İNFLAMATUAR BAĞIRSAK HASTALIĞININ YÖNETİMİNDE DİYET LİFLERİNİN POTANSİYEL ETKİLERİ

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ÖZET
İnflamatuar bağırsak hastalığı, etiyolojisi tam olarak bilinmeyen, genetik ve çevresel faktörler ile intestinal immün faktörler arasındaki etkileşim sonucu ortaya çıktığına inanılan sistemik bir hastalıktır. Temel olarak ülseratif kolit ve Crohn hastalığı olarak incelenmektedir. Günümüzde, İBH'nın kesin bir tedavisi bulunmamaktadır. Mevcut yaklaşımlar semptomların kontrol altına alınması, nükslerin engellenmesi ve hastalığın remisyon süresinin uzatılmasına yönelik bir yaklaşım içerir. Bu nedenle, alternatif tedavi stratejilerine olan ilgi giderek artmaktadır. Son yıllarda yapılan çalışmalar, diyet lifi tüketiminin İBH'nın gelişme riskini azaltabileceğini göstermektedir. Diyet lifleri, çözünürlük özelliklerine göre suda çözünür ve suda çözünmez olmak üzere iki ana gruba ayrılmaktadır. Suda çözünmez diyet lifleri düşük fermentasyon kapasitesine sahip bileşenlerdir. Bağırsak hareketlerini düzenleyerek gastrointestinal sağlığı destekler, tokluk hissini artırır ve vücut ağırlığının kontrolüne katkıda bulunur. Suda çözünür diyet lifleri ise su ile birleşerek viskoz çözeltiler oluşturur ve bağırsak mikrobiyotası tarafından fermente edilebilir. Ek olarak, pektin, β-glukan ve sakızlar gibi polisakkaritlerden oluşan bu çözünür lifler, kan lipit seviyelerini düşürerek inflamasyonu azaltır. İnflamatuar bağırsak hastalığına sahip bireylerin büyük çoğunluğu, lifli besinlerin bağırsak semptomlarını kötüleştirdiğini ve/veya alevlenmeye yol açtığını belirtmektedir. Bu nedenle günümüzde çoğunlukla, İBH'nın aktif dönemlerinde semptomları yönetmek amacıyla düşük lif içeren diyet önerilmektedir. Diyet lifinin İBH'nın etiyolojisindeki rolü netlik kazanmamıştır. Farklı diyet lifi türleri, İBH'nın ilerleyişi ve semptomları üzerinde farklı etkiler gösterebilmektedir. Bu derleme, İBH'da diyet liflerinin hastalık riski ve semptomlar üzerindeki etkilerini incelemeyi amaçlamaktadır.
Anahtar Kelimeler: İnflamatuar bağırsak hastalığı, Crohn hastalığı, ülseratif kolit, diyet lifi, inülin

POTENTIAL EFFECTS OF DIETARY FIBER IN THE MANAGEMENT OF INFLAMMATORY BOWEL DISEASE

ABSTRACT

Inflammatory bowel disease is a systemic disease of unknown etiology, believed to be the result of the interaction between genetic and environmental factors and intestinal immune factors. The forms of IBD are ulcerative colitis and Crohn disease. At present, no definitive treatment has been identified for IBD. Current approaches include an approach aimed at controlling symptoms, preventing relapses, and prolonging the remission period of the disease. Consequently, there is an increasing interest in exploring alternative treatment strategies. Recent studies suggest a potential correlation between dietary fiber consumption and a reduced risk of developing IBD. Dietary fibers are classified into two primary categories based on their solubility properties: water soluble and water insoluble. Water insoluble dietary fibers are components with low fermentation capacity. These substances have been demonstrated to promote gastrointestinal health by regulating bowel movements, increasing satiety sensations, and contributing to body weight regulation. Water soluble dietary fibers have the ability to form viscous solutions when combined with water, and they can be utilized by the gut microbiota for fermentation. Additionally, these soluble fibers, which are composed of polysaccharides such as pectin, beta-glucan, and gums, have been shown to reduce inflammation by lowering blood lipid levels. The majority of individuals diagnosed with IBD report that the consumption of fiber-rich foods worsens their symptoms and/or results in flare-ups. Consequently, a low-fiber diet is frequently recommended to manage symptoms during active periods of IBD. The role of dietary fiber in the etiology of IBD remains unclear. The impact of various types of dietary fiber on the progression and symptoms of IBD may vary. The objective of this review is to examine the effects of dietary fiber on the risk of developing IBD, and the symptoms associated with the condition.

