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Nutritional Assessment in Patients with Inflammatory Bowel Disease

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ABSTRACT

Background: Several illnesses, including Crohn's disease and ulcerative colitis, share the clinical category of "inflammatory bowel disease," which is characterized by chronic inflammation of the gastrointestinal system. Symptoms of inflammatory bowel disease include colonic pain, diarrhea, bloody stool, and loss of appetite.

Aim of the Work: Our research tries to determine whether or not people with CD and UC are getting enough of certain nutrients by comparing their consumption to dietary guidelines, measuring their body composition, and looking at molecular markers of nutrition.

Materials and Methods: Ninety patients with inflammatory bowel disease (IBD), including Crohn's disease (CD), ulcerative colitis (UC), and indeterminate colitis (UD), were enrolled in this cross-sectional study at the IBD outpatient clinic in the Department of Internal Medicine at Ain Shams University Hospital. Patients filled questionnaires regarding their backgrounds, treatments, and diets.

Results: Our study showed that the majority of the chosen patients had normal body mass indexes, suggesting that malnutrition especially underweight is not widespread. There was an unfavorable ratio of essential fatty acids (FA) in our study groups compared to the most up-to-date recommendations. However, due to the widespread usage of margarine, the ratio of n-6 to n-3 fatty acids, linoleic acid (LA) to -linolenic acid (ALA), was significantly higher than the recommended 5:1.

Conclusion: Increases in IBD prevalence coincide with the "Westernization" of eating patterns in underdeveloped nations. Suboptimal energy intake, malabsorption, enteric nutrient loss, elevated basal energy expenditure, and medicines all contribute to IBD patients' impaired nutritional status.

Keywords: Nutritional assessment - Inflammatory bowel disease.

INTRODUCTION

Crohn's disease, ulcerative colitis, and other disorders are all included in the clinical category of inflammatory bowel disease (IBD), which is a chronic inflammatory illness of the gastrointestinal system. IBD is characterized by periods of abdominal pain, diarrhea, bloody stools, and weight loss, as well as the infiltration of neutrophils and macrophages that generate cytokines, proteolytic enzymes, and free radicals, all of which contribute to inflammation and ulceration of the intestinal mucosa [(1)].

Both men and women are equally at risk for developing IBD in early childhood, and it is a condition that lasts a lifetime once it sets in. Since the turn of the 21st century, IBD has been recognized as one of the most common gastrointestinal disorders, and its prevalence is expected to rise even further in newly industrialized countries, where it was already at an alarmingly high rate in the second half of the 20th century [(2)].

Some of the highest rates of inflammatory bowel disease (IBD) prevalence were found in Europe (ulcerative colitis, 505 cases per 100,000 people in the southeast of Norway; Crohn's disease, 322 cases per 100,000 people in Hesse, Germany) and North America (ulcerative colitis, 286.3 cases per 100,000 people in Olmsted County, USA; Crohn's disease, 318.5 cases per 100,000 people in Nova Scotia, Canada) [(2)]. It has been established that the incidence rate of IBD in Western countries has been steady or declining since 1990, whereas it has been rising in newly industrialized countries in Asia, Africa, and South America [(2)].

Although Crohn's disease most frequently affects the terminal ileum, cecum, peritoneum, and colon, it can manifest itself in any part of the intestine in a patchwork fashion. In contrast, ulcerative colitis is characterized by the involvement of the rectum and, in a continuous pattern, can affect all of the colon [(3)]. Inflammatory bowel disease (IBD) patients are more likely to become malnourished when their disease is actively progressing. Between 6 and 16 percent of people with IBD are malnourished, which is a risk factor 5-fold higher than in people without IBD [(4)].

Our research objectives were to determine whether or not people with CD and UC are getting enough of certain nutrients by comparing their consumption to dietary guidelines, measuring their body composition, and looking at molecular markers of nutrition.

PATIENTS AND METHODS

Patients and study design:

Patients with inflammatory bowel disease (IBD) were recruited from January 2020 to July 2020 in the outpatient clinic for IBD in the Department of Internal Medicine at the University Hospital of Ain Shams University. There were a total of 90 people with IBD (65 with UC, 22 with CD, and 3 with UD colitis).

