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The Use and Efficacy of the Low FODMAP Diet in the Treatment of Gastrointestinal Diseases

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Abstract

Introduction and objective: *The L-FODMAP diet limits products that contain hard-to-digest carbohydrates and other substances that may affect the symptoms of gastrointestinal diseases. The main objective is to eat foods with a low content of poorly absorbable carbohydrates that undergo fermentation and lead to an increase in osmotic pressure in the small and large intestine. This group includes lactose, fructose, polyhydroxy alcohols (mannitol, xylitol, sorbitol), galactooligosaccharides and fructans. The aim of this work is to review the available studies and to collect information on the use of the L-FODMAP diet in gastroenterological diseases.*

Abbreviated description of the state of knowledge: *Research results show that there are benefits of using the L-FODMAP diet in patients with irritable bowel syndrome – in the group of patients on a L-FODMAP diet there was a significant improvement in gastrointestinal symptoms as well as an improvement in quality of life. In the remission of inflammatory bowel diseases such as colitis ulcerosa and Crohn's disease, a reduction of symptoms and an improvement in quality of life were also observed, a reduction of symptoms and an improvement in quality of life were also observed. There have been studies on the use of this diet in gastroesophageal reflux disease, but no hard evidence of its effectiveness has been found yet.*

Summary: *According to the results of recent studies, we can assume that the L-FODMAP diet can reduce troublesome ailments in some gastroenterological diseases. It is also important to remember that its use can lead to the elimination of many nutrients. There may also be a negative impact on motility and intestinal microbiota. More clinical trials are needed to provide more evidence for the use of the L-FODMAP diet in these disease entities.*

Key words: *diet, irritable bowel syndrome, crohn's disease, ulcerative colitis, gerd*

Introduction

In recent years, there has been growing interest in a diet low in fermenting oligosaccharides, disaccharides, monosaccharides, and polyols (L-FODMAP). It is mainly used in the treatment of functional symptoms in irritable bowel syndrome (IBS), but it is also used in an increasing number of patients who are suffering from other conditions. The main assumptions of the L-FODMAP diet are to eat foods with a low content of poorly absorbable carbohydrates that undergo fermentation and increase osmotic pressure in the small and large intestines. This group includes lactose, fructose, polyhydroxy alcohols (mannitol, xylitol, sorbitol), galactooligosaccharides, and fructans. The above-mentioned compounds are common in an average diet; they are found in vegetables, fruits, legumes, dairy products, grain products, oilseeds, spices, sugar products, alcoholic beverages, sweeteners, and many processed products [1, 2].

There are two basic mechanisms leading to the appearance or worsening of symptoms as a result of consuming the compounds contained in the FODMAP. In the first of them, as a result of the high osmotic activity of FODMAP, there is an increased secretion of fluids into the intestinal lumen and the subsequent stretching of its walls, which leads to symptoms. The second mechanism leading to the development of symptoms is the rapid fermentation of FODMAP by the gut bacteria, which results in an overproduction of gas in the gut lumen. The result of gas accumulation is pain, discomfort, and flatulence [2, 3].

The L-FODMAP diet is not a diet that should be used for life. It consists of three stages. In the first phase of the diet, products containing large amounts of FODMAP (milk, cottage cheese, honey, onions, wheat products, sweetener, glucose-fructose syrup, etc.) should be excluded for a period of 6 to 8 weeks and replaced with products containing low FODMAP content. After this time, as symptoms subside, the transition to stage two occurs, in which the diet is gradually expanded to include products containing more FODMAPs. The third step is the individualization of the diet with the elimination of foods that cause symptoms [4, 5].

Table 1. Examples of products with low and high FODMAP content [7]

Food group	Low FODMAP	High FODMAP
Dairy	cheddar cheese, brie cheese, camembert cheese, almond milk, rice milk, butter, peanut butter, margarine	cottage cheese, mascarpone cheese, ricotta cheese, yogurt, cow's milk, cream, soy milk
Grains	quinoa, rice, millet, cornmeal, gluten-free products	wheat, barley, rye
Proteins	meat, fish, poultry, eggs, tofu	lentils, chickpeas, beans, soy
Fruits	bananas, grapes, kiwi, mandarins, oranges	apple, pear, mango, watermelon, peaches, apricots
Vegetables	carrots, tomatoes, cucumbers, peppers, celery, corn, eggplant, lettuce, pumpkin, zucchini, sweet potatoes, chives	onions, asparagus, artichokes, broccoli, cauliflower, brussels, green peas, leeks, red beet, cabbage, fennel, garlic
Other	granulated sugar, maple syrup, aspartame, stevia, espresso, filtered coffee, green tea	agave syrup, honey, glucose-fructose syrup, sweeteners (sorbitol, mannitol, maltitol, xylitol), fruit juices, instant coffee

Apart from the use of the L-FODMAP diet in the treatment of symptoms of irritable bowel syndrome, studies have also been undertaken to evaluate the use of the L-FODMAP diet in the course of other gastrointestinal diseases – Crohn's disease, ulcerative colitis, and others [6]. This work aims to review the available studies and collect information on the use of the low FODMAP diet in the following disease entities.

