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Scientific Research

Factors Associated with Low Intake of Dietary Fiber in Inflammatory Bowel Disease Patients

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Abstract

Inflammatory bowel disease patients reduce their intake of foods rich in dietary fibers in an attempt to prevent recurrence of the disease, predisposing these patients to nutritional losses. The aim of this study was to evaluate the intake of dietary fiber and associated factors in a group of patients with inflammatory bowel disease. This was a cross-sectional study with 61 inflammatory bowel disease patients, and all participants were outpatients in Salvador, Bahia. Patients completed a semi-structured questionnaire that included questions about demographics, socioeconomic status and anthropometric and clinical information and a food frequency questionnaire to assess the intake of dietary fiber. The mean intake of dietary fiber was 28.2 ± 14.8 g/day for inflammatory bowel disease patients, 27.9 ± 10.1 g/day for ulcerative colitis (UC) patients and 28.9 ± 21.1 g/days for those with Crohn's disease (CD) ($p > 0.05$). Most inflammatory bowel disease patients (52.5%) had intake below that recommended for dietary fiber. Inadequate consumption was present in 56.3% of CD patients and 43.8% of those with UC ($p = 0.28$). Men had lower fiber intake than women ($p = 0.04$). No significant associations between fiber intake and disease activity, location, presence of complications, gastrointestinal complaints, and nutrition counseling were found ($p > 0.05$). The low intake of dietary fiber was present in most patients, and the greatest inadequacy was found in males. Insufficient intake of dietary fiber appears to be linked to demographic features and not necessarily clinical characteristics relevant to inflammatory bowel disease.

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Keywords

Inflammatory Bowel Disease, Dietary Fiber, Eating

1. Introduction

Inflammatory bowel disease (IBD) is a general term for a group of chronic inflammatory diseases involving the gastrointestinal tract and often refers to ulcerative colitis (UC) and Crohn's disease (CD) [1]. IBD has been a major problem in the gastroenterological westernized world [2].

IBD patients often worry about the foods that can trigger or exacerbate gastrointestinal symptoms (anorexia, nausea, vomiting, diarrhea, abdominal pain and distension), and they restrict their diet in an attempt to control symptoms or to prevent disease recurrence [3]. Fruits and vegetables are the most restricted foods by both CD and UC patients [4]-[8].

Some specific types of carbohydrates and fermentable fibers commonly found in some fruits and vegetables have been related to the onset or exacerbation of symptoms, such as pain, bloating and watery diarrhea, in patients with controlled IBD [9]. However, reducing the consumption of these foods involves reducing nutrient intake, dietary fiber, and antioxidants, predisposing individuals to nutritional loss [10]. In addition, diets low in dietary fiber may limit the synthesis of short chain fatty acids (SCFA), which are major fuels for colonocytes.

The aim of this study was to evaluate the intake of dietary fiber and associated factors in a group of IBD outpatients.

2. Materials & Methods

2.1. Patients and Study Design

This was a cross-sectional study with patients receiving care at Nutrition and Gastroenterology Outpatient at a university hospital, which is a reference center for specialized care for IBD patient in the State of Bahia. The eligibility criteria for the study were a clinical, endoscopic, radiological and/or histological diagnosis of IBD [11], age more than 18 years, of both sexes. The exclusion criteria were pregnancy, previous gastrointestinal surgery, other inflammatory bowel diseases (colon diverticular disease of, hemorrhoids, irritable bowel syndrome) and limitations of neuromotor order.

The total of 65 IBD patients was recruited from September 2011 to March 2012. However, two patients were excluded because they presented with hemorrhoidal disease, and two were excluded for diverticular disease of the colon, resulting in a final sample of 61 patients.

2.2. Evaluation Socio-Demographic and Clinical

Demographic and socioeconomic data were collected by semi-structured questionnaire, which included questions about gender, age, level of education and income. Age was organized into quartiles, and income data were divided into tertiles of per capita family income and coded as ≤1, between 1.1 and 3.5 and >3.5 times the minimum salary for the region. The number of years of education was grouped into <1 year, 1 - 8 years, 9 - 11 years and >12 years.

