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Habitual Dietary Intake and Adherence to Dietary Guidelines of Patients with Inflammatory Bowel Diseases

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Abstract: Inflammatory bowel disease (IBD) belongs to a group of autoimmune conditions characterized by chronic inflammation and mucosal ulceration of the gastrointestinal tract. The etiology of IBD is complex. The etiological factors include environmental factors, among which diet is important. The aim of this study was to evaluate the diet of IBD patients. This case–control study was carried out on 82 patients with IBD; the control group consisted of 80 clinically healthy subjects. Food intake was assessed using a 24 h recall and frequency food questionnaire. Energy intake in the IBD group was insufficient and significantly lower than in the control group. The energy intake in the group of patients with active IBD was significantly lower than in the group of subjects in remission. The total fat and protein intake was significantly lower in the IBD group compared to the healthy subjects. IBD patients were characterized by underconsumption of all food groups analyzed, except for the intake of red meat and poultry. Our study showed inadequate intake of energy and most nutrients in IBD patients, even during the remission period. The study indicates the need for routine assessment of dietary intake and nutrition among IBD patients, as well as potential dietary interventions aimed at improving the energy and nutritional quality of diet in order to optimize treatment outcomes and prevent the development of accompanying diseases.

Keywords: diet; inflammatory bowel disease; Crohn's disease; ulcerative colitis; dietary guidelines; nutrition

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1. Introduction

Inflammatory bowel disease (IBD), including ulcerative colitis (UC) and Crohn's disease (CD), belongs to a group of autoimmune conditions characterized by chronic inflammation and mucosal ulceration of the gastrointestinal tract. These conditions are known to have an irregular course, with periods of exacerbation of disease symptoms alternating with remission [1]. The etiology of IBD is complex, and the etiological factors include genetic predisposition and disruption of the intestinal microbiome, as well as environmental factors. A growing body of scientific evidence points to a dysbiosis of the microbiota and an abnormal immune response in individuals with a genetic predisposition [2–5]. It is likely that this process is provoked by changes in environmental factors, among which diet is very important [6,7]. The Western diet, characterized by a high intake of energy, fats and sugars, as well as a low intake of fruit and vegetables [8–11], is indicated as an important risk factor. In contrast, foods that protect against the development of IBD include dietary fiber [11–14], fruit [15,16], vegetables [15–17], fish [15,18,19] and nuts [15,19]. Despite extensive research, it has not yet been possible to establish strict dietary recommendations for this group of patients [13,20].

High intake of total fat, polyunsaturated fatty acids (PUFAs), omega-6 fatty acids and meat increases the risk of developing UC, while a high intake of saturated fatty acids (SFAs), PUFAs, omega-6 fatty acids and meat increases the risk of developing CD [21,22]. A high intake of dietary fiber and fruit reduces the risk of CD; however, this relationship has not been proven for UC [21,22]. In contrast, no association has been shown between total carbohydrate intake and IBD risk, even in studies reporting intakes more than twice the recommended level [21]. A meta-analysis conducted in 2011 found a relationship between a high intake of total fat, PUFA, omega-6 fatty acids and meat and a higher risk of CD and UC. Additionally, a high intake of fiber and fruit was shown to be associated with a lower risk of CD, while a high intake of fiber from vegetables was associated with a lower risk of UC [22]. These relationships have also been confirmed in prospective studies [13,23]. Moreover, some papers have described an association between the consumption of meat, synthetic sweeteners, and food additives with a higher incidence of IBD [24].

Due to the lack of strict guidelines, IBD patients, based on their own experience and fear of relapse, self-impose restrictive elimination diets, as confirmed in many studies [25–27]. This behavior promotes nutritional deficiencies and malnutrition, which is often diagnosed in these patients and which hinders the achievement of therapeutic goals [28–30]. Among the most commonly cited dietary abnormalities are inadequate intake of iron, calcium, magnesium and vitamins B9, D and K [29]. Products that these patients often avoid include alcohol and fried foods, as well as fruit and vegetables [25,26,29], whereas fruit and nuts have been mentioned as products that have a potentially protective effect [30–32].

In IBD patients without food allergies and intolerances, the Mediterranean diet appears to be the safest nutrition model. Due to the variety of products used, it is a highly diversified diet with high nutritional value. The Mediterranean dietary pattern is based on a high intake of olive oil, fruit, vegetables, whole-grain cereal products, legumes, nuts and seeds. It also includes a moderate intake of fish, white meat, eggs and fermented dairy products (cheese and yogurt), as well as relatively small amounts of red meat, processed meats and high-sugar products. The results of clinical studies on the Mediterranean diet indicate its potential contribution to IBD treatment. High adherence to the Mediterranean diet has been observed to have a beneficial effect on the intestinal microflora and associated metabolism [33–37]. Additionally, it has also been indicated that adherence to the Mediterranean dietary pattern lowers the risk of subsequent CD and improves the quality of life in IBD patients [34]. The Mediterranean diet shows a high potential for the beneficial modulation of intestinal inflammation, a possible preventive effect for IBD.

In recent years, some evidence has emerged with regard to a relation between IBD and an increased risk of cardiovascular incidents resulting from chronic inflammation that contributes to the development of atherosclerosis [38–40]. A meta-analysis conducted in 2014 found coronary incidents in more than 5% of patients with IBD, as well as an increased risk of ischemic heart disease in one in five patients [41]. A study by Kristensen et al. showed that IBD patients face an increased risk of stroke and hospitalization for heart failure compared to healthy subjects [39]. A study by Panhwar et al. reported a significantly higher risk of myocardial infarction in patients with CD and UC compared to the healthy population [38]. Thus, it seems reasonable to introduce nutritional prevention guidelines for cardiovascular disease in IBD patients.

The aim of this study was to quantitatively and qualitatively evaluate the diet of IBD patients to identify dietary errors and possible nutrient deficiencies. Additionally, this group of patients was assessed for adherence to the Mediterranean diet and dietary guidelines for prevention of cardiovascular diseases.

