Occurrence of dietary risk factors in inflammatory bowel disease: Influence on the nutritional status of patients in clinical remission

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Abstract

Background. Among the complex factors that may favor the occurrence of inflammatory bowel disease (IBD), genetic, immunological and environmental initiators, including nutritional factors, are listed. So far, there have been no previous studies on the type and frequency of dietary risk factors for IBD in Poland and their effect on the nutritional status of patients.

Objectives. The aim of the study was to assess the influence of the frequency and type of dietary risk factors for IBD on the nutritional status of patients with ulcerative colitis (UC) and Crohn's disease (CD).

Material and methods. In the study, the dietary habits and nutritional status of patients were assessed using the cross-check dietary history method and the Mini Nutritional Assessment (MNA) questionnaire. The study group consisted of 162 IBD patients: 61 individuals with CD and 101 with UC. The data was compared to the results of a control group (129 healthy volunteers).

Results. The results obtained showed that IBD patients during a period of remission disclosed such dietary risk factors as inadequate consumption of fiber and excessive consumption of red meat and meat products, animal fats, and sugars in comparison to the control group. Only low fiber intake was associated with a worse nutritional status of patients with UC. No consistent influence of the number of IBD dietary risk factors on the nutritional status of patients was found.

Conclusions. The nutritional status of IBD patients in remission was related to the type of dietary risk factors, but did not depend on the number of them.

Key words: nutritional status, dietary risk factors, inflammatory bowel disease

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Introduction

Inflammatory bowel disease (IBD) comprises chronic diseases of the gastrointestinal tract. Crohn's disease (CD) and ulcerative colitis (UC), also called IBD, affect up to 500 per 100,000 people in the Western world. The countries reporting the highest estimates of IBD are the USA, the UK and Sweden, as opposed to the countries of Southern Europe, South Africa and Australia.[1–3] Only a few scattered reports on IBD frequency come from the countries of Eastern and Central Europe.[2,3] An accurate count of the incidence of IBD in Poland has not yet been compiled.[3] Recent studies on the etiology of IBD suggest that these diseases are caused by a combination of genetic, environmental and immunological factors.[4,5] One of the most important environmental factors is nutrition. Many of the recent studies show dietary risk factors which may cause or intensify IBD symptoms. Dietary risk factors include high intake of sugar and sweets, hydrogenated fats, products with a high sulphur content, and a diet poor in fiber, vitamin C and n-3 fatty acids.[6–9] Hypothetically, dietary components could increase the risk of colonic inflammation by several mechanisms, which include a direct contact with the colonic mucosa, affecting the chemical composition of mucosal cell membranes or altering the balance of intestinal flora.[10] Moreover, it has also been suggested that the visceral fat tissue and adipocytokines may play a role in IBD development.[11] Nutritional treatment plays an important role in the clinical care of patients with IBD. Supportive nutritional therapy aims to correct the nutritional status and macronutrient deficiencies and to reverse their metabolic/pathological consequences, in addition to providing advice to patients on recommended dietary regimes. This should be considered in all patients with IBD. It should also be remembered that there is no single, common diet suitable for all IBD patients; each of them is unique and dietary recommendations must be individually developed for each patient, depending on the course of the disease. Studies of exclusive enteral nutrition, exclusion diets, a low fermentable oligosaccharides, disaccharides, monosaccharides, and polyols (FODMAP) diet, as well as semi-vegetarian diets suggest that minimizing the exposure of the intestinal lumen to selected foods may prolong the remission period of patients with IBD.[12–14] Poor nutritional status is common in patients with IBD, especially in active CD, and it is a result of reduced dietary intake, maldigestion and malabsorption. Several studies have shown weight loss in 70–80% of hospitalized IBD patients and in 20–40% of outpatients with CD.[9] The prevalence of malnutrition is lower in patients with UC, but nutritional deficiencies can quickly develop in these patients during periods of active disease.[3]

The aim of this study was to assess the influence of the frequency and type of dietary risk factors on the nutritional status of patients with IBD in remission.