The disease activity index proposed by Harvey & Bradshaw was used to determine the inflammatory activity in CD, and if the value was below 5 index points, the disease was considered in remission. If the value was equal to or greater than 5, the disease was considered active [12]. The index created by Lichtiger was used for CU, and clinical remission was defined as a score less than 10 points, while active disease was considered a score greater than or equal to 10 points [13].

The patients were questioned about the presence of gastrointestinal symptoms (diarrhea, nausea, vomiting, bloating and/or abdominal pain, bleeding in the stool). Information concerning the time of diagnosis, disease location or extent of intestinal involvement, presence of complications (fistula and fissure), and other associated diagnoses and medications were obtained from medical records. Data regarding disease location or extent of intestinal involvement were in accordance with the classification system of Montreal [14]. All patients reported regular use of prescribed medications.

2.3. Anthropometric Assessment

Anthropometric measurements were taken in duplicate by trained and qualified professionals. Weight (kg) and height (cm) were measured with light clothing and without shoes using a scale with a coupled stadiometer from Filizola. The scale had a capacity of 150 kg and a resolution of 100 g, and the stadiometer measured in 0.5 cm increments. The body mass index (BMI) was calculated from weight and height using the following formula: weight (kg)/height^2 (m^2). BMI cut points were used for classifying the anthropometric status. Different cut points were used for adults [15] and elderly adults [16].

2.4. Evaluation of Dietary Fiber Intake

To assess the daily intake of dietary fiber, patients answered a Quantitative Food Frequency Questionnaire (QFFQ). This QFFQ was validated for use in intervention studies and chronic disease prevention programs [17]. The QFFQ was administered in combination with a photo album of foods for more reliable data. The questionnaire contained 103 food items, food groups, beverages and supplements commonly consumed by the Brazilian population.

Daily dietary fiber intake (in grams) was calculated using the DietWin Personal program version 1.0 (DietWin, Porto Alegre, RS, Brazil). The established Adequate Intake (AI) values for fiber were used to examine the adequacy of fiber intake. For people between 19 and 50 years of age, the values were 38 g/day for men and 25 g/day for women. For people over 51 years old, the values were 30 g/day for men and 21 g/day for women [18].

Patients were also assessed for previous nutritional counseling and the use of dietary supplements. Any supplementation of dietary fiber reported by patients was not accounted for in calculations of fiber intake.

2.5. Statistical Analysis

For the descriptive analyses, we calculated the means with standard deviations (mean ± SD) for the continuous variables and the absolute and relative frequencies for the categorical variables. The chi-square test or Fisher's exact test was used to determine the strength of the association between two categorical variables. SPSS 17.0 software (SPSS, Chicago, IL, United States) was used for the statistical analyses. Statistical significance was set at $p < 0.05$.

2.6. Ethical Considerations

The study protocol was approved by the Ethics Committee in Research of the Complex Professor, Edgar Santos Hospital, Federal University of Bahia, under protocol number 50/11. All patients were informed about the study objectives and signed a Free and Informed Consent.

3. Results

Of the 61 IBD patients evaluated, 39 had UC and 22 had CD. The mean time to diagnosis was 7.0 ± 4.3 years for UC patients and 6.7 ± 3.1 years for CD. The disease was active in 7.7% of UC patients and 18.2% of those with CD ($p = 0.24$). Ulcerative proctitis (51.3%) was the most frequent location of the disease in UC and colonic was the most frequent location in CD (40.9%). The prevalence of normal weight patients, according to BMI, was independent of clinical diagnosis. Overweight patients accounted for 30.0% of IBD patients, while 22.7% of those with CD and 7.9% of those with UC were obese. Complications of the disease were more frequent in CD patients than in those with UC (27.3% and 5.1%, respectively, $p = 0.02$), but gastrointestinal complaints were similar in both groups (46.2% in UC and in CD 68.2%, $p = 0.09$) (**Table 1**).