2. Materials and Methods

This case–control study was carried out on 82 Caucasian patients with IBD, including 48 patients with CD and 34 patients with UC, recruited from the Department of Digestive Tract Diseases, Medical University of Lodz, between June and October 2022. Patients were not hospitalized during the assessment and had not had a regular diet evaluations

or consultations before the assessment. Detailed characteristics of the study participants was described in our previous articles [42–44]. Shortly, all the subjects had a confirmed diagnosis of IBD. Disease activity was assessed using validated scales. For CD patients, the Crohn's Disease Activity Index (CDAI) was used; for UC patients, the Partial Mayo Score was applied [45,46]. Individuals with conditions that may disrupt the nutritional status (cancer, metabolic syndrome) were excluded from the study. The control group consisted of 80 clinically healthy subjects without IBD.

In all the subjects, waist circumference was measured, and BMI (Body Mass Index) was determined. The body composition of each study participant was assessed by bioelectrical impedance analysis (BIA) using an InBody 270 instrument.

Food intake was assessed using a 24 h recall questionnaire, obtained three times from each subject. The mean intake of energy and nutrients was assessed using the computer program Diet 6.0 (license number 52/PD/2022) [47]. Additionally, dietary data were obtained with the Food Frequency Questionnaire (FFQ), based on the previous week/month as a reference period.

Assessment of the subjects' dietary habits was performed using the Mediterranean Diet Score (MedDietScore) [48,49]. According to the recommendations of the European Society of Cardiology, the diet of the subjects was assessed by verifying the implementation of 11 dietary guidelines for the prevention of cardiovascular diseases, one point for each achieved guideline. The higher the values, the higher the adherence to the guidelines of the European Society of Cardiology [49,50].

All the computational procedures were performed using Statistica™ 14 (TIBCO Software Inc., Palo Alto, CA, USA). Descriptive statistics with determination of the mean and standard deviation or median and interquartile range were made. Categorical variables were presented in the form of numbers and percentages. The Shapiro–Wilk W test was used to assess the normality of distribution. For univariate analyses, the Mann–Whitney U test was adjusted when a grouping variable was dichotomous, or the Kruskal–Wallis H test was carried out when a grouping variable had more than two categories. To compare the frequencies of the two groups, Fisher's exact test was used. A level of $p < 0.05$ was considered statistically significant.

3. Results

3.1. Characteristics of the Study Subjects

Eighty-two IBD patients participated in the study, including 42 women (51.2%) and 40 men (48.8%). Nearly half of the subjects had a university degree (48.8%) and more than half had a high school diploma (51.2%). One in five respondents smoked cigarettes (17.1%). The majority of the study participants received biological treatment (80.5%) or oral preparations of 5-aminosalicylic acid (78.0%), while one in three subjects took immunosuppressants (40.2%) and corticosteroids (30.5%). Thirty-seven patients (45.1%) reported vitamin and/or mineral supplement use. Seventeen subjects (35.4%) among the CD patients and seventeen subjects among the UC patients (50%) were in remission and reported having no disease symptoms (Table 1).

Table 1. General characteristics of study participants.

	IBD **N(%)/Mean ± SD**	**Controls** **N(%)/Mean ± SD**
CD	48 (58.5)	-
UC	34 (41.5)	-
Age (years)	38.1 ± 11.6	35.6 ± 8.2
Female	42 (51.2)	43 (53.8)

Table 1. *Cont.*

	IBD N(%)/Mean ± SD	Controls N(%)/Mean ± SD
Level of education		
Secondary	42 (51.2)	24 (30) *
High	40 (48.8)	56 (70) *
Work status		
Full time job	70 (85.4)	69 (86.3)
Part time job	10 (12.2)	8 (10)
Unemployed	2 (2.4)	3 (3.7)
Disease duration (years)	8.4 ± 5.7	-
Anthropometry		
BMI (kg/m^2)	24.23 ± 4.76	25.87 ± 3.82
Waist circumference (cm)	88.88 ± 14.54	87.81 ± 9.12
Fatty tissue (%)	27.1 ± 9.6	32.9 ± 8.4 *
Medications		
Biological therapy	66 (80.5)	-
Immunosuppression	33 (40.2)	-
Steroids	25 (30.5)	-
5-ASA	64 (78.0)	-
Vitamins or/and minerals supplements	37 (45.1)	35 (43.75)
Disease activity		
UC Partial Mayo Score (0/1/2/3)	17 (50.0)/0 (0)/11 (32.4)/6 (17.6)	-
CDAI (0/1/2/3)	17 (35.4)/10 (20.9)/17 (35.4)/4 (8.3)	-

* $p < 0.05$, IBD vs. controls.

3.2. Energy and Macronutrients

Energy intake in the IBD group was insufficient and significantly lower than in the control group (1575.7 kcal vs. 1980.2 kcal, $p < 0.001$). There were no significant differences in energy intake between the CD and UC patients (1540.2 kcal vs. 1626.1 kcal, respectively, $p = 0.0921$). The composition of protein, fat and carbohydrate intake differed significantly between the IBD patients and the control group. The IBD patients were characterized by a significantly higher proportion of energy derived from carbohydrates than the healthy subjects (53.4% vs. 47.9%, $p < 0.001$). Additionally, the IBD patients were characterized by a significantly lower proportion of energy derived from protein (18.8% vs. 20.7%, $p < 0.001$) and fat (28.8% vs. 33.9%, $p < 0.001$) compared to the healthy controls. The percentage distribution of carbohydrates and fats in the dietary energy composition of the IBD patients was in line with the ESPEN guidelines (Tables 2 and 3).