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Patients with inflammatory bowel disease were all given questionnaires to fill out regarding their backgrounds, treatments, and diets. In addition, a self-administered food frequency questionnaire was used to document the dietary intake of all individuals in the study (FFQ).

Before being included in the study, all participants were given a thorough explanation of the study's aims and methods by a medical professional and obtained their written consent.

Status of disease:

For Crohn's disease, we used the Crohn's Disease Activity Index and the Simple Endoscopic Activity Index; for ulcerative colitis and indeterminate colitis , we used the True Love CC and Mayo Score; and for inflammatory bowel disease, we used C-reactive protein (CRP).

Assessment of diet:

A food frequency questionnaire (FFQ) was developed for use in evaluating dietary habits. Fats, amino acids, specialized carbohydrates, trace elements, vitamins, and dietary fibers are all part of the larger group of macronutrients. In addition, self-imposed dietary restrictions made over the past year were documented and organized by major food groups (Products from the dairy family, the produce section, the meat and meat product section, the bakery section, the deli section, the pasta and pastry section, the snack and candy section, and the beverage section) IBD patients' dietary intake was compared to the RDIs by using a scoring system based on their food consumption.

Nutritional status:

The nutritional status was calculated using the measured body weight (BW) and height (BH). Body mass index (BMI) was determined using the following formula: [kg/m²]=BW [kg]/(BH × BH [m²]). According to the World Health Organization's (WHO) body mass index (BMI) classification, an individual is underweight if their BMI is less than 18.5 kg/m2, normal weight if their BMI is between 18.5 kg/m2 and 25.0 kg/m2, and overweight (pre-obese) if their BMI is between 25.0 kg/m2 and 30.0 kg/m2, and obese if their BMI is greater than 30.0 kg/m2.

Ethical consent:

The research had prior permission from the Academic and Ethical Committee at Ain Shams University. All participants agreed to participate in the study after signing an informed written consent form. All procedures involving human participants in this study have been performed in conformity with the principles outlined in the World Medical Association's Declaration of Helsinki.

Statistical analysis

SPSS (Statistical Package for the Social Sciences) for Windows® version 22 was used for data coding, processing, and analysis (IBM SPSS Inc, Chicago, IL, USA). The Shapiro-Wilk test was used to check if the data followed a normal distribution. The qualitative information was shown in the form of frequencies and relative percentages. In order to determine the level of dissimilarity between two or more sets of qualitative data, the Chi-square test (2) is often used. Averages and standard deviations were used to summarize quantitative information (Standard deviation). Two sets of normally distributed data were compared using the independent samples t-test (parametric data). A significance level of 0.05 was used.

RESULTS

Table (1) showed that the majority of patients follow a nutritional program as 20 patients (22.2%) prefer a low-fat diet, 2 patients prefer high protein diet, 23 patients (25.5%) prefer to avoid dairy products and 5 patients (5.6%) follow diabetic food, while 37 patients (41%) do not follow any nutritional program.

Table (1): Nutritional program followed by the patients

Nutritional program	Total no. = 90
Low fat	20 (22.2%)
Low carb.	0 (0.0%)
High protein	2 (2.2%)
Low salt	3 (3.3%)
No gluten	0 (0.0%)
Vegetarian	0 (0.0%)
Diabetic	5 (5.6%)
No dairy	23 (25.5%)
No wheat	0 (0.0%)
Weight	0 (0.0%)
No	37 (41%)

Table (2) showed the regular meals eaten by the studied group and dinner was the most consumed meal 40 (44.4%) followed by lunch 30 (33.3%) followed by snacks meals 30 (33.3%).

Table (2) : Regular meals

Meals regular	Total no. = 90
Breakfast	0 (0.0%)
Lunch	30 (33.3%)
Dinner	40 (44.4%)
Snacks	20 (22.2%)

Table (3) showed beverage intake among the studied patients that shows that according to coffee intake 18 patients drink coffee daily, 32 patients weekly, and 16

patients drink coffee 2-3 times per month while the other patients never drink coffee.