3.1. Demographic and Socioeconomic Characteristics

In both diseases, UC and CD, there was a predominance of females, 61.5% and 54.4%, respectively. The mean age of CD patients was 39.9 ± 9.7 years and 46.1 ± 13.8 years in those with UC, $p = 0.07$. Most of the UC patients (51.3%) had a per capita income between 1.1 and 3.5 times the minimum salary, and those with CD (42.9%) were more likely to have greater than 3.5 times the minimum salary, $p = 0.36$. It was noted that most patients, 59.0% and 59.1% for UC and for CD, respectively, had 9 - 11 years of schooling (**Table 1**).

Table 1. Description of the demographic, socio-demographic, anthropometric and clinical characteristics of the Crohn disease and ulcerative colitis patients.

Variables	UC (n = 39)	CD (n = 22)	IBD (n = 61)	p
Gender n (%)				
Male	15 (38.5)	10 (45.5)	25 (41.0)	0.59
Female	24 (61.5)	12 (54.4)	36 (59.0)	
Age (years) mean ± SD	46.1 ± 13.8	39.9 ± 9.7	43.8 ± 12.8	0.07
Schooling n (%)				
<1 years	00 (0.0)	01 (4.5)	01 (1.6)	0.23
1 - 8 years	11 (28.2)	03 (13.6)	14 (23.0)	
9 - 11 years	23 (59.0)	13 (59.1)	36 (59.0)	
≥12 years	05 (12.8)	05 (22.7)	10 (16.4)	
Income n (%)		*	*	
1˚ tercil (≤1 MS)	10 (25.6)	05 (23.8)	15 (25.0)	0.25
2˚ tercil (1.1 - 3.5 MS)	20 (51.3)	07 (33.3)	27 (45.0)	
3˚ tercil (>3.5 MS)	09 (23.1)	09 (42.9)	18 (30.0)	
BMI classification n (%)				
Underweight	04 (10.5)	03 (13.6)	07 (11.7)	0.37
Normal	24 (63.2)	11 (50,0)	35 (58.3)	
Overweight	07 (18.4)	03 (13.6)	10 (16.7)	
Obesity	03 (7.9)	05 (22.7)	08 (13.3)	
Disease duration (years) mean ± SD	7.2 ± 4.8	6.7 ± 3.1	7.0 ± 4.2	0.62
Location of disease n (%)				
Terminal ileum	-	05 (22.7)	-	-
Colon	-	09 (40.9)	-	
Ileocolon	-	08 (36.4)	-	
Upper GI		00 (0.0)	-	
Extent of disease n (%)				
Distal	20 (51.3)	-	-	-
Left-sided	08 (20.5)	-	-	
Extensive	11 (28.2)	-	-	
Disease activity n (%)				
Activity	03 (7.7)	04 (18.2)	07 (11.5)	0.24
Remission	36 (92.3)	18 (81.8)	54 (88.5)	
Complications of disease n (%)				
Yes	02 (5.1)	06 (27.3)	08 (13.1)	0.02
No	37 (94.9)	16 (72.7)	53 (86.9)	
Gastrointestinal symptoms n (%)				
Yes	18 (46.2)	15 (68.2)	33 (54.1)	0.09
No	21 (53.8)	07 (31.8)	28 (45.9)	

MS = Minimum Salaries; BMI = Body Mass Index; *CD (n = 21) e IBD (n = 60), 01 loss.

3.2. Intake of Dietary Fiber and Demographic and Socioeconomic Characteristics

The inadequate intake of fiber was higher in men (53.1%) than women (46.9%) (p = 0.04). No associations between low fiber intake and age, per capita income or study time were observed (p = 0.18, p = 0.17 and p = 0.36, respectively) (**Table 2**).

3.3. Intake of Dietary Fiber

The mean intake of dietary fiber was 28.2 ± 14.8 g/day for all IBD patients, 27.9 ± 10.1 g/day for UC patients and 28.9 ± 21.1 g/day for those with CD. Most of the IBD patients (52.5%) had intake below the AI values. There was no association between restricting food sources of dietary fiber and counseling with a nutritionist, p = 0.68 (data not shown in table). Inadequate consumption of fiber was present in 56.3% of CD patients and 43.8% of those with UC (p = 0.28) (**Table 3**).

Only one patient reported the use of supplemental dietary fiber.

3.4. Intake of Dietary Fiber and Clinical Characteristics

No associations between inadequate intake of dietary fiber and disease activity, location, presence of complications, or gastrointestinal complaints were observed (p > 0.05) (**Table 3**).

