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Unveiling the power of diet and lifestyle in managing Crohn's disease

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Abstract

Introduction:

Crohn's disease (CD) is an inflammatory bowel disease that can affect any part of the digestive tract. Onset, progression, complications and treatment are influenced by many genetic, environmental and dietary factors. Dietary management is very useful in a variety of gastrointestinal diseases, including CD. Some nutrients have been studied in animal models to exacerbate the disease, while others have strong scientific evidence from large studies in human populations, allowing conclusions to be drawn about their impact on the disease. Dietary management is now a well-established and important part of treatment, in addition to the use of systemic corticosteroids, aminosalicylates, immunomodulators (e.g. azathioprine, 6-mercaptopurine, cyclosporine, tacrolimus) or biologic therapies.

State of knowledge:

To test the associations between the intake of specific macronutrients and the course of CD, we searched the PubMed database focusing on articles about the effects of consumed food components and stimulants on the onset and progression of CD.

Conclusion:

Nutritional treatment plays an important role in the management of CD. An appropriate diet can make a significant contribution to reducing inflammation and attenuating the course and exacerbations of the disease. The intake of proteins, fats, carbohydrates, fiber and certain food additives has been shown in studies to influence the onset and course of CD.

Keywords: Crohn’s disease; inflammatory bowel disease; diet; nutrition; gastroenterology; microbiota;

Impact of nutritional factors:

Diet popular in developed societies, called western diet with a high salt, sucrose, fat (especially omega-6 polyunsaturated fats), high additives content, based on cereals (especially wheat), and low in fiber is a factor that increases the level of pro-inflammatory cytokines, which can exacerbate intestinal inflammation and disease symptoms [1].

The Mediterranean diet is a well-known part of the lifestyle that reduces the risk of contracting many of the civilisation diseases. It is based on a large amount of plant-based foods (cereals, fruits, vegetables, nuts), olive oil as the main source of fat, a high intake of fish and seafood, and low consumption of red meat. It has been shown that the Mediterranean diet can support the treatment of inflammatory bowel diseases (IBD) by attenuating the symptoms of the disease and lowering inflammatory markers in patients following it, but does not reduce hepatic steatosis [2].

Impact of dietary protein intake is uncertain. One study showed a positive effect on the occurrence of CD in the population of French women of middle age [3]. Whereas another overviev study found no effect of protein intake on disease manifestation [4]. Through this, the association of protein ingestion with this disease should be confirmed by broader targeted studies.

Intake of total fats, although having a lot of negative effects on human health, has no effect on the occurrence of CD [5]. In turn, high consumption of n-6 polyunsaturated fatty acids may increase risk of CD, and less n-3 polyunsaturated fatty acids intake, notably over the long term, may reduce risk of CD [5,6].

Fermentable oligo-, di-, mono-saccharides and polyols (FODMAP) include fructose, lactose, fructose and polyhydroxy alcohols (sorbitol, mannitol, maltitol, xylitol - which are commonly use as artificial sweeteners) are easily fermentable, poorly absorbed and of high osmotic pressure, thus accelerates intestinal motility and increases the rate of passage into the large intestine where, in the undigested state, they undergo bacterial fermentation with increased production of carbon dioxide and hydrogen, hydrogen sulphide and methane. These processes are responsible for a lot of symptoms like discomfort in the abdominal region, pain and a feeling of overflow, diarrhoea or constipation and flatulence.

Diet low in FODMAP results in a reduction of the level of calprotectin (which is an indicator of inflammation and increases in the course of inflammatory bowel disease) [7] and symptoms of functional disorders of the gastrointestinal tract, irritable bowel syndrome (IBS) and IBD [8,9,10,11].
Reducing the intake of FODMAPs also leads to decreased abdominal pain, flatulence, bloating, improved in patients and the number of diarrheic stools decreased, but had no effect on constipation.
Furthermore by reducing the amount of FODMAP it is possible to lower the inflammatory parameters measured in the blood and faeces of patients [12], which indicates reduction of bowel inflammation.

A diet rich in FODMAP may improve severity of symptoms of the disease and its exacerbations, cause increasing level of cytokines IL-1β, IL-6, IL-17, TNF-α, and IFN-γ presented in tissues of intestines, which participate in the formation of inflammation. Moreover, FODMAP may lead to dysbiosis and increase a level of endotoxins like lipopolysaccharide in the intestinal lumen, which induce inflammation and barrier dysfunction, which allows toxic substances and microorganisms to pass through the wall of the intestine [13,14].

High consumption of fiber may decrease risk of CD, thus consumption of vegetables and fruits may be useful to reduce risk of CD [4,15]. Especially fruit fibers seem to be better at preventing disease than fibers from vegetables or cereals [16,17]. Moreover, starches and fibers are converted in the intestinal lumen into butyrate, which can lead to a reduction of inflammation [18].