All patients drink water daily with a variant amount that increases with activity. As for tea intake, it was found that 67 patients consumed tea daily, 19 patients consumed it every week, and 4 patients consumed it twice to three times a month.

As for soda intake, it was found that 41 patients consumed soda daily, 45 patients consumed it weekly, while 4 patients consumed it twice to three times a month. As for milk intake it was found that 15 patients consumed milk daily, 23 patients consumed it weekly, and 20 patients consumed it twice to three times a month while the other patients prefer to avoid milk intake. According to alcohol intake only one patient consume it once to twice per month while the other never.

Table (3): Beverage intake

Beverage intake		**Total no. = 90**
Coffee	Never	24 (26.7%)
	Daily	18 (20.0%)
	Weekly	32 (35.6%)
	Monthly	16 (17.8%)
Water	Never	0 (0.0%)
	Daily	90 (100.0%)
	Weekly	0 (0.0%)
	Monthly	0 (0.0%)
Tea	Never	0 (0.0%)
	Daily	67 (74.4%)
	Weekly	19 (21.1%)
	Monthly	4 (4.4%)
Soda	Never	0 (0.0%)
	Daily	41 (45.6%)
	Weekly	45 (50.0%)
	Monthly	4 (4.4%)
Milk	Never	32 (35.6%)
	Daily	15 (16.7%)
	Weekly	23 (25.6%)
	Monthly	20 (22.2%)
Alcohol	Never	89 (98.9%)
	Daily	1 (1.1%)
	Weekly	0 (0.0%)
	Monthly	0 (0.0%)

Table (4): shows the frequency of food intake such as fast food, frozen meals, home-cooked meals, leftovers, beef intake, fish type, fresh vegetables, cooked vege tables, fruit intake, margarine intake, dairy products, French fries with high intake of margarine food, French fried and limitation of milk products.

Table (4): Food intake

Total no. = 90		
Fast food	Never	19 (21.1%)
	2-3 per month	42 (46.7%)
	One per week	24 (26.7%)
	2-3 per week	5 (5.6%)
Frozen meals	Never	46 (51.1%)
	2-3 per month	40 (44.4%)
	One per week	4 (4.4%)
Home-cooked meals	One per week	7 (7.8%)
	2-3 per week	22 (24.4%)
	One per day	48 (53.3%)
	2-3 per day	13 (14.4%)
Leftovers	Never	49 (54.4%)
	2-3 per month	19 (21.1%)
	One per week	18 (20.0%)
	2-3 per week	4 (4.4%)
Total no. = 90		
Beef (hamburger, steak, etc.)	2-3 per month	35 (38.9%)
	One per week	47 (52.2%)
	2-3 per week	8 (8.9%)
Fish, type:	Never	1 (1.1%)
	2-3 per month	32 (36.0%)
	One per week	53 (59.6%)
	2-3 per week	3 (3.4%)
Total no. = 90		
Fresh/Raw vegetables	Never	3 (3.3%)
	2-3 per month	3 (3.3%)
	One per week	44 (48.9%)
	2-3 per week	37 (41.1%)
	One per day	3 (3.3%)
Cooked vegetables	2-3 per month	2 (2.2%)
	One per week	38 (42.2%)
	2-3 per week	49 (54.4%)
	One per day	1 (1.1%)
Fruit, fresh or frozen	2-3 per month	1 (1.1%)
	One per week	24 (26.7%)
	2-3 per week	43 (47.8%)
	One per day	22 (24.4%)
Margarine	Never	9 (10.0%)
	2-3 per month	1 (1.1%)
	One per week	24 (26.7%)
	2-3 per week	56 (62.2%)
Dairy (Milk, yogurt, cheese, butter)	Never	30 (33.3%)
	2-3 per month	36 (40.0%)
	One per week	11 (12.2%)
	2-3 per week	11 (12.2%)
	One per day	2 (2.2%)
French fries	Never	2 (2.2%)
	2-3 per month	7 (7.8%)
	One per week	31 (34.4%)
	2-3 per week	49 (54.4%)
	One per day	1 (1.1%)
FCS	Mean ± SD	53.31 ± 19.22
	Range	30 – 92.5

Table (5): showed the anthropometric measures among the studied patients, height in cm was ranging from 140-178, weight in Kg was ranging from 38-87, BMI was ranging from 15-32, Mid arm circumference in cm was ranging from 2-19.TSC in mm with a range of 1.9-27 and pulse rate with a range of 75-98.