4. Discussion

In this study, the majority of patients consumed less fiber than the recommended amounts. These findings are consistent with studies that have shown an insufficient intake of dietary fiber in IBD patients [3] [6] [7] [19] [20]. Although a possible explanation for this result is the association that patients make between food sources of

Table 2. Adequacy of intake of dietary fiber according to demographic and socioeconomic aspects in inflammatory bowel disease patients (n = 61).

	Intake of dietary fiber		
Demographic and socioeconomic aspects	Adequate n (%)	Inadequate n (%)	p
Gender			
Male	08 (27.6)	17 (53.1)	0.04
Female	21 (72.4)	15 (46.9)	
Age (years)			
20 - 35	06 (20.7)	13 (40.6)	0.18
36 - 44	05 (17.2)	08 (25.0)	
45 - 54	10 (34.5)	06 (18.8)	
55 - 74	08 (27.6)	05 (15.6)	
Income		*	
1˚ tercil (≤1 MS)	04 (13.8)	11 (35.5)	0.17
2˚ tercil (1.1 - 3.5 MS)	15 (51.7)	12 (38.7)	
3˚ tercil (>3.5 MS)	10 (34.5)	08 (25.8)	
Schooling			
<1 year	0 (0.0)	01 (3.1)	0.36
1 - 8 years	06 (20.7)	08 (25.0)	
9 - 11 years	20 (69.0)	16 (50.0)	
≥12 years	03 (10.3)	07 (21.9)	

MS = Minimum Salaries; *n = 60 (01 loss).

Table 3. Adequacy in fiber intake according to diagnosis and clinical features in inflammatory bowel disease patients (n = 61).

	Intake of dietary fiber		
Clinical aspects	Adequate n (%)	Inadequate n (%)	p
Clinical diagnosis			
Ulcerative colitis	21 (72.4)	18 (56.3)	0.28
Crohn's disease	08 (27.6)	14 (43.8)	
Disease activity			
Activity	01 (3.4)	06 (18.8)	0.10
Remission	28 (96.6)	26 (81.3)	
Extent/location of disease ulcerative colitis			
Distal	13 (61.9)	07 (38.9)	0.14
Left-sided	05 (23.8)	03 (16.7)	
Extensive	03 (14.3)	08 (44.4)	
Crohn's disease			
Terminal ileum	02 (25.0)	03 (21.4)	
Colon	03 (37.5)	06 (42.9)	1.00
Ileocolon	03 (37.5)	05 (35.7)	
Upper GI	00 (0.0)	00 (0.0)	
Complications of disease			
Fissure			
Yes	02 (6.9)	01 (3.1)	0.60
No	27 (93.1)	31 (96.9)	
Fistula*			
Yes	01 (12.5)	04 (28.6)	0.61
No	07 (87.5)	10 (71.4)	
Gastrointestinal symptoms			
Bleeding			
Yes	05 (17.2)	03 (9.4)	0.46
No	24 (82.8)	29 (90.6)	
Abdominal pain			
Yes	04 (13.8)	09 (28.1)	0.22
No	25 (86.2)	23 (71.9)	
Nausea			
Yes	02 (6.9)	06 (18.8)	0.26
No	27 (93.1)	26 (81.3)	
Vomiting			
Yes	01 (3.4)	02 (6.3)	1.00
No	28 (96.6)	30 (93.8)	
Diarrhea			
Yes	03 (10.3)	07 (21.9)	0.31
No	26 (89.7)	25 (78.1)	
Bloating			
Yes	10 (34.5)	10 (31.3)	0.78
No	19 (65.5)	22 (68.8)	

*Applicable only for Crohn's disease patients.

fiber with the onset or exacerbation of symptoms, we found no association with clinical characteristics. We only found one association with gender.