Keywords: Inflammatory bowel disease, Crohn disease, ulcerative colitis, dietary fiber, inulin

INTRODUCTION

Inflammatory bowel disease (IBD) is a chronic systemic disease characterized by intestinal inflammation and mucosal damage. Currently, the mechanism of the emergence of this disease is thought to be related to the complex interaction of environmental, genetic and immunologic factors (1). Inflammatory bowel disease affects an estimated 11.2 million people worldwide, with the majority of cases observed in Europe and North America (2). Inflammatory bowel disease is also commonly observed in Turkey, with most cases reported among young adults aged 20 to 40 years, and with a higher incidence in males (3). Although there is no definitive cure for IBD, current treatment strategies aim to control symptoms, prevent relapses, and prolong remission periods. Consequently, interest in alternative therapeutic approaches has been increasing. In medical treatment, corticosteroids are used to induce remission; however, their efficacy is limited, and long-term use has been associated with complications such as growth retardation and osteopenia (4). Recent studies have indicated that the consumption of dietary fiber may reduce the risk of developing IBD. It has been established that the impact of different types of dietary fiber on the progression and symptoms of IBD may vary (5–8). The objective of this review is to examine the effects of dietary fibers on disease risk and symptoms in IBD.

RELATIONSHIP BETWEEN DIETARY FIBER AND HEALTH

The World Health Organization (WHO) defined the term fiber in 2007 as “indigestible carbohydrates found in cereals, seeds, vegetables, and fruits.” Currently, dietary fiber is defined as “dietary components that are not enzymatically broken down into absorbable subunits in the stomach and small intestine” (9). Basically, dietary fiber is a complex compound obtained from plant sources, consisting of starch-free carbohydrates and lignin. Since the human body lacks the enzymes necessary to break these compounds down into their monomeric forms, dietary fibers pass through the small intestine undigested and reach the colon. In the colon, they can be converted into fermentable substrates by the gut microbiota (10). While dietary fibers are not considered as a direct source of calories, the metabolites released during the fermentation process by bacteria in the colon contribute to the provision of energy to humans. However, the variability in the utilization of this energy is influenced by differences in microbial activity and metabolic capacity among individuals. This situation makes it difficult to assign a specific and fixed calorie value to dietary fibers (10).

Dietary fibers are classified into two primary categories based on their solubility properties: water-soluble and water-insoluble. These two categories of dietary fiber differ in their functional characteristics and physiological effects following digestion. All dietary fibers, whether soluble or insoluble, remain undigested as they transit the gastrointestinal tract. However, soluble fibers are rapidly and easily fermented by gut bacteria in the presence of water, leading to the production of beneficial metabolites, primarily short-chain fatty acids (SCFAs) that support the health of the gut microbiota (11). Water-soluble fibers such as inulin, β-glucans, and pectins undergo a process of fermentation by intestinal microbiota when combined with water, resulting in the formation of viscous solutions. These fibers have been shown to reduce inflammation by lowering blood lipid levels, thereby playing an important role in reducing the risk of cardiovascular disease. In contrast, water-insoluble fibers, mainly cellulose, hemicellulose, and lignin, have low fermentation capacity. These dietary fibers are structural components of the plant cell wall and have been shown to promote digestive health by enhancing gastrointestinal motility, increasing satiety, and contributing to body weight management. Therefore, due to their distinct physiological effects, a balanced and adequate intake of both soluble and insoluble dietary fibers is recommended to support overall health and maintain optimal physiological function (9,11).

THE EFFECT OF DIETARY FIBER IN INFLAMMATORY BOWEL DISEASE

According to the Turkish Nutrition Guide (TUBER), the recommended daily intake of dietary fiber for a healthy adult is 25-35 g (12). A meta-analysis published in the literature reported that a daily fiber intake ranging from 13.4 to 33.4 g is considered safe for individuals with IBD (13). However, many patients report that consuming high-fiber foods exacerbate their intestinal symptoms or trigger disease flare-ups. Therefore, during the active or exacerbation phases of IBD, a low-fiber diet is commonly recommended for symptom management (14,15).