Table (5): Anthropometric measures

Total no. = 90		
Height cm	Mean ± SD	164.02 ± 7.58
	Range	140 – 178
Weight kg	Mean ± SD	60.84 ± 11.36
	Range	38 – 87
BMI	Mean ± SD	21.53 ± 4.73
	Range	1 – 32
MAC in cm	Mean ± SD	12.01 ± 3.11
	Range	2 – 19
TSC in mm	Mean ± SD	16.67 ± 4.92
	Range	1.9 – 27
Pulse	Mean ± SD	86.32 ± 6.80
	Range	75 – 98

Table 6 showed the laboratory results of the patients. HB in grames with Mean ± SD 9.98 ± 1.27. MCV with Mean ± SD 74.83 ± 4.97. WBCs (1000) with Mean ± SD 8.54 ± 2.10. Platelets (1000) Mean ± SD 348.38 ± 76.55. INR with Mean ± SD 1.07 ± 0.09. CRP with Mean ± SD 15 ± 3.12. ESR with Mean ± SD 22.5 ± 5.32. Total protein with Mean ± SD 5.96 ± 0.49.

Albumin with Mean ± SD 3.29 ± 0.45. Random blood sugar with Mean ± SD 98.38 ± 23.13. BUN with Mean ± SD 14.40 ± 3.42. Serum creatinine with Mean ± SD 0.92 ± 0.19. Na level with Mean ± SD 136.44 ± 2.53. K level with Mean ± SD 3.67 ± 0.25. Mg level with Mean ± SD 1.80 ± 0.19. Calcium level with Mean ± SD 8.69 ± 0.21. Phosphorus level with Mean ± SD 1.97 ± 0.33. Fecal calprotectin level with Mean ± SD 420.80 ± 101.32.

Table (6): Laboratory results

Total no. = 90		
HB in grams (g/dl)	Mean ± SD	9.98 ± 1.27
MCV (µm^3)	Mean ± SD	74.83 ± 4.97
WBCS x 1000 (cells/µL)	Mean ± SD	8.54 ± 2.10
PLT x1000 (mcL)	Mean ± SD	348.38 ± 76.55
INR	Mean ± SD	1.07 ± 0.09
CRP (mg/L)	Mean ± SD	15 ± 3.12
ESR (mm/hr)	Mean ± SD	22.5 ± 5.32
Total Protein (g/dL)	Mean ± SD	5.96 ± 0.49
Albumin (g/dL)	Mean ± SD	3.29 ± 0.45
RBS (mg/dL)	Mean ± SD	98.38 ± 23.13
BUN (mg/dL)	Mean ± SD	14.40 ± 3.42
S. creatinine (mg/dL)	Mean ± SD	0.92 ± 0.19
Na (mmol/l)	Mean ± SD	136.44 ± 2.53
K (mEq/L)	Mean ± SD	3.67 ± 0.25
Mg (mg/dL)	Mean ± SD	1.80 ± 0.19
Ca (mg/dL)	Mean ± SD	8.69 ± 0.21
Ph	Mean ± SD	1.97 ± 0.33
Fecal calprotectin	Mean ± SD	420.80 ± 101.32

DISCUSSION

Inflammatory bowel disease (IBD) is on the rise around the world, and this trend coincides with the "Westernization" of eating patterns in underdeveloped regions. Thus, it is clear that environmental factors, particularly nutrition, have a significant role in the onset of inflammatory bowel disease (IBD), in addition to a hereditary predisposition [(2)].

Although the precise pathomechanism by which nutrition promotes the development of IBD remains unknown, the primary mechanistic theory stand out as particularly important and should be highlighted here. The gut microbiota composition is strongly influenced by one's food, and dietary shifts throughout formative years or later in life might favor either an anti- or proinflammatory microbiome [(5)].