As for the total protein intake, a significantly lower intake was found in the group of IBD patients compared to the healthy subjects (70.5 g vs. 94.6 g, $p < 0.001$) and in CD patients compared to UC patients (65.5 g vs. 71.3 g, $p < 0.05$). Protein deficiencies were also significantly more common in the group of patients than among the healthy controls (9.8% vs. 5%, respectively, $p < 0.01$). Among the IBD patients, animal protein intake was found to be higher than plant protein intake (44.3 g vs. 27.2 g, respectively), while in the healthy group, plant and animal protein intake was balanced (45.1 g vs. 47.7 g, respectively).

Table 2. Energy and nutrient intake by study participants.

Nutrient	Guidelines [21,47] Female/Male	IBD Mean ± SD/n (%)	Controls Mean ± SD/n (%)
Energy (kcal)	2000 kcal/2500 kcal	1575.7 ± 302.5	1980.2 ± 368.4 *
% Calories from carbohydrates	45–60%	53.4 ± 9.1	47.9 ± 7.1
% Calories from fats	20–35%	28.8 ± 5.4	33.9 ± 6.2 *
% Calories from proteins		18.8 ± 4.2	20.7 ± 3.1 *
	Macronutrients		
Fat (g)		42.8 ± 9.6	77.9 ± 20.1 *
SFA (g)	As low as possible	17.7 ± 1.9	32.1 ± 14.9 *
MUFA (g)		14.3 ± 3.5	33.6 ± 15.7 *
PUFA (g)		5.4 ± 1.5	13.0 ± 5.7 *
Cholesterol (mg)		203.6 ± 25.1	220.8 ± 21.7
Protein (g)		70.5 ± 8.7	94.6 ± 27.3 *
Protein (g/kg BW)	Active disease 1.2–1.5 g/kg BW; Remission 1 g/kg BW	1.2	1.6 *
Protein intake lower than recommended (%)		8 (9.8)	4 (5) *
Animal protein (g)		44.3 ± 4.3	45.1 ± 4.8
Plant protein (g)		27.2 ± 4.1	47.7 ± 3.9 *
Carbohydrates (g)		220.9 ± 56.2	255.3 ± 72.2
Fiber (g)	Active disease reduction; Remission 25 g/day	14.7 ± 6.5	27.3 ± 7.1 *
Fiber intake lower than recommended (%)		70 (85.4)	20 (25) *
Simple sugars (g)	As low as possible	10.6 ± 4.8	15.4 ± 6.1 *
Lactose (g)		3.4 ± 1.1	12.5 ± 3.2 *
Sucrose (g)	As low as possible	27.7 ± 5.6	20.3 ± 5.8 *
Starch (g)		130.7 ± 33.6	140.6 ± 27.2
	Micronutrients		
Dietary folate equivalents (μg)	400	215.5 ± 44.2	270.3 ± 36.9 *
Vitamin A (μg retinol equivalent)	500/630	1270.4 ± 300.8	1412.5 ± 287.9
Vitamin E (mg α-tokoferol equivalent)	8/10	5.1 ± 2.2	6.1 ± 1.8
Vitamin C (mg)	75/90	75.5 ± 39.3	121.5 ± 32.7 *
Vitamin B-12 (μg)	2.4	2.1 ± 0.3	2.3 ± 0.9
Vitamin D (μg)	15	2.4 ± 1.6	5.6 ± 1.2 *
Calcium (mg)	800	527.9 ± 100.2	902.5 ± 200.7 *
Magnesium (mg)	265/350	292.5 ± 90.8	301.5 ± 68.9
Iron (mg)	6/8	8.5 ± 3.3	8.3 ± 2.6
Zinc (mg)	6.8/9.4	7.8 ± 2.3	9.8 ± 3.1 *
Sodium (μg)	1500	2984.5 ± 203.7	3010.6 ± 187.2
Potassium (mg)	3500	2553.7 ± 216.4	2601.7 ± 227.1

IBD, inflammatory bowel disease; SD, standard deviation; SFA, saturated fatty acids; MUFAs, monounsaturated fatty acids; PUFAs; polyunsaturated fatty acids. * p-value < 0.05 IBD vs. controls.

Table 3. Energy and nutrient intake by CD and UC patients.

Nutrient	Guidelines [21,47] Female/Male	CD Mean ± SD/n (%)	UC Mean ± SD/n (%)
Energy (kcal)	2000 kcal/2500 kcal	1540.2 ± 282.5	1626.1 ± 320.7
% Calories from carbohydrates	45–60%	53.1 ± 7.1	52.9 ± 6.9
% Calories from fats	20–35%	26.8 ± 7.4	27.9 ± 5.5
% Calories from proteins		18.2 ± 4.7	18.3 ± 3.3
Macronutrients			
Fat (g)		40.8 ± 9.6	44.6 ± 9.1
SFA (g)	As low as possible	17.1 ± 1.8	18.2 ± 1.6
MUFA (g)		13.9 ± 3.2	14.4 ± 2.6
PUFA (g)		5.3 ± 1.3	5.6 ± 0.9
Cholesterol (mg)		202.6 ± 17.1	210.4 ± 14.6
Protein (g)		65.5 ± 9.7	71.3 ± 10.2 *
Protein (g/kg BW)	Active disease 1.2–1.5 g/kg BW; Remission 1 g/kg BW	1.1	1.3
Protein intake lower than recommended (%)		5 (10.4)	3 (8.8)
Animal protein (g)		41.3 ± 4.1	46.9 ± 3.2
Plant protein (g)		27.9 ± 4.1	26.3 ± 3.3
Carbohydrates (g)		232.7 ± 50.2	200.4 ± 44.8
Fiber (g)	Active disease reduction; Remission 25 g/day	10.1 ± 5.1	16.7 ± 3.8 *
Fiber intake lower than recommended (%)		41 (85.4)	29 (85.3)
Simple sugars (g)	As low as possible	11.6 ± 4.1	9.9 ±3.6
Lactose (g)		2.6 ± 1.2	3.4 ±1.1 *
Sucrose (g)	As low as possible	29.7 ± 5.5	27.1 ±5.1
Starch (g)		133.7 ± 30.6	130.5± 29.9
Micronutrients			
Dietary folate equivalents (µg)	400	212.5 ± 40.2	200.5 ± 42.9
Vitamin A (µg retinol equivalent)	500/630	1260.4 ± 330.1	1300.3 ± 276.5
Vitamin E (mg α-tokoferol equivalent)	8/10	5.3 ± 2.1	5.5 ± 1.9
Vitamin C (mg)	75/90	73.1 ± 34.3	76.4 ± 37.1
Vitamin B-12 (µg)	2.4	2.1 ± 0.6	2.2 ± 0.9
Vitamin D (µg)	15	2.2 ± 1.3	2.4 ± 1.7
Calcium (mg)	800	520.9 ± 90.2	530.4 ± 102.8
Magnesium (mg)	265/350	299.5 ± 88.8	300.3 ± 90.7
Iron (mg)	6/8	8.6 ± 3.7	8.8 ± 3.2
Zinc (mg)	6.8/9.4	7.9 ± 2.9	8.3 ± 3.1
Sodium (µg)	1500	3084.5 ± 200.1	2699.8 ± 300.2
Potassium (mg)	3500	2653.1 ± 206.7	2598.5 ± 128.9