Material and methods

Study population

The study group consisted of 162 IBD patients aged 18–81 years (72 females and 90 males): 61 individuals with CD and 101 with UC. Inflammatory bowel disease diagnosis was based on clinical manifestation, endoscopic and/or radiological findings, and pathological studies. Patients with unidentified colitis were excluded. All patients in the study were interviewed, after giving an informed consent, within 1 year of the onset of symptoms, most of them 4–6 months after the onset of symptoms; all of them were in remission. Remission was defined as having no need for oral steroids (either prednisolone or budesonide) for at least 3 months. All of the patients were in remission according to the Crohn's Disease Activity Index and the Mayo Activity Index for CD and UC, respectively. Control subjects were recruited from the healthy population in the study region. The control group was matched for gender and age to the IBD group (within the same 10-year age group, as follows: 18–29, 30–39, 40–49, 50–59, 60–69, or 70–81 years).

Data collection

In all subjects (patients and controls), the typical dietary intake over the month before the interview was assessed using the validated cross-check dietary history method.[15] The patients and controls were interviewed about their dietary intake in the same way by experienced dieticians. The questionnaire comprised of 2 parts. The 1st one consisted of sociodemographic characteristics, namely, age, gender, weight, height, place of residence, education level, and current smoking habits. In the 2nd part, concerning dietary habits, the subjects were asked about the average intake frequency of foods and dishes, including potential dietary risk factors for IBD.

Nutritional status

The nutritional status of all subjects (patients and controls) was evaluated by the Mini Nutritional Assessment (MNA) and by anthropometric measurements of the subjects: body mass index (BMI) and the percentage of body fat, determined by a bioelectrical impedance analysis, using a body-fat analyzer (Omron BF306; Omron Healthcare Co., Ltd., Matsusaka, Japan).[16] Malnutrition and risk for malnutrition were defined by the MNA. The questionnaire is composed of 18 items and involves anthropometric, general, dietary, and subjective assessment. The questionnaire consists of 2 main parts: screening and assessment. Screening includes questions related to changes in weight loss, oral intake, mobility, stress, etc. Assessment additionally includes medical history, some questions related to eating habits, and measurements of arm and calf circumferences.

A total score >23.5 indicates adequate nutritional status; a score of 17.0–23.5 denotes a risk for malnutrition, while <17.0 indicates malnutrition.[16]

Statistical methods

Using the χ^2 test, we compared the dietary habits of UC or CD patients to those of control subjects and those of UC or CD patients with different nutritional status. The significance of the test was assumed if $p \leq 0.05$. Statistical analyses were performed with STATISTICA v. 8.0 for Windows (StatSoft Polska Sp. z o.o., Kraków, Poland). The evaluation of nutrient intake derived from the dietary recall was performed using FoxPro software v. 2.6/Win and Excel 2000 by (Microsoft Polska Sp. z o.o., Warszawa, Poland). The dietary recall data from the studied men and women were combined into 1 group for statistical analysis.

This study was approved by Wroclaw Medical University Research Ethical Board (KB-216/2016).

Results

The background characteristics of UC and CD patients and control subjects are presented in Table 1. The mean body weight, BMI and body fat were lower among CD patients and slightly lower in UC patients than among control subjects. The highest percentage of patients with malnutrition or a risk for malnutrition was among CD patients; almost 100% of control subjects had adequate nutritional status.

The exposure to dietary risk factors for UC and CD patients with different nutritional status and control subjects is shown in Tables 2 and 3.

Low fiber intake was significantly more prevalent among UC patients with malnutrition and a risk of malnutrition than in UC patients with adequate nutritional status. Low fiber intake and high intake of red meat and meat products were significantly higher in UC patients than in control subjects. No significant differences in the exposure to dietary risk factors were observed between CD patients with different nutritional status. Low fiber intake and high intake of sugar and sweets, animal fats, and red meat and meat products were significantly higher in CD patients than in control subjects. Crohn's disease patients had a higher intake of animal fats, and sugar and sweets than UC patients. There was a trend toward a higher intake of red meat and meat products among UC patients with malnutrition and risk for malnutrition vs CD patients with the same nutritional status.

Most patients were exposed to 3–5 dietary risk factors, though the number of dietary risk factors was not associated with the nutritional status of UC and CD subjects (Table 4).