Recent studies have indicated that a diet high in fiber, fruits, and vegetables may reduce the risk of IBD (5–8). In a prospective cohort study, it was found that participants with high dietary fiber intake (23.0 ± 4.2 g/day) had a 26% reduced risk of developing IBD and a 52% reduced risk of developing Crohn disease (CD). Similarly, another prospective study that followed 170.776 adult women with IBD over a 26-year period found that long-term dietary fiber intake was associated with a 40% reduction in the risk of developing CD. In both studies, no statistically significant association was observed in terms of ulcerative colitis (UC) (6,8).

A meta-analysis was conducted to evaluate the relationship between dietary fiber, fruit and vegetable consumption, and the risk of developing IBD. The analysis reported a significant inverse relationship between dietary fiber intake and the risk of developing IBD. The most significant risk reduction was observed after a daily fiber intake of 22 g (5). A study published in Clinical Gastroenterology and Hepatology in 2016 determined that the risk of exacerbation of the disease decreased by 40% during the six-month follow-up period in individuals with CD who had the highest quartile of fiber consumption (23.7 g/day). However, no significant association was found between fiber intake and disease exacerbation among participants with UC (16). In another meta-analysis that examined the combined effects of medical treatment and dietary intervention, a high-fiber diet administered concurrently with infliximab therapy was found to increase remission rates, help regulate acute-phase reactants, and improve the clinical course of the disease in some patients (13).

Inulin

Inulin, a type of dietary fiber, has been shown to have a positive impact on individuals suffering from IBD. It is a water-soluble, indigestible dietary fiber that belongs to the fructan group. Its main sources are artichoke, garlic, asparagus and red/white onion (17). A prospective randomized, double-blind, controlled study was conducted to evaluate the effect of inulin enriched with fructooligosaccharides (FOS) in patients with active UC. Patients participating in the study were divided into two groups. The first group was administered FOS-enriched inulin (12 g/day, orally, n = 10) while the second group received a placebo (12 g/day maltodextrin, orally, n = 9). The study's findings indicated that the placebo group exhibited no significant change in dyspepsia scores, while the FOS-enriched inulin group demonstrated a notable reduction in dyspeptic symptoms. Furthermore, a comparison of the FOS-enriched inulin group with the placebo group revealed a statistically significant decrease in calprotectin levels on day seven, exclusively in the inulin group. This change was not significant in the placebo group. Conversely, there was an increase in IBD-related quality of life scores in both groups; however, this increase was not statistically significant (18). Further analysis revealed that oligofructose-enriched inulin modulated the gut microbiota by increasing *Bifidobacterium longum* levels. This microbial alteration has been shown to be positively correlated with a reduction in disease severity. Additionally, it has been reported to provide anti-inflammatory effects by increasing butyrate and other SCFAs levels (19).

A study evaluating the potential of inulin to alleviate disease symptoms in a stress-induced relapse model of IBD administered diets containing 5% cellulose or 5% inulin to mice previously induced with IBD using dextran sulfate sodium (DSS), following a two-week recovery period. According to the findings, consumption of 5% inulin significantly reduced

bloody stool and diarrhea scores compared to the cellulose group, indicating an attenuation of colonic inflammation. Furthermore, fecal levels of immunoglobulin A (IgA), a marker of mucosal immune response, were significantly decreased in the inulin group after stress exposure, whereas no significant change was observed in the cellulose group. These results suggest that inulin may exert a protective effect against stress-induced IBD relapses and has the potential to mitigate inflammatory processes (20).

The beneficial effects of inulin on stress-induced IBD relapse extend beyond modulation of immune responses and involve alterations in gut microbiota-derived metabolites and cellular stress mechanisms. Accordingly, the study further evaluated the levels of SCFAs and markers of endoplasmic reticulum stress. In a stress-recurrent IBD model, a decrease in the content of SCFAs was observed. However, subsequent to inulin ingestion, there was an increase in total SCFAs levels in the intestine. A notable increase in the levels of propionic acid, lactic acid, and butyric acid was observed. These findings indicate that inulin has the potential to alleviate the symptoms of recurrent IBD with stress by supporting the production of SCFAs and improving the intestinal environment (20).