SD, standard deviation; SFA, saturated fatty acids; MUFAs, monounsaturated fatty acids; PUFAs; polyunsaturated fatty acids. * p-value < 0.05 CD vs. UC.

The total fat intake was found to be significantly lower in the IBD group as compared to the healthy subjects (42.8 g vs. 77.9 g, $p < 0.001$). Additionally, there was a lower intake of SFAs, MUFAs and PUFAs in the patients compared to the healthy controls. In contrast, cholesterol intake in the IBD patients was not significantly different from in the healthy subjects (203.6 mg vs. 220.8 mg, respectively; $p > 0.05$).

There were no significant differences in the total carbohydrate intake in the IBD group compared to the healthy subjects (220.9 g vs. 255.3 g). However, there was a significantly lower fiber intake in the IBD patients compared to the healthy controls (14.7 g vs. 27.3 g, respectively; $p < 0.001$) and in CD patients compared to UC patients (10.1 g vs. 16.7 g, $p < 0.05$). There was more frequent fiber deficiency in the patients with IBD compared to the healthy subjects (85.4% vs. 20%, $p < 0.001$). Also, lactose intake was significantly lower among the IBD patients compared to controls (3.4 g vs. 12.5 g, respectively; $p < 0.001$) and among CD patients compared to UC patients (2.6 g vs. 3.4 g, $p < 0.05$). The IBD patients had a significantly lower intake of simple sugars (10.6 g vs. 15.4 g, respectively; $p < 0.001$) but a higher intake of sucrose (27.7 g vs. 20.3 g, respectively; $p < 0.001$).

The energy intake in the group of patients with active IBD was significantly lower than in the group of subjects in remission (1371.7 kcal vs. 1623.7 kcal, $p < 0.001$). The patients with active IBD compared to those in remission had a significantly higher proportion of energy derived from carbohydrates (55.4% vs. 49.4%; $p < 0.001$) but a lower proportion of energy derived from protein (15.8% vs. 22.5%; $p < 0.001$) (Table 4).

Table 4. Energy and nutrient intake by patients with IBD according to disease activity.

Nutrient	Guidelines [21,47] Female/Male	Active Mean ± SD/n (%)	Remission Mean ± SD/n (%)
Energy (kcal)	2000 kcal/2500 kcal	1371.7 ± 272.5	1623.7 ± 350.5 *
% Calories from carbohydrates	45–60%	55.4 ± 7.8	49.4 ± 10.1 *
% Calories from fats	20–35%	27.8 ± 4.6	28.9 ± 6.4
% Calories from proteins		15.8 ± 3.2	22.5 ± 4.7 *
Macronutrients			
Fat (g)		40.8 ± 8.6	42.9 ± 10.1
SFA (g)	As low as possible	16.6 ± 1.8	17.9 ± 2.1
MUFA (g)		14.9 ± 2.8	15.3 ± 2.2
PUFA (g)		5.2 ± 1.7	5.6 ± 1.4
Cholesterol (mg)		213.6 ± 23.1	201.6 ± 26.8
Protein (g)		57.5 ± 7.7	72.5 ± 8.2 *
Protein (g/kg BW)	Active disease 1.2–1.5 g/kg BW; Remission 1 g/kg BW	0.9	1.5 *
Animal protein (g)		31.3 ± 5.1	40.3 ± 4.1 *
Plant protein (g)		26.2 ± 2.1	35.2 ± 4.1 *
Carbohydrates (g)		200.9 ± 50.1	210.6 ± 46.2
Fiber (g)	Active disease reduction; Remission 25 g/day	12.7 ± 7.8	17.1 ± 5.5 *
Simple sugars (g)	As low as possible	10.1 ± 4.2	11.2 ± 3.8
Lactose (g)		3.4 ± 1.1	3.4 ± 1.1
Sucrose (g)	As low as possible	25.1 ± 5.1	28.7 ± 4.2
Starch (g)		134.3 ± 30.6	129.8 ± 35.4

Table 4. *Cont.*

Nutrient	Guidelines [21,47] Female/Male	Active Mean ± SD/n (%)	Remission Mean ± SD/n (%)
	Micronutrients		
Dietary folate equivalents (µg)	400	212.7 ± 40.2	217.5 ± 42.9
Vitamin A (µg retinol equivalent)	500/630	1255.4 ± 310.2	1279.4 ± 276.8
Vitamin E (mg α-tokoferol equivalent)	8/10	5.0 ± 2.8	5.4 ± 1.2
Vitamin C (mg)	75/90	70.5 ± 41.3	76.1 ± 36.8
Vitamin B-12 (cobalamin) (µg)	2.4	2.1 ± 0.7	2.0 ± 0.9
Vitamin D (µg)	15	2.4 ± 1.1	2.3 ± 2.1
Calcium (mg)	800	500.9 ± 100.2	570.9 ± 100.2
Magnesium (mg)	265/350	272.5 ± 92.8	302.5 ± 99.7
Iron (mg)	6/8	8.1 ± 2.6	8.5 ± 4.3
Zinc (mg)	6.8/9.4	7.1 ± 2.0	8.2 ± 2.7
Sodium (µg)	1500	3010.5 ± 198.7	2836.5 ± 221.2
Potassium (mg)	3500	2653.7 ± 205.4	2488.1 ± 232.2

IBD, inflammatory bowel disease; SD, standard deviation; SFAs, saturated fatty acids; MUFAs, monounsaturated fatty acids; PUFAs, polyunsaturated fatty acids. * p-value < 0.05 Active vs. Remission.