Low fiber intake is a common condition in developing countries, and the Brazilian population is no exception [21]. The World Health Organization (WHO) and the Food and Agriculture Organization (FAO) published results on this issue, revealing that only 5% - 25% of the population follow the current guidelines on dietary fiber intake [22]. Although there is some evidence, epidemiological studies are on the presence of an association between lower intake of dietary fiber and low family income, low education level and younger age [23]-[26]. In this study, we also did not observe these associations. Men had lower fiber intake, which agrees with the study by Figueiredo *et al.* (2008) [23]. It appears that male subjects are less concerned about health and body image and therefore consume fewer fruits and vegetables than women consume.

Dietary fibers are among the dietary components that exert a protective effect on predisposition for IBD and colon cancer [27]. One of the mechanisms that supports the association between fiber intake and the risk of these diseases is the production of butyrate as a result of bacterial fermentation of fibers in the colon. This and other short chain fatty acids have received considerable attention due to their possible influence on the inflammatory response. Experimental studies suggest that butyrate, for example, is able to downregulate the production of pro-inflammatory cytokines and activate nuclear factor kappa B (NF-κB) [28] [29]. Furthermore, fiber plays a key role in maintaining intestinal barrier function and gut microbiome balance [30]. Hallert *et al.* (1991) concluded that supplementation with Plantago ovata (PO) resulted in fewer gastrointestinal symptoms in IBD patients [31]. In another study, supplementation with PO proved effective in preventing relapses during drug therapy [32].

However, some studies found a relationship between a group of carbohydrates and fermentable fibers called FODMAPs (*Fermentable Oligo-saccharides*, *Di-saccharides*, *Mono-saccharides And Polyols*), which are found in some vegetables and fiber supplements, and the onset of the symptoms in IBD patients in remission. The hypothesis is that these fibers would be rapidly fermented, favoring bacterial overgrowth and excess gas production, resulting in bloating, abdominal pain and watery stools [9]. According to Richman & Rhodes (2013), a diet low in FODMAPs would be useful in IBD patients who have persistent symptoms despite using conventional treatments for IBD activity [33]. However, the role of dietary components in the pathogenesis of IBD remains unclear, and there is little evidence for the effectiveness of restricting FODMAPs or consuming a low-fiber diet in IBD patients [34].

Although no association was found between the restriction of dietary fiber sources and counseling with a nutritionist, the recommendations of health professionals may also justify the dietary restrictions of fibers in IBD patients. These recommendations may be justified because many diets prescribe low residue foods to minimize or prevent gastrointestinal symptoms and bacterial overgrowth in the active phase of the disease [8]. However, many patients maintain this restriction during periods of remission [3] [7] [19], which may contribute to the results reported here.

CD and CU are distinguished by the location and severity of the disease. It is known that CD patients may develop more severely. However, in this study, there were no significant differences in the relationship between fiber intake and the clinical characteristics of either disease. Furthermore, both forms of the disease profoundly affect the quality of life of patients and have been increasing in incidence and prevalence in recent years [35] [36].

Society's eating habits, the advice of health professionals to consume restrictive diets and the strong association that IBD patients make between the intake of fruits and vegetables and symptomatology are all important risk factors that can lead to inadequate food intake and, thus, nutritional deficiencies. The exclusion of these foods in the usual diet, besides reducing fiber intake, contributes to the low intake of micronutrients and antioxidants, such as folic acid [10]. Recent studies do not yet know to what extent these nutritional deficiencies may negatively influence disease progression. Therefore, investigations into the intake of each nutrient are important for clinical practice to better guide the evaluation and treatment of these patients.

This study has some limitations, such as sample size, absence of a control group, the fact that patients who agreed to participate in this type of study may have different eating habits, the lack of differentiation of the various sources of dietary fiber consumed, and the use of a food frequency questionnaire that is subject to memory bias and changing eating habits related to disease symptoms. These disadvantages make it necessary to conduct further longitudinal studies to examine the relationship between the intake of fiber from different sources and IBD.

5. Conclusion

IBD patients are a population at risk for protein-energy and micronutrient malnutrition. Insufficient consumption of dietary fiber in IBD patients was shown to be associated with population aspects and not necessarily relevant to clinical disease characteristics. It is necessary to increase patients' motivation to have healthy eating habits that include the adequate intake of fiber-rich foods and to assess each patient individually to avoid unnecessary dietary restrictions and greater injury to the health of these individuals.

Declared Conflict of Interest of All Authors

None.

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