A prospective, randomized, double-blind, placebo-controlled study was conducted to evaluate the relationship between disease activity and oligofructose-enriched inulin supplementation in individuals with CD. Participants were divided into two groups. One group (n = 67) received oligofructose-enriched inulin supplementation (10 g, twice daily, orally) in addition to standard therapy, while the control group (n = 40) continued with standard treatment and received a placebo. Stool samples were collected from all participants before and after the intervention, and disease activity was assessed using the Harvey-Bradshaw Index (HBI). The findings of the study demonstrated that there was no statistically significant change in the mean HBI scores within the placebo group, whereas a significant reduction was observed in the intervention group. Analysis of stool metabolite profiles revealed a meaningful association between disease activity and butyrate levels. Among individuals with active CD, butyrate concentrations were initially low; however, following oligofructose-enriched inulin supplementation, a significant increase in butyrate levels was achieved, likely due to the stimulation of saccharolytic fermentation. As a result of this increase, butyrate levels became more similar to those seen in healthy individuals (21).

β-Glucan

Beta (β)-glucans are heterogeneous non-starch polysaccharides formed by the association of D-glucose monomers with β-glycosidic bonds. Beta-glucans are found in significant concentrations in natural sources such as cereals, microorganisms, fungi, lichens, and seaweed. Beta-glucans have been demonstrated to exert beneficial effects on a variety of metabolic and cardiovascular health parameters, including blood glucose and insulin regulation, reduction of cholesterol levels, prevention of cardiovascular diseases, management of obesity, and control of hypertension. It also has immune system-modulating properties due to its anti-tumor and anti-inflammatory effects (22).

In an in vivo study, it has been demonstrated that the oral administration of β-glucan can reduce the expression of pro-inflammatory cytokines such as interleukin (IL)-1β, tumor necrosis factor (TNF)-α, and IL-6. This reduction in cytokine levels is associated with decreased inflammation severity and the preservation of colonic tissue integrity in a DSS-induced colitis model (23). In a randomized controlled study involving individuals with IBD (n=43), participants were divided into two groups. The intervention group received a mixture of β-glucan, inositol, and digestive enzymes twice a day for a period of four weeks in addition to conventional treatment, while the control group received only conventional treatment. At the end of the four-week intervention period, the group receiving the β-glucan supplement exhibited a 64% reduction in

abdominal pain, a 48% reduction in bloating, and a 29% reduction in flatulence. Furthermore, a 12% enhancement in the participants' general well-being was reported (24).

Pectin

Pectin, a water-soluble polysaccharide and a structural component of plant cell walls can be almost entirely fermented by colonic microbiota (25). An in vivo study has demonstrated that pectin, as a widely consumed soluble dietary fiber, exhibits protective effects against IBD, primarily through the production of SCFAs by gut microbial fermentation (26). In an investigation exploring how dietary macronutrients and gut microbiota influence intestinal health and IBD development, psyllium, pectin, and cellulose were found to most effectively reduce disease severity among the nine fiber types tested in a DSS-induced colitis model (27).

Intestinal dysbiosis is commonly observed in individuals with IBD, although it remains unclear whether this microbial imbalance is a cause or a consequence of the disease. This imbalance in the gut microbiota is characterized by reduced microbial diversity, an increased prevalence of pathogenic species, and a decline in beneficial anaerobic bacteria (28). An in vitro study was conducted to investigate the effects of dietary fiber fermentation on SCFAs production and gut microbiota composition. Fecal samples were collected from individuals with IBD in clinical remission, including 20 patients with CD and 20 with UC, as well as from 20 healthy individuals. A fiber mixture totaling 500 mg—composed of 100 mg each of apple pectin, raftilose, high-amylose corn starch, and wheat bran—was prepared. This mixture was fermented with the collected fecal samples, and SCFAs production was assessed following the fermentation process. The findings indicated that, despite the prevalent microbial dysbiosis in individuals with IBD, these individuals exhibited a comparable capacity to ferment fiber and produce SCFAs as healthy individuals. Therefore, it was concluded that fiber supplementation alone may not be sufficient to reverse the changes in microbiota composition specific to IBD to a healthy state (29).

Partially hydrolyzed guar gum

Partially hydrolyzed guar gum is a natural and water-soluble source of dietary fiber. Guar gum is a galactomannan derived from the endosperm of guar seeds and occurs naturally in many different plant sources. These sources include carob gam, clover seeds, coconut meat, soybeans, pineapple, sugar beet and coffee beans. Although guar gum has several physiological benefits, its addition to food products is limited due to its high viscosity. To overcome this problem, partially hydrolyzed guar gum was developed by enzymatic hydrolysis of guar gum. Partially hydrolyzed guar gum is widely used as a functional dietary fiber source in cereals, fruit juices, milk-based beverages, yogurt, soups, baked goods and enteral nutrition products due to its lower viscosity and increased solubility (30). In addition, partially hydrolyzed guar gum is a water-soluble dietary fiber that is fermented by bacteria in the colon and promotes the production of SCFAs, especially butyric acid (31).