Regarding the total protein intake, a significantly lower consumption was observed in the group of patients with active IBD compared to those in remission (57.5 g vs. 75.5 g; $p < 0.001$). There were no significant differences between the patients with active disease and those in remission in terms of total fat, SFA, MUFA, PUFA, and cholesterol intake. No significant differences were found in the intake of total carbohydrates, simple sugars, sucrose, or starch in the patients with active IBD compared to those in remission. In contrast, there was a significantly lower intake of fiber in subjects with active IBD compared to those in remission (12.7 g vs. 17.1 g, respectively; $p < 0.001$).

3.3. Micronutrients

When comparing micronutrient intake, there were no significant differences found in the intake of vitamin B12, iron, magnesium, sodium and potassium between the patients and the healthy subjects. However, there was a significantly lower intake of folic acid (215.3 µg vs. 270.3 µg, respectively; $p < 0.001$) and vitamin D (2.4 µg vs. 5.6 µg, respectively; $p < 0.001$) among the IBD patients compared to the healthy subjects. Additionally, the IBD patients showed a significantly lower intake of calcium (527.9 mg vs. 902.5 mg; $p < 0.001$) and zinc (7.8 mg vs.9.8 mg; $p < 0.001$) compared to the control group (Table 2).

There were no significant differences found in micronutrient intake in the IBD patients in the periods of remission and symptom exacerbation and between CD and UC patients.

3.4. Product Groups

There was a significantly lower intake of all foodstuff groups in the patients compared to the healthy subjects, with the exception of red meat, poultry, fish and butter, whose intake did not differ significantly between the groups. Additionally, when assessing the intake of food groups against the recommended standard, the IBD patients were characterized by underconsumption of all food groups analyzed, except for the intake of red meat and poultry (Table 5).

Table 5. Food group consumption, MedDietScore, and total score for adherence to European dietary guidelines for CVD prevention in study participants.

Food Groups	Polish Dietary Guidelines [47]	IBD Me (Q1–Q3)/Mean ± SD	Controls Me (Q1–Q3)
Frequency of consumption (times per day)			
Fruits	2 portions/day	1.1 (0.5–2.0)	2.7 (0.7–2.7) *
Vegetables	3 portions/day	1.1 (0.5–1.4)	1.9 (0.7–3.3) *
Legumes	3 portions/week	0.3 (0.1–0.7)	1.1 (0.5–2.1) *
Whole grain products	5–8 portions/day	1.1 (0.3–1.9)	3.2 (1.0–4.4) *
Red meat	Up to 1 portion/week	1.1 (0.3–2.1)	1.3 (0.5–2.2) *
Poultry	1–2 portions/week	1.5 (0.9–2.9)	1.6 (0.5–2.8)
Fish	2 portions/week	0.3 (0.1–0.9)	0.4 (0.5–1.3)
Lactose dairy products	2 portions/day	1.0 (0.5–1.9)	2.1 (0.5–3.1) *
Lactose-free dairy products		1.5 (0.9–2.5)	0.2 (0.1–0.9) *
Butter		2.1 (0.5–3.2)	2.1 (0.5–3.1)
Plant oils		0.7 (0.0–1.5)	1.5 (0.5–2.5) *
Fast foods	Avoidance	0.5 (0.5–1.5)	1.5 (0.5–2.9) *
Sweetened beverages	Avoidance	0.5 (0.5–1.5)	1.6 (0.5–2.8) *
Sweets	Avoidance	0.7 (0.5–2.0)	2.1 (0.5–4.1) *
Coffee		1.1 (0.5–2.0)	1.3 (1.0–3.0)
Tea		1.5 (0.3–1.9)	1.5 (1.0–2.0)
Total MedDietScore (0–55)		24.6 ± 6.7	30.2 ± 4.6 *
Total score of adherence to European dietary guidelines for CVD prevention (0–11)		4.2 ± 1.7	6.1 ± 1.3 *

* $p < 0.05$, IBD vs. controls.

When comparing the intake of food groups, significantly, a lower intake of lactose products and a higher intake of lactose-free products were found in CD patients compared to UC patients (Table 6).

Table 6. Food group consumption, MedDietScore, and total score for adherence to European dietary guidelines for CVD prevention in CD and UC patients.

Food Groups	Polish Dietary Guidelines [47]	CD Me (Q1–Q3)/Mean ± SD	UC Me (Q1–Q3)/Mean ± SD
Frequency of consumption (times per day)			
Fruits	2 portions/day	1.0 (0.5–1.8)	1.2 (05–2.1)
Vegetables	3 portions/day	1.0 (0.5–1.6)	1.2 (0.5–1.4)
Legumes	3 portions/week	0.3 (0.1–0.6)	0.3 (0.1–0.4)
Whole grain products	5–8 portions/day	1.1 (0.3–1.6)	1.0 (0.5–1.7)
Red meat	Up to 1 portion/week	1.1 (0.3–2.1)	1.2 (0.5–2.0)
Poultry	1–2 portions/week	1.4 (0.9–2.9)	1.6 (1.0–2.2)
Fish	2 portions/week	0.3 (0.1–0.9)	0.3 (0.2–0.9)
Lactose dairy products	2 portions/day	0.5 (0.3–1.1)	1.0 (0.5–1.9) *
Lactose-free dairy products		1.5 (0.8–2.5)	0.8 (0.5–1.1) *