Discussion

Diet, as a source of luminal antigens, is thought to be an important factor in the immunopathogenesis of IBD, but whether antibodies against dietary antigens play a primary role in IBD etiology or are secondary to intestinal inflammation is yet to be determined. While many studies associate diet with IBD, there is still no conclusive evidence that any specific food or dietary factor directly contributes to the pathogenesis of either CD or UC. Low-fiber, high-sugar, high-animal-fat intake, and westernized diets have been proposed as risk factors for the development of IBD.[9,17,18] In the literature, there are many reports on possible associations between diet and IBD, with a range of foods being implicated, such as fast foods, refined sugar, margarine, and highly processed foods.[6,15,19,20]

This is the first population-based case-control study to investigate whether there is an association between the nutritional status of patients with IBD and the frequency and type of dietary risk factors during remission. The nutritional status of patients with IBD was evaluated by the MNA questionnaire. Since the MNA questionnaire is not routinely used in the nutritional assessment of IBD patients, we compared the mean values of biochemical factors

Table 1. Characteristics of study subjects

Characteristics	UC patients (n = 101)	CD patients (n = 61)	Control group (n = 129)
Age [years]	49.3 (19–79)	40.2 (18–81)	45.6 (18–82)
Gender (male/female)	60/41	32/29	71/58
Body weight [kg]	68.0 (40–108)	61.5 (42–105)	74.5 (49–115)
Body fat [%] (male/female)	21.9 (4.0–38.6)/ 31.5 (10.7–45.1)	18.3 (8.8–40.0)/ 27.3 (10.0–38.3)	21.6 (10.5–38.0)/ 33.4 (13.5–49.2)
BMI [kg/m^2]	23.5 (16.0–36.9)	21.7 (15.2–33.1)	24.8 (18.1– 43.0)
Obese/overweight/healthy weight/underweight by BMI (n, %)	6/30/57/8 (n), 6/30/57/7 (%)	3/7/39/12 (n), 5/11/64/20 (%)	8/38/81/2 (n), 6/29/63/2 (%)
Adequate nutritional status/risk for malnutrition/malnutrition by MNA (n, %)	54/42/5 (n), 54/42/4 (%)	22/31/8 (n), 36/51/13 (%)	127/2/0 (n), 98/2/0 (%)

BMI – body mass index; CD – Crohn's disease; MNA – Mini Nutritional Assessment; UC – ulcerative colitis; values expressed as means (min–max) or (n, %).

Table 2. Exposure to dietary risk factors of UC patients with different nutritional status vs control subjects

Dietary risk factor	UC patients with adequate nutritional state [%]	UC patients with a risk for malnutrition and malnutrition [%]	p-value*	Control subjects [%]	p-value**
	n = 54	n = 47		n = 129	
Fiber intake <20 g/day	71.7	88.9	0.0283	51.5	0.0004
Cheese intake >3 slices/day	25.6	17.4	NS	14.5	NS
Animal fat >3 servings/day	81.2	72.7	NS	67.3	NS
Sugar intake ≥15 g and/or sweets 3 times/day	39.1	39.8	NS	29.1	NS
Red meat and processed meat intake >4 servings/day	8.7	11.5	NS	0.9	0.0006
Oily sea fish intake <1 serving/week	65.9	70.2	NS	64.7	NS
Dark chocolate intake >4 servings/week	13.4	7.5	NS	14.3	NS
Milk chocolate intake >4 servings/week	3.6	9.7	NS	13.7	NS
Highly processed food intake >1 serving/week	3.7	4.1	NS	4.7	NS

NS – not significant; UC – ulcerative colitis; * comparison between UC patients with different nutritional status; ** comparison between UC patients and control subjects.

Table 3. Exposure to dietary risk factors of CD patients with different nutritional status vs control subjects

Dietary risk factor	CD patients with adequate nutritional state [%]	CD patients with a risk for malnutrition and malnutrition [%]	p-value*	Control subjects [%]	p-value**
	n = 22	n = 39		n = 129	
Fiber intake <20 g/day	62.3	74.9	NS	51.7	0.011
Cheese intake >3 slices/day	12.2	11.7	NS	14.4	NS
Animal fat >3 servings/day	87.2	88.7	NS	67.4	0.001
Sugar intake ≥15 g and/or sweets 3 times/day	37.9	55.3	NS	29.7	0.005
Red meat and processed meat intake >4 servings/day	8.5	0.0	NS	0.8	0.046
Oily sea fish intake <1 serving/week	66.9	49.9	NS	64.8	NS
Dark chocolate intake >4 servings/week	8.6	6.4	NS	14.3	NS
Milk chocolate intake >4 servings/week	12.7	16.5	NS	13.7	NS
Highly processed food intake >1 serving/week	0.0	2.6	NS	4.7	NS

NS – not significant; CD – Crohn's disease; * comparison between CD patients with different nutritional status; ** comparison between CD patients and control subjects.