Irritable bowel syndrome (IBS)

Irritable bowel syndrome is a chronic, functional gastrointestinal disease characterized by recurrent gas, altered bowel movements, and abdominal pain without an underlying organic or biochemical cause. The cause of the disease is probably complex and has not been fully understood. Many factors are involved in the pathogenesis of IBS, and the most important role is attributed to disturbances in gut-brain interaction. Other factors include disorders of the intestinal microbiota, food intolerances, a history of infectious diarrhea, intestinal motility disorders, visceral hypersensitivity as well as genetic and psychosocial factors, especially chronic stress of considerable intensity.

The diagnosis of IBS is based on the Rome IV criteria, which state that if during the last three months, for at least one day a week, there was abdominal pain related to bowel movement, change in its consistency, or change in the bowel movement rhythm (2 criteria must be met), IBS can be diagnosed. According to the IV Rome criteria, several forms of IBS may be distinguished based on the dominant symptoms. We can identify IBS with diarrhea (IBS-D), IBS with constipation (IBS-C), mixed IBS (IBS-M), and the unclassified form (IBS-U) [8].

So far, no clear cause of IBS has been established, so there is no possibility of using causal therapy. Irritable bowel syndrome is a chronic disease, with most patients having recurring symptoms, sometimes for life. An important step in the treatment is a lifestyle change, especially increasing physical activity and modifying the diet. In 2006, one of the first retrospective studies on the effect of FODMAP on the incidence of disease symptoms in the group of patients with irritable bowel syndrome with fructose malabsorption was published. Following the commencement of the L-FODMAP diet, improvement was observed in 74% of patients in the study group [5].

A study by Zahedi et al. shows that in patients with IBS-D who began to follow the L-FODMAP diet, after 6 weeks there was a significant improvement in gastrointestinal symptoms compared to the GDA (general dietary advice) group [9].

A study by Halmos et al., including 30 IBS patients and 8 healthy patients who followed either the L-FODMAP diet or the classic diet for 21 days, proved that a diet low in FODMAP was effective in reducing gastrointestinal functional symptoms in IBS patients [10].

Meta-analysis using 9 randomized controlled trials (RCT), including a total of 596 subjects (3 RCTs compared the L-FODMAP diet with a habitual diet, 2 RCTs provided all meals and compared the L-FODMAP diet with a western diet, 1 RCT compared the L-FODMAP diet with a diet high in FODMAPs or a sham diet, and 2 RCTs compared the L-FODMAP diet with other diet recommendations for IBS) showed significant group differences for the L-FODMAP diet for gastrointestinal symptoms, abdominal pain, and health-related quality of life compared with other diets. This meta-analysis found evidence of the short-term efficacy and safety of the L-FODMAP diet in patients with IBS [11].

Small intestinal bacterial overgrowth (SIBO)

Small intestinal bacterial overgrowth syndrome (SIBO) is a diverse disease that is often underdiagnosed due to non-specific symptoms, such as abdominal discomfort, constipation, flatulence, diarrhea, and abdominal pain [12]. The most common risk factors for excessive bacterial overgrowth in the small intestine include anatomical abnormalities and disturbances in the motility of the small intestine [13]. The most common non-invasive diagnostic method is the methane and hydrogen breath test, while the microbial investigation of jejunal aspirates is still the gold diagnostic standard [12]. Treatment of SIBO is based mainly on antibiotics, but supportive drugs, such as probiotics or PPIs (proton pump inhibitors), are also used [14].

An adequate diet should be the complementary treatment to antibiotic therapy used in SIBO. In patients with SIBO, carbohydrates such as monosaccharides, disaccharides, oligosaccharides, lactose, and fructose are fermented by intestinal bacteria, leading to the formation of excessive gas, which is manifested by abdominal pain and flatulence [15]. The L-FODMAP diet is recommended to reduce symptoms and prevent the recurrence of SIBO. However, studies on the effectiveness of the L-FODMAP diet in SIBO therapy are based on studies of patients with IBS, which clinically overlap with SIBO to a large extent [16]. The L-FODMAP diet reduces the population of selected bacteria due to the limitation of the consumption of substances necessary for their proliferation and growth [15]. Studies assessing the effect of the L-FODMAP diet on SIBO showed a decrease in Bifidobacteria in stool samples collected from patients, and a decrease in the concentration of exhaled hydrogen compared to the group not using the L-FODMAP diet. However, no differences were found in the case of colonic volume between the group using the L-FODMAP diet and the group not using the diet [17].

Crohn's disease

Crohn's disease (CD) is classified as a chronic inflammatory disease of the gastrointestinal tract of a granulomatous nature. Inflammation most commonly

affects the terminal ileum, ileo-colon, colon, and anus, but can affect any part of the digestive tract from the mouth to the anus. The most common symptoms include abdominal pain, diarrhea, mucus or blood in the stool, weight loss, irritation, and discharge from perianal fistulas. Uveitis, arthritis, and skin rash are among the extraintestinal symptoms of Crohn's disease. The diagnosis takes into account the clinical picture as well as endoscopic, radiological, histological, and biochemical examinations [18].