Table 6. *Cont.*

Food Groups	Polish Dietary Guidelines [47]	CD Me (Q1–Q3)/Mean ± SD	UC Me (Q1–Q3)/Mean ± SD
Butter		2.1 (0.3–3.2)	2.0 (0.5–2.5)
Plant oils		0.7 (0.0–1.4)	0.7 (0.2–1.2)
Fast foods	Avoidance	0.5 (0.3–1.4)	0.6 (0.5–1.5)
Sweetened beverages	Avoidance	0.5 (0.3–1.5)	0.5 (0.5–1.4)
Sweets	Avoidance	0.7 (0.3–2.0)	0.6 (0.3–1.8)
Coffee		1.1 (0.5–2.0)	1.0 (0.7–2.0)
Tea		1.3 (0.3–1.9)	1.6 (0.5–1.6)
Total MedDietScore (0–55)		24.1 ± 6.2	23.9 ± 6.8
Total score of adherence to European dietary guidelines for CVD prevention (0–11)		4.1 ± 1.8	4.4 ± 1.2

* $p < 0.05$, CD vs. UC.

When comparing the intake of food groups between the patients, significantly lower intakes of fruit, vegetables, whole grain cereal products, red meat, and poultry were found in the group of patients with symptom exacerbation compared to those in remission. In contrast, there were no differences in the intake of dry pulses, whole-grain cereal products, dairy products, edible fats, or sweets depending on disease activity (Table 7).

Table 7. Food group consumption, MedDietScore, and total score for adherence to European dietary guidelines for CVD prevention in patients with IBD according to disease activity.

Food Groups	Polish Dietary Guidelines [47]	Active Me (Q1–Q3)	Remission Me (Q1–Q3)
Fruits	2 portions/day	0.7 (0.5–1.5)	1.5 (0.7–2.0) *
Vegetables	3 portions/day	0.9 (0.3–1.1)	1.2 (0.5–1.4) *
Legumes	3 portions/week	0.3 (0.1–0.6)	0.4 (0.1–0.7)
Whole grain products	5–8 portions/day	0.9 (0.3–1.7)	1.2 (0.4–1.9) *
Red meat	Up to 1 portion/week	0.9 (0.4–2.0)	1.2 (0.3–2.1) *
Poultry	1–2 portions/week	1.2 (0.9–2.5)	1.8 (0.7–2.7) *
Fish	2 portions/week	0.3 (0.2–0.8)	0.3 (0.1–0.9)
Lactose dairy products	2 portions/day	0.9 (0.5–1.7)	1.1 (0.7–1.9)
Lactose-free dairy products	2 portions/day	1.3 (0.7–2.5)	1.5 (0.9–2.5)
Butter		2.0 (0.6–3.2)	2.1 (0.5–3.0)
Plant oils		0.6 (0.1–1.5)	0.7 (0.0–1.3)
Fast foods	Avoidance	0.5 (0.5–1.5)	0.4 (0.4–1.2)
Sweetened beverages	Avoidance	0.6 (0.5–1.5)	0.5 (0.5–1.4)
Sweets	Avoidance	0.7 (0.5–2.1)	0.7 (0.4–2.0)
Coffee		0.5 (0.3–1.6)	1.3 (0.5–2.0)
Tea		0.5 (0.2–0.9)	1.7 (0.9–2.0)
Total MedDietScore (0–55)		22.3 ± 5.2	27.1 ± 6.1 *
Total score of adherence to European dietary guidelines for CVD prevention (0–11)		3.5 ± 1.4	4.7 ± 1.5 *

* $p < 0.05$, active vs. remission.

3.5. Mediterranean Diet Guidelines and European Dietary Guidelines for CVD Prevention

The mean MedDietScore in the IBD patients was 24.6 ± 6.7 points, indicating moderate adherence to the Mediterranean diet guidelines. This value was significantly lower than in the control group (30.2 ± 4.6 points; $p < 0.05$). The adherence to the dietary guidelines for the prevention of cardiovascular disease among the IBD patients was assessed at a mean level of 4.2 ± 1.7 points, which indicates insufficient implementation of these recommendations. This value was significantly lower than in the healthy group (6.1 ± 1.3 points; $p < 0.05$) (Table 4).

The mean MedDietScore in the IBD patients during symptom exacerbation was significantly lower than in those in remission (22.3 ± 5.2 points vs. 27.1 ± 6.1 points, respectively; $p < 0.05$). The mean adherence to dietary guidelines for cardiovascular disease prevention in the IBD patients during symptom exacerbation was significantly lower than in those in remission (3.5 ± 1.4 points vs. 4.7 ± 1.5 points, respectively; $p < 0.05$) (Table 5).

4. Discussion

The aim of this study was to quantitatively and qualitatively assess the diet of IBD patients. Energy and protein intake are key elements in restoring the normal nutritional status of these patients and the success of therapy. In our study, we demonstrated insufficient energy intake in the IBD patients, significantly lower than in the healthy group. The BMI of the IBD patients was not significantly lower than the controls despite their significantly lower caloric intake. A lower metabolic rate in IBD patients might be responsible for this discrepancy. Patients with IBD often stay on low-energy diets which may lead to a lower basal metabolic rate. Additionally, patients with symptom aggravation were characterized by a significantly lower energy intake than those in remission.

Similar data were obtained in several studies [51,52]. In a study by Szczuko et al., the authors reported insufficient energy intake in patients with CD and UC. Similarly to the results of our own study, a significantly lower intake was found in patients with active IBD compared to those in remission [51]. Similar data were obtained in a study by Konecka et al., in which insufficient energy intake was found in patients with CD [52]. Also, a 2021 meta-analysis of 19 studies on the diet of IBD patients showed insufficient energy intake in IBD patients with both UC and CD. The study showed a significant impact of disease activity on energy intake, with higher values recorded in patients in remission compared to individuals with active IBD [53]. Different data were obtained in a study by Peters et al., conducted in a group of nearly 500 IBD patients. It showed insufficient energy intake in patients with CD and UC. In contrast, this intake did not differ significantly between IBD patients and healthy subjects. Disease activity did not significantly change energy intake either [54]. Similarly, in a study by Karachaliaou et al., there were no differences in energy intake between IBD patients and healthy subjects. Disease activity did not affect dietary energy intake either [49].

Analysis focused on meeting the nutritional requirements found differences in protein intake, which, in our study, was significantly lower in the group of patients with IBD than in the control group. However, the mean dietary protein intake of IBD patients expressed in g/kg BW met the ESPEN recommendations, and a deficiency was found in only one in ten subjects. No significant differences were found between patients in remission and those with active IBD in terms of protein intake. The data on protein intake among IBD patients in the literature are inconclusive. In a study by Karachaliaou et al., the mean protein intake in a group of IBD patients was sufficient, in line with the ESPEN guidelines. However, as many as 40.5% of patients did not meet the ESPEN recommendations in terms of protein intake expressed in g/kg BW, indicating a wide variation in protein intake among the patient group studied. Furthermore, protein intake was significantly lower in patients with the active form of disease than in those in remission, which was not observed in our study [49]. In the study by Peters et al., the protein intake of patients with CD and UC was significantly lower than that of healthy subjects. Among the study group, animal

protein intake predominated over plant protein intake. In contrast, there were no significant differences in protein intake depending on disease activity, as in our study [54].

According to the ESPEN guidelines, patients with active disease should have a higher protein intake, in the range of 1.2–1.5 g/kg BW/day [21], whereas in the general population, only 0.8–1.0 g/kg BW/day is recommended [47]. The higher intake results from compensating for protein losses due to, among others, inflammation in the gastrointestinal tract. Too low an intake of protein can lead to loss of muscle mass, a decline of which has been reported among patients following IBD diagnosis [55,56].

A very important issue is the origin of dietary protein. Guidelines for the general population recommend a balanced intake of protein of plant and animal origin, which is also reflected in recommendations for patients [21,47]. Protein of animal origin has a higher nutritional value as it contains all essential amino acids, allowing the full use of protein as building blocks. On the other hand, a high intake of protein, especially animal protein, can affect the composition of the intestinal microflora, thereby inducing dysbiosis and increasing the risk of IBD [57]. Among animal protein sources, a high consumption of meat and/or fish, but not eggs or dairy products, increases IBD risk [56]. Therefore, when advising IBD patients to increase their protein supply, attention should be paid to the source of the protein [56,57].

In our study, the IBD patients were characterized by a high intake of total carbohydrates and their high share in dietary energy composition. There was a significantly higher proportion of sucrose and a lower proportion of fiber in the diet of the IBD patients compared to the healthy subjects. Additionally, patients with symptom exacerbation showed a lower fiber intake, compared to those in remission. Similar data were obtained in other studies. A study by Karachaliaou et al. reported a lower-than-recommended intake of total carbohydrates in patients with CD. This was accompanied by a high intake of simple sugars and sucrose, and a low fiber intake, which was also confirmed in our own study [49]. In a study by Peters et al., carbohydrate intake in a group of IBD patients was in line with the recommendations and did not differ significantly either between patients and healthy controls or between patients with active disease and those in remission [54]. In contrast, a meta-analysis of data on fiber intake among IBD patients conducted in 2021 found that most of the studies analyzed confirmed a lower fiber intake in IBD patients compared to healthy subjects, who did not follow generally accepted recommendations. However, the effect of disease type, its course and activity on dietary fiber intake in IBD patients remains controversial [53].

We found a significantly lower intake of total fats, MUFAs, PUFAs and SFAs in the IBD patients compared to the healthy subjects. In contrast, the percentage of fats in the patients' diets was in line with the ESPEN guidelines. There were no significant differences in fat intake depending on disease activity. In a study by Karachaliou et al., the intake of total fat, MUFAs, PUFAs and SFAs was significantly higher in a group of IBD patients than in our study. However, similarly to our study, fat intake did not differ between patients with active IBD and those in remission [49]. In a study by Peters et al., total fat intake in patients with IBD was higher than in our study, and it did not differ significantly between patients and healthy controls. The study showed no differences in fat intake between patients with active IBD and those in remission [54]. A study by Opstelten et al. found a significantly lower intake of total fat, MUFAs and PUFAs in IBD patients compared to healthy subjects. In turn, it showed a significantly lower fat and PUFA intake in patients during IBD symptom exacerbation than during remission [58].

The low intake of certain nutrients, such as fiber, lactose, calcium and vitamin D, observed in our study was reflected in the reduced consumption of selected food groups by IBD patients. In our study, we found insufficient and significantly lower intakes of all products, except red meat and poultry, than in the control group. Our results support the assumption that dietary restrictions and elimination diets are implemented by these patients, not only during exacerbation periods, but also in remission, for fear of aggravation of disease symptoms. The greatest disproportions in the intake of food groups between the

patients and healthy subjects were observed for dairy products and high-fiber products (fruit, vegetables, whole-grain cereal products). Similar studies assessed consumption of selected food groups by IBD patients. The study by Peters et al. found a significantly lower intake of milk and dairy products in CD patients as compared to healthy subjects. Additionally, the authors of the study noted a significantly lower intake of whole-grain cereal products in UC patients, which was in line with our results [54]. A study by Karachaliou et al. reported an insufficient intake of dairy products among IBD patients. Also, the authors showed a significantly lower intake of dairy products in patients with active IBD compared to those in remission. As for grain foods, the authors reported a sufficient intake in IBD patients. However, they noted a very low intake of whole-grain cereal products compared to those made from refined flour. Additionally, a significantly lower consumption of these foods was noted in patients with active IBD compared to those in remission [49]. Similarly, a study by Opstelten et al. found a significantly lower intake of dairy products among IBD patients compared to healthy individuals. Additionally, the study also showed a reduction in the intake of whole-grain cereal products, vegetables and fruit in these patients as compared to individuals without IBD [59]. In contrast, in a study by Xu et al., the authors noted no differences in the consumption of milk and dairy products between IBD patients and healthy people. The intake of whole-grain cereal products, vegetables and fruit was also similar for IBD patients and healthy subjects [60].