of the patient groups with different nutritional statuses evaluated by the MNA in our previous work.[21] It was found that IBD patients' nutritional status assessment according to the MNA largely overlapped with changes in iron and cholesterol serum levels, as well as blood hemoglobin concentration. In this case-control study, low intake of fiber was associated only with the nutritional status assessed by the MNA for UC patients, though both UC and CD patients were exposed to a higher degree of these dietary risk factors than control subjects. Low fiber intake,

Table 4. Number of dietary risk factors in IBD patients with different nutritional status

Number of dietary risk factors	IBD patients with adequate nutritional status [%] (n = 76)	IBD patients with a risk for malnutrition and malnutrition [%] (n = 86)	p-value
0–2	18.1	16.0	NS
3–5	74.7	78.7	NS
6–8	7.2	6.4	NS

IBD – inflammatory bowel disease; NS – not significant.

especially fiber from fruit and vegetables, may elevate the risk of IBD.[7,20] It is not clear, however, whether the fiber content of fruits and vegetables is the seemingly protective factor or whether one or more of the micronutrient components of these foods, for example water or vitamin C, are involved.[7] Furthermore, the finding that the fiber intake from cereals, fruits and/or vegetables is lower in IBD patients may represent a response to the disease rather than an etiological factor. Patients may choose a low-fiber diet, consequently avoiding fruits and vegetables, in order to minimize symptoms such as diarrhea. This is a possible reason why UC patients with malnutrition and a risk for malnutrition had a higher incidence of low fiber intake than UC patients with adequate nutritional status in our study. A striking finding among individual food items was high intake of red and processed meat among both patient groups. High meat intake, as a source of sulfur, is more associated with an increased UC risk than with a CD risk.[22,23] Consumption of large amounts of sulfur and sulfate-rich foods is also associated with an increased risk of UC relapse.[23] High sulfur intake, either from sulfur amino acids or sulfate additives, results in the generation of hydrogen sulfide and mucosal damage in the colon. The acute toxicity of hydrogen sulfide appears to result from the inhibition of cytochrome oxidase, leading to mucosal damage, loss of barrier function and histological changes resembling UC.[22] In our study, the patients with CD were found to consume more animal fat, sucrose and refined carbohydrates from sweets compared to control subjects. Since the 1980s, various studies have indicated high consumption levels of these products in patients with IBD, to the extent that they are now considered a risk factor for CD and UC.[6,7,24,25] High consumption of animal fat is a risk factor for many diseases, but its mechanism of action in IBD is currently still unknown. The findings of a large epidemiological study suggest that high consumption of refined carbohydrates or added sugars may be true risk factors for IBD, while they may also be just an expression of a "modern lifestyle", which also involves other risk factors for the development of IBD.[7,26]

No statistically significant associations were detected between IBD patients and control subjects in regard to their exposure to other dietary risk factors studied. A similar result was reported in some other European studies, in which there was no correlation or a low correlation between a risk for IBD and a limited number of potential dietary risk factors.[10,20,23]

Canadian authors reported slightly different results in patients with active and inactive IBD. In their study, food avoidance among active and inactive IBD patients, in comparison to the control group, was prevalent for alcohol, popcorn, legumes, nuts, seeds, deep-fried foods, and processed deli meat, with a higher prevalence among those with active IBD. Patients with active IBD also consumed significantly more portions of sports drinks and sweetened beverages compared to those with inactive disease.[27]

In this study, we found no association between the number and type of dietary risk factors and the nutritional status of UC and CD patients. However, lower fiber intake and higher red meat intake in both patient groups, in comparison to the control group, as with higher animal fat and sugar intake in UC patients, indicate that those factors are important in the etiology of IBD. These results suggest that dietary factors are less statistically important than prior disease activity in the current nutritional status of UC and CD patients. The most important causes of malnutrition, excluding reduced food intake, are probably reduced absorptive surface due to inflammation, resection, diarrhea, and the enteric loss of nutrients during periods of disease activity, as well as during remission.[28–31] Previous studies have shown that UC and CD patients in remission are at risk of developing nutritional deficiencies in micro- and macronutrients, and that they are also exposed to dietary risk factors.[21,32,33] Future nutritional concepts for patients with IBD in remission should therefore include strategies for disease modification, e.g., involving immunomodifying substances or limiting the number of dietary risk factors, rather than focusing on the prevention and treatment of malnutrition alone.

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