An open-label intervention study was conducted to evaluate the long-term effects of partially hydrolyzed guar gum supplementation on gut bacterial composition, inflammatory response, and stool characteristics in individuals with IBD. In the study, individuals diagnosed with IBD (n=14) were administered 6-18 g of partially hydrolyzed guar gum daily in conjunction with their standard drug treatment, while a separate group of healthy individuals (n=6) received an equivalent amount of guar gum. At the end of the six-month intervention period, no statistically significant changes were observed in stool frequency, C-reactive protein (CRP) levels, fecal calprotectin concentrations, or in the relative abundance of total gut bacteria and SCFAs-producing bacterial populations among participants with IBD (31).



Fructooligosaccharides

Fructooligosaccharides are a type of carbohydrate that is not digested in the small intestine and are classified as prebiotics due to their ability to promote the growth of beneficial gut microbiota, particularly Bifidobacterium species (32). Prebiotics are defined as short-chain carbohydrates that are not digested or absorbed in the upper gastrointestinal tract and are selectively fermented by the intestinal microbiota. The ingestion of prebiotics has been demonstrated to enhance the production of IgA and immunomodulatory IL, which regulate gut immunity. Consequently, prebiotics have been shown to reduce the levels of pro-inflammatory IL, thereby modulating the immune response (20). These properties make them potential therapeutic agents in IBD. Fructooligosaccharides are naturally occurring in various foods, including fruits, vegetables, and honey. A global perspective reveals that more than 36.000 plant species have been identified as containing FOS. Given its prevalence in naturally occurring vegetables commonly consumed in daily diets, the occurrence of daily dietary intake of FOS is quite common (32).

In the first clinical trial to utilize FOS as a primary treatment agent, patients with moderate to severe/active CD were administered 15 g of FOS supplementation daily for a period of three weeks. The study demonstrated a substantial decrease in disease activity and a notable increase in fecal bifidobacteria concentrations among individuals with CD. According to patient reports, the adverse effects noted were an increase in the frequency of intestinal noise and an increase in the severity of intestinal gas (33).

In a randomized, double-blind, placebo-controlled study to evaluate the intake of FOS in individuals with active CD, patients (n=103) were divided into two groups. One group received FOS treatment (15 g), and the other group received placebo treatment devoid of prebiotics. At the end of the four-week study, favorable effects on dendritic cell function were observed in patients treated with FOS. However, subsequent analyses revealed that these modifications did not result in a clinically significant enhancement (34). In an in vivo study examining the effects of FOS on gut microbiota, it was determined that FOS consumption led to a significant decrease in pro-inflammatory cytokine IL-1β levels. These results suggest that FOS may potentially contribute to the alleviation of intestinal inflammation (35).

Wheat bran

Wheat (*Triticum spp.*) is one of the most widely consumed staple grains worldwide and holds a significant place in human nutrition. Wheat bran, a byproduct of the milling process, constitutes the outermost layer of the wheat kernel and is primarily composed of insoluble polysaccharides such as cellulose, hemicellulose, and lignin. This composition contributes to gastrointestinal health by reducing intestinal transit time and increasing stool bulk (36,37). In addition to its high dietary fiber content, wheat bran is considered a nutritionally valuable component due to its rich profile of bioactive compounds and micronutrients. It contains all 18 essential amino acids required by the human body, along with B-complex vitamins, vitamin E, and carotenoids, which contribute antioxidant properties. Furthermore, wheat bran is a significant source of important minerals such as potassium, phosphorus, calcium, and magnesium (36).

A randomized, controlled, single-blind study was conducted to evaluate the effects of dietary recommendations encouraging whole wheat bran consumption on health-related quality of life and gastrointestinal function in individuals with CD. Participants were assigned to two groups: one group (n = 4) received a diet including whole wheat bran, while the other group (n = 3) was given a control diet. At the end of the four-week intervention, the group consuming whole wheat bran showed a statistically significant improvement in Inflammatory Bowel Disease Questionnaire (IBDQ) scores over time, with a more pronounced enhancement in health-related quality of life compared to the control group. Furthermore, a statistically significant reduction

in Partial Harvey-Bradshaw Index (pHBI) scores was observed in the intervention group, indicating better gastrointestinal function than in the control group. The findings demonstrated differences that were not only statistically significant but also clinically meaningful, suggesting that whole wheat bran consumption may have the potential to improve gastrointestinal function and enhance quality of life in individuals with CD (38).