Our research objectives were to determine whether or not people with CD and UC are getting enough of certain nutrients by comparing their consumption to dietary guidelines, measuring their body composition, and looking at molecular markers of nutrition.t

Previous studies have reported that as many as 85% of patients with IBD are malnourished, yet our patients all had normal body mass indexes. Patients with inflammatory bowel disease are more likely to be overweight or obese now than in the past, likely as a result of better therapy options and prolonged remission status [(6)].

Some 23% of those with IBD in our study reported modifying their diet due to gastrointestinal symptoms. A recent study by **Vidarsdottir *et al.*** [(7)] found that 87% of individuals with inflammatory bowel disease were convinced that food impacts their gastrointestinal system; 72% of these patients adjusted their diet while dealing with the disease.

Patients with inflammatory bowel disease (IBD) have been the focus of multiple studies examining their eating habits and food limitations. Consistent with the Cohen study, people avoided eating foods like leafy or non-leafy vegetables, fruits, dairy, alcohol, red meat, and fast food [(8)].

The majority of our IBD patients (46.7%), along with roughly 21.1% of the general population, have reported cutting back on their intake of fast food. Forty to forty-four percent of people with inflammatory bowel disease (IBD) report that eating deep-fried or high-fat foods makes their symptoms worse [(9)].

There is no significant avoidance of fruits and in our study that did not match with other studies like **Cohen *et al.*** [8] which stated that there is a high fruits restriction rate in their IBD patients whom often attribute their symptoms to the fruits and vegetables they eat.

Also, **Zallot *et al.*** [11] stated that eight percent to seventy-one percent of people with IBS avoided uncooked fruits and vegetables.

In agreement to a study by **Schink *et al.*** [10], we found that the overall nutrient intake was higher in carbohydrates and lower in fat**.** Also **Zopf *et al.*** [11] revealed that all IBD patients had considerably consumed larger absolute amounts of carbs, which is consistent with the findings of an earlier investigation. Our IBD patients have a surprisingly increased consumption of sugar, especially mono- and disaccharides. In the past, this phenomenon had already been noticed [12].

This is consistent with data from a Canadian cohort that found those with active CD or UC drank more beverages sweetened with simple sugars than those without the condition [13].

In comparison to other studies that have documented milk and dairy product avoidance in up to 65% of individuals with IBD, our study found that only 32% do so and that 22% to 40% restrict themselves from doing so [14].

People with inflammatory bowel disease are at risk for nutritional deficiencies and related disorders, such as osteoporosis, if they avoid dairy products, which are high in calcium and Vitamin D [15].

In addition, when comparing our study groups to the most recent recommendations, we found an unfavorable ratio of essential fatty acids (FA). Due to the widespread use of margarine, which is in agreement with the findings of **Simopoulos's** [16] study, the ratio of n-6 to n-3 fatty acids, linoleic acid (LA) to -linolenic acid (ALA), was significantly higher than the recommended 5:1 [16].

There is a correlation between the imbalanced ratio of these two fatty acids and the development of cardiovascular disease, cancer, inflammatory and autoimmune disorders, all of which are hallmarks of the Western diet [16].

A high intake of n-6 fatty acids is related to an increased risk of developing ulcerative colitis, and a diet high in LA, as a precursor of arachidonic acid, is connected with an increased risk of developing inflammatory bowel disease [17].

However, the benefit for IBD patients is still uncertain, despite the anti-inflammatory activities and protective qualities of n-3 fatty acids such as ALA from plant sources or eicosatetraenoic acid (EPA) and docosahexaenoic acid (DHA) from animal sources[18].

However, to achieve a more desirable fatty acid ratio, patients should be urged to lower their intake of n-6-fatty acid-rich foods and increase their intake of n-3-fatty acid-enriched foods, such as plant oils and fatty fish. According to the results of this investigation, microcytic hypochromic anemia may be the most common type of anemia among patients. 30%-90% of IBD patients with anemia had low iron levels [19].

CONCLUSION

Inflammatory bowel disease (IBD) is on the rise around the world, and this trend coincides with the "Westernization" of eating patterns in underdeveloped regions. Thus, it is clear that environmental factors, particularly nutrition, have a significant role in the onset of inflammatory bowel disease (IBD), in addition to a hereