominal pains, bloating, and abnormal bowel movements, whose therapeutic outcomes were improved compared to individual interventions. It is clinically important to educate patients about potential adverse drug reactions and dietary limitations in advance, promote patient adherence with the help of health education, and make sure that the system is effective. The plan would be especially appropriate in IBS patients who report high levels of abdominal pain that can easily reverse the pain experience of the patient.

4.4. Psychological Intervention and Low FODMAP Diet

The brain gut axis has been implicated in psychological aspects on the intestinal activities and contributes significantly to the initiation of IBS symptoms. Low FODMAP diet in combination with psychological intervention can be used to reduce the effects of dietary triggers and psychological responses at the same time in order to increase the effectiveness of treatment. Palsson et al. discovered that cognitive-behavioral therapy in tandem with the low FODMAP diet is found to take the process of enhancing the symptoms further by regulating the functions of the brain gut axis [15]. Nonetheless, the cost of psychological intervention is high and benefits of psychological intervention are not accepted well by every patient, considering the necessity of professional staff to conduct the psychological intervention. In a clinical context, patient acceptance can be enhanced through optimization of the form of the psychological intervention.

This is an integrated physiological and psychological approach that can be applied to comorbid and anxious IBS patients. The form of psychological intervention may be optimized, implementation expenses minimized, further patient acceptance increased, and the benefits of combined intervention may also be exploited by clinical practice. This combination therapy may be useful in enhancing the result of overall treatment in IBS patients with apparent emotional disorders.

5. Adjustment and Feasibility Strategies of Low FODMAP Diet in IBS Patients in Special Populations

5.1. Children with IBS

This is due to the fact that the intestinal functioning of the children with IBS is not yet fully functional and in a critical phase of growth and development. The viability of a low FODMAP diet is primarily dependent on the state of maximizing the state of growth and development based on the improvement of symptoms, although there is the need to prevent the lack of nutrients. The investigations conducted by Bischoff SC et al. proved that in case of children with IBS having a low FODMAP diet, a reasonable ratio of high nutrient density foods can alleviate the symptoms and at the same time allow growth and development demands [16]. The involved adjustment plan of children with IBS should focus on effectiveness and nutritional adequacy, selecting low-FODMAP and high-nutrient density foods, restrictions on whole grains and dairy products will not take place, supplementation of calcium and iron influence were provided by the other food. Nevertheless, not all children adhere to dietary restrictions, and a limited variety of eaten dishes can have an impact on the appetite. Thus, compliance has to be enhanced by means of fun eating mixes.

5.2. Elderly IBS Patients

Aging patients with IBS tend to be associated with underlying illnesses, reduced intestinal capability of digestion of food and absorption, inadequate nutritional stores. A low FODMAP diet is also feasible because it is effective in treating bloating and diarrhea, as well as, better quality of life. According to the study by Langmead et al., in case of the elderly IBS patients, it is necessary to pay attention to the nutritional support of the diet in particular to proteins and vitamins to avoid the

possibility of malnutrition when following a low-FODMAP diet [17]. RE officer should provide elderly IBS patients with an adjustment strategy that is based on the use of nutritional supplementation to prevent the lack of protein and vitamin due to the limitation of high FODMAP foods. They are able to select eggs, fish, low FODMAP vegetables, and other ones. Simultaneously, modify their diets as per comorbidities like hypertension and make low salt food choices. Nevertheless, the meal pattern of older people is established, and they have low tolerance toward dietary changes. Cognitive decline is also problematic with some elderly people because they find it challenging to determine the high FODMAP foods accurately. Thus, the enhancement of the feasibility by the help of family members and simplified dietary guidelines is required.

5.3. Pregnant Women with IBS

During pregnancy, IBS is likely to cause intestinal dysfunction because of hormones and the compression of the uterus. The possibility to use the low FODMAP diet in an attempt to safely mitigate the symptoms and prevent the possible impact of the medication on the fetus is the reason why the diet is feasible. The article by Kaiser KK et al. established that a low FODMAP diet in the expectant stages of an IBS patient group does not contribute to a higher risk of the fetus having growth restrictions but could enhance the quality of life of a pregnant woman [18]. The adjustment plan of pregnant women with IBS needs to consider pregnancy and breast feeding diets, so the selection of food with low FODMAP and abundant in folate, iron, and calcium should be used to ensure no one eats too little and the body becomes deficient in nutrients. Meanwhile, the diet plan should be adapted to the various developmental phases of pregnancy, including the middle and late phases of pregnancy (rise in energy levels). But during the time of pregnancy, there is a considerable change in the appetite and some pregnant women might feel hungry because of dietary restrictions. Moreover, certain low FODMAP foods can be of a poor taste, and other problems, and it is necessary to maximize the experience with the participation of small meals, frequent meals, and different diets.

5.4. Patients Who have IBS Complicated Diabetes

The diabetic patients with IBS should consider two factors: the control of blood glucose levels and the improvement of the intestinal symptoms. Low FODMAP diet has the feasibility to mitigate intestinal symptoms and part of the low FODMAP food aids in stabilizing blood glucose. According to Chandra A et al., low FODMAP foods with low glycemic index can have two objectives of controlling blood sugar and improving intestinal symptoms. The change plan of diabetes patients with IBS should select low-glycemic index, low-FOCI, low-refined-carbohydrate foods, avoidance of high fructose fruits and refined carbohydrates, and should decide the content of diet intake based on blood sugar levels to achieve the dual effect on blood sugar and intestinal symptoms. There are however, others low FODMAP foods whose dietary fiber is not adequate, long-term administration could interfere with blood sugar levels, and patient management needs could become more burdensome. Thus, the plan needs to be optimized through the reasonable combination of foods with high fiber content and low FODMAP content.

6. Conclusion

IBS can be effectively treated using low FODMAP dietary intervention that reduces intestinal osmotic pressure, corrects microbiota imbalance and visceral sensitivity in reducing the symptoms. Diversity in individual response is associated with baseline intestinal status. A single low FODMAP diet has high safety, and high relief effect, when a combination of probiotics, antidiarrheal drugs, and other regimens could enhance the stability of therapeutic efficacy. Specific populations should come up with their own special diet strategies keeping their physiological peculiarities in view, finding the balance between the need to control the symptoms and satisfy their nutritional requirements.

Low FODMAP diet offers a valuable guideline in non pharmacotherapy towards IBS which is very significant in enhancing the quality of life of the patients as well as decreasing medical cost.

This requires the further investigation of the molecular basis of its various mechanism of action and the optimization of interventions combination in the future. An accurate nutritional prescription system grounded on the characteristics of patients must also be devised to facilitate the unified and customized use of this nutritional plan in clinical practice.

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