Many additives included in processed food (like polysorbate 80, carrageenan, or carboxymethylcellulose) may enhance risk of CD [19]. Emulsifiers which reduce the interface tension may destroy the protective mucus layer covering the intestinal epithelium, cause dysbiosis and stimulate the growth of bacteria that destroy the mucosal layer of the and affect the translocation of bacterias through the bowel wall [20,21,22]. Saccharides, which are used as fillers, and artificial sweeteners, widely used in the food and beverage industry, can be metabolized by pathogenic bacteria. Titanium oxide, often used as a white dye in the pharmaceutical or food industry, can worsen inflammation in inflammatory bowel diseases [23]. Recent studies indicate that sodium chloride used in large amounts can increase the expression of inflammatory cytokines in the intestinal wall [24].

Vitamin D has important immune-regulating functions. It is a known factor in enhancing the immune system's ability to defend itself. Research suggests that low levels of 25-hydroxy vitamin D (less than 20 ng/mL) are a significant risk factor for ulcerative colitis, but have no significant effect on the onset of CD [25].It would be desirable to deepen research in this area, as a large proportion of the population is deficient in this vitamin.

Special diets:

In the treatment of CD, various attempts at nutritional management are being made, such as limiting specific foods suspected of having the ability to increase inflammation of the intestinal mucosa, avoiding foods that potentially increase pro-inflammatory cytokines and immune system sensitivity, or using foods that improve the bacterial flora in the intestinal lumen. In recent years, especially in the pediatric population, Exclusive enteral nutrition and Partial enteral nutrition have been favored, with well-documented high efficacy in alleviating the course of the disease and the potential to induce remission. Exclusive enteral nutrition (EEN) is a specially designed formula containing the right amount of calories, proteins, fats, carbohydrates and minerals. EEN is most recommended for patients with CD for the induction of remission of symptoms [4]. EEN exists in several versions, differing in the form of the protein contained, from amino acids to oligopeptides to whole proteins. EEN studies have confirmed their efficacy irrespective of the type of formulation - elemental, oligopeptide and polymeric nutrition are equally effective in the treatment of CD. [26]

Partial enteral nutrition (PEN) is a method involving the use of mixtures used with EEN as providing up to 50% of the daily food supply. It was used with the hope of good clinical outcomes due to patients' reluctance to take EEN mixtures alone due to their taste, but studies have shown their inferior therapeutic effect in CD compared to EEN [27]. However, PEN used together with an appropriate exclusion diet is able to significantly increase the chance of remission and improve prognosis than the use of PEN alone [28].

Crohn's Disease Exclusion Diet (CDED) is a diet that involves excluding or limiting exposure to foods that may negatively affect the microbiome, lead to dysbiosis or impair gut barrier function. The first 6-week phase of the induction phase limits insoluble fiber to prevent bowel obstruction. The second 6-week phase reintroduces many of these vegetables by week 10. The induction phase is the most important phase of the diet and is necessary for effectiveness. The maintenance phase is used after remission has been achieved and is designed to maintain remission. The CDED excludes processed meat, seeds, artificial sweeteners, processed foods, preservatives, artificial additives and emulsifiers. In studies, the use of CDED in combination with PEN, especially in first

weeks, has been shown to have the ability to induce CD remission and improve patient well-being [28,29]. In addition, this diet can have a positive effect on the intestinal microbiota contributing to the health of patients.

Stimulants:

Many stimulants over the past few years have been suspected of influencing the onset of CD and its exacerbations.
Alcohol consumption in developed societies is popular and strongly culturally rooted. It is very harmful and remains a frequent and important factor in the development of many serious diseases including gastrointestinal diseases. Despite this, the studies show that it has no effect on the onset of CD [30,31].
Although smoking cigarettes, cigars and other tobacco products is an important risk factor for many diseases and pathological conditions, studies have not shown a clear link between smoking and CD [32]. After all, more research should be conducted because of the association of smoking with many autoimmune diseases.
Moreover, smoking can cause an increased risk of extraintestinal complications, which can be very disruptive and negatively affect patients' well-being and lives [33].
Cannabis use, which is becoming increasingly popular due to the world's increasing legalization, does not improve biochemical parameters of inflammation or reduce CD exacerbations [34], but may result in subjective improvements in patients' well-being and reduced pain sensation, diarrhea and improve appetite and mood [35].
Consumption of tea and coffee, the most popular hot beverages, may slightly reduce the chance of CD [30], but the scientific evidence relating to their impact on disease should be more strongly researched.

Summary:

Dietary management has an important place in the care of patients with Crohn's disease. Appropriate nutrition and avoidance of some of the macronutrients and food additives and stimulants seem to offer a good chance of reducing the inflammation associated with the disease, improving the composition of the bacterial flora in the intestinal lumen, inducing remission of disease exacerbations and alleviating the disease course. In particular, the use of exclusive enteral nutrition or partial enteral nutrition in combination with an appropriate exclusion diet in studies has shown great therapeutic potential in patients with Crohn's disease.

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