Research shows that the introduction of an appropriate diet in CD can positively affect the reporting of symptoms, disease progression, inflammatory markers, and the patient's quality of life [19]. Many studies show the benefits of the Mediterranean diet and the L-FODMAP diet [20, 21, 22, 23]. Patients following the L-FODMAP diet should limit products that are a source of fermentable oligosaccharides, disaccharides, monosaccharides, and polyols, which are poorly absorbed in the intestine and are strongly fermented by intestinal bacteria, which causes flatulence, abdominal pain, and diarrhea [24, 25]. In the studies on the effectiveness of the L-FODMAP diet in patients with CD, it was found to reduce inflammatory markers, reduce the number of diarrheal stools, alleviate gastrointestinal symptoms, and improve the quality of life [26, 27, 28, 29]. Despite the strong evidence of reducing gastrointestinal discomfort in patients with CD, we must be aware that this diet can lead to potential side effects. A restrictive diet can lead to a deterioration in nutritional status; therefore, a dietitian should ensure an adequate supply of fiber and calcium energy is provided. Studies were carried out to assess the fecal microbiota of healthy people and people with CD who were on the L-FODMAP diet, and healthy people and people with CD who were not using this diet. The prebiotic effect of FODMAP-containing products has been demonstrated compared to patients on a diet that restricts these products [28]. Although the effectiveness of the L-FODMAP diet has been demonstrated in many studies, the restrictiveness and difficulties in using the L-FODMAP diet require the support of a dietitian. Difficulties in maintaining a diet and excluding multiple products are a source of heterogeneity in the overall results, which is the main limitation of these studies [30].

Ulcerative colitis

Colitis ulcerosa (UC), like Crohn's disease, belongs to the group of inflammatory bowel diseases (IBD). Unlike Crohn's disease, it is confined to the rectum and large intestine, affects the superficial layers of the gut wall, and most commonly presents with diarrhea, with up to 20 bowel movements a day, usually with blood. It is a chronic disease and at the moment incurable, so it is important to look for activities that, apart from pharmacotherapy, could improve the quality of life. Unfortunately, most studies examining the effects of FODMAP on inflammatory bowel disease recruit people with both Crohn's disease and UC – there are no studies based on each of these diseases separately. One study showed that a L-FODMAP diet reduced fecal microbes believed to regulate the immune response, but the diet did not affect inflammatory markers [31]. Studies have also shown the elimination of intestinal symptoms (such as flatulence) in patients in remission and with IBS symptoms [32]. The respondents also assessed their quality of life as better. [31] A randomized, double-blind study was also conducted in which quiescent IBD and functional gastrointestinal symptoms patients responding to a L-FODMAP diet were assigned to a series of 3-day challenges with several fermenting carbohydrates in random order. The fructans used in the study exacerbated functional gastrointestinal symptoms in quiescent IBD [33]. A systematic review conducted on studies collected from three medical databases revealed that the L-FODMAP diet shows promising therapeutic benefits for IBD patients [6]. In both Crohn's disease and UC, the L-FODMAP diet may be considered as a possible treatment. However, it is important to consider possible side effects and weigh the pros and cons.

Gastroesophageal Reflux Disease (GERD)

There have been reports of attempted treatment of GERD patients with the L-FODMAP diet. There is not much research on this topic and the results are conflicting. One Norwegian study of 12 people showed a reduction in both symptomatic and asymptomatic reflux episodes on the L-FODMAP diet

compared to the normal diet [34]. Another study in 31 subjects showed that the L-FODMAP diet and usual dietary recommendations had a similar but limited beneficial effect to proton pump inhibitors treatment on symptoms in patients with refractory GERD [35]. However, in patients with overlapping IBS, this diet may alleviate the postprandial symptoms of GERD [36]. Due to the lack of conclusive evidence, the lack of high-efficacy studies, and a larger research group, this diet has not found widespread use in the treatment of GERD.

Summary

The L-FODMAP diet is gaining popularity mainly among patients with irritable bowel syndrome, but there are also reports of its positive effects on other gastrointestinal conditions such as Crohn's disease, ulcerative colitis, and SIBO. However, although the L-FODMAP diet can reduce the troublesome ailments of irritable bowel syndrome, inflammatory bowel diseases, and other gastrointestinal diseases, its use leads to the elimination of many nutrients, such as vegetables, fruits, dairy products, and cereals, which may result in a deficiency of B vitamins, calcium, iron, and other valuable substances. [1, 37, 38] Therefore, supplementation could be necessary, especially iron. Regular checkups and consultations with a specialist supervising the course of treatment are essential. In addition to nutrient deficiencies, there may also be a negative impact on motility and the intestinal microbiota, which is why a long-term diet (over 6–8 weeks) is not recommended [1, 2, 39]. Due to the individual tolerance threshold for products with high FODMAP content, it is also recommended to personalize the diet. In conclusion, it is necessary to conduct more clinical trials that will provide more evidence for the use of the L-FODMAP diet in these diseases.

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