In our study, the IBD patients restricted all food groups except meat and poultry. This is consistent with data on protein intake, which was adequate in this group. Of the other food groups, dairy, whole-grain cereal products, vegetables, and fruit were restricted to the greatest extent. The consequences of food elimination are nutrient deficiencies, such as calcium and dietary fiber, as demonstrated in our study.

In the following section, we examined the compliance of IBD patients' dietary preferences with the recommendations of the Mediterranean diet. According to the ESPEN guidelines, the Mediterranean diet model, which includes consumption of fruit, vegetables, whole-grain cereal products, legumes and nuts, and a reduction in saturated fatty acids of animal origin and sugars, is recommended for IBD patients, particularly those in remission [27]. For this reason, our study assessed the patients' dietary compliance with the recommendations of the Mediterranean diet, particularly since this is also the dietary model promoted by international guidelines for the general population as well [47,61]. In our study, based on the MedDietScore, we showed moderate adherence to the Mediterranean diet recommendations among the IBD patients. We observed a significantly lower rate in the patient group compared to the healthy subjects. Additionally, the MedDietScore was significantly lower in patients with active IBD compared to those in clinical remission. In a study by Karachaliaou et al., patients with IBD were characterized by moderate adherence to the Mediterranean diet, and the MedDietScore was significantly higher among patients in remission [49]. Adherence to the Mediterranean pattern was also assessed in a study by Marsh et al., which focused on eating behaviors among patients with IBD. It showed a low adherence to the recommendations of the Mediterranean diet [62]. Similarly, a study by Taylor et al. conducted in a group of patients with CD also demonstrated non-adherence to the Mediterranean dietary model. Patients mainly abstained from the consumption of fresh fruit, vegetables and dry pulses [63]. A study by Vrojdak et al. assessed adherence to the Mediterranean diet recommendations with the use of the Mediterranean Diet Service Score. It showed insufficient adherence to these guidelines in the majority of IBD patients. They most frequently gave up olive oil, vegetables and fruit [39].

The reluctance to consume fruit, vegetables and legumes observed in patients with IBD, caused by the fear of symptom exacerbation and the hope of sustaining remission, contributes to nutritional deficiencies, as shown in studies [64–67]. This undoubtedly has an impact on the shift away from the Mediterranean pattern observed over the past decade or so, even in the Mediterranean populations. It is related to the general westernization of life, as reported in many studies [68–70]. Therefore, nutritional education and dietary counseling should be implemented among IBD patients, according to the current guidelines.

Considering the persistent inflammation in IBD patients, and thus the increased risk of cardiovascular disease (CVD), our study assessed adherence to dietary guidelines in primary CVD prevention. We demonstrated insufficient adherence to the ESC dietary recommendations in IBD patients. Similar data have been obtained in other works which indicate that the elements of the so-called Western diet play a large part in the dietary preferences of IBD patients. A study by Karachaliaou et al. assessed the implementation of the ESC recommendations in a group of CD patients. The authors of the study reported implementation of these guidelines at a moderate level, which is similar to the results obtained in our own study [49]. A study by Fu et al. examined the association between adherence to dietary recommendations for the prevention of cardiovascular diseases and the risk of IBD. The authors of the study showed a lower risk of IBD in those who followed the ESC dietary recommendations [71].

An important part of the discussion on chronic inflammation and CVD risk is the impact of anti-inflammatory treatment, which probably provides better control and reduces the risk of cardiovascular incidents in IBD patients. A study by Paschou et al. observed a decrease in insulin levels and HOMA-IR in IBD patients after six months of biological treatment [72]. These data suggest that clinical treatment of IBD, apart from reducing inflammation, promotes the control of CVD risk factors, thereby reducing the overall risk of cardiovascular incidents. These data, however, require further study.

Our study showed differences in standard energy, nutrient and food intake between healthy individuals and IBD patients. Our results clearly indicate that IBD patients implement food restrictions, both during exacerbations of disease symptoms and in remission. The most commonly eliminated foods were milk and dairy products, as well as high-fiber foods such as whole-grain bakery products, vegetables and fruit. The consequence of these dietary behaviors is an insufficient intake of energy, nutrients and dietary fiber, as confirmed in our study. Additionally, poor adherence to Mediterranean dietary recommendations, as well as recommendations for CVD prevention, is part of a dietary pattern that contributes to increased inflammation, which, in the case of IBD patients, worsens prognosis and hinders treatment success.

Our study has some limitations. It is a single-center study that was conducted in a relatively small group of patients. Data on food intake and food preferences were collected only once. For this reason, they did not allow for differences resulting from the variability of seasons and access to selected products and could not assess the effect of disease stage on intake in each patient. The study was based on questionaries and the mean value of nutrients and vitamins was calculated based on questionaries, not measured parameters, e.g., in blood or urine.

5. Conclusions

Our study showed an inadequate intake of energy and most nutrients and fiber in IBD patients. Disease activity was a parameter that affected the quality and quantity of intake, but even during the remission period, the subjects' diets did not meet the dietary recommendations. Additionally, inadequate adherence to the Mediterranean diet and dietary recommendations for CVD prevention exposes this population to the risk of other diseases.

The conducted study indicates the need for routine assessment of dietary intake and nutrition among IBD patients, as well as potential dietary interventions aimed at improving the energy and nutritional quality of diet in order to optimize treatment outcomes and prevent the development of accompanying diseases.

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