The effects of dietary supplementation with resistant starch (RS) and wheat bran (WB) on gastrointestinal health were assessed in a single-blind, randomized controlled crossover study by James et al., involving UC patients in remission (n=14) and healthy participants (n=10). Among healthy individuals, the high intake of these two fiber types (15 g RS and 12 g WB) increased fecal starch levels and shortened intestinal transit time. However, the same intervention did not produce similar effects in UC patients; no significant changes were detected in either fecal starch levels or gut transit time. Additionally, the microbiota composition of UC patients has been reported to differ from that of healthy individuals, with lower levels of the beneficial bacterium *Akkermansia muciniphila* in particular. These findings suggest that the capacity of intestinal bacteria to ferment starch and non-starch polysaccharides is reduced in UC patients and that fiber supplementation alone may not correct this condition (39).

CONCLUSION AND RECOMMENDATIONS

The effects of dietary fibers on IBD have emerged as an important research area in terms of their regulatory role on both gut microbiota and inflammatory response. Current evidence indicates that dietary fibers modulate the composition of the gut microbiota and increase the production of SCFAs, especially metabolites such as butyrate, and reduce inflammation by maintaining intestinal barrier integrity (19,21). While soluble and insoluble fibers exert distinct physiological effects, prebiotic fibers such as pectin, β-glucan, and inulin have been reported to support gut health (21,24,27). Notably, existing data suggest that wheat-derived fibers may offer potential benefits for individuals with CD. However, similar efficacy has not been conclusively demonstrated for patients with UC. These divergent outcomes may be due to disease-specific alterations in gut microbial composition and function (39). In addition to fiber-specific effects, other dietary components may also play a protective role in IBD. For instance, meta-analyses evaluating fruit and vegetable consumption suggest that increased intake may have protective effects due to their high content of anti-inflammatory compounds, such as flavonoids and polyphenols (5,40).

A review of the existing literature indicates that controlled trials of dietary fiber interventions have been conducted with limited numbers of participants (18,38). However, several meta-analyses have shown that high dietary fiber intake may reduce the risk of IBD (5–8). In addition, dietary fiber intake is thought to have the potential to increase remission rates in individuals with IBD who achieve clinical remission with standard treatment modalities (13). Nevertheless, the limitations of the existing evidence make it impossible to recommend a particular dietary intervention. The complexity is further compounded by the fact that habitual diets contain a variety of fiber sources, and many individual food products include multiple fiber types. This variability poses challenges in isolating the specific effects of individual fibers, especially in the context of long-term outcomes. Furthermore, when evaluating the long-term effects and applicability of dietary fiber interventions, it is also essential to consider individual tolerability, as some fibers may lead to gastrointestinal side effects in IBD patients.

Consequently, further scientific research is needed on the amount and type of dietary fiber consumption to increase remission rates in IBD. Considering that high-fiber diets may exacerbate symptoms during the active disease period, it is thought that controlled and balanced dietary fiber intake during the remission period may be beneficial in disease management by supporting gut microbiota (14,15). In particular, large-scale, randomized controlled trials evaluating the effects of different types of dietary fiber on gut microbiota composition and

inflammatory responses are critical to addressing the current knowledge gap in this field. Such studies not only contribute to a more comprehensive understanding of the relationship between dietary fiber intake and IBD but also support the development of personalized nutritional strategies for disease management. In this way, the effects of various fiber sources on inflammatory processes and gut health can be more clearly elucidated, enabling the formulation of evidence-based dietary interventions for IBD.

In conclusion, while high dietary fiber intake may hold therapeutic potential, particularly during remission phases, no universal dietary recommendation can be made based on the current evidence. There is a clear need for randomized controlled trials with larger cohorts to evaluate the effects of specific fiber types on gut microbiota dynamics and immune modulation in IBD. Such research is essential not only to clarify fiber-specific outcomes, but also to facilitate the development of individualized, evidence-based nutritional strategies for long-term IBD management.

Author Contributions

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Conflict of Interest

The authors declare that there is no conflict of interest.

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Ethical Statement

Ethical approval was not required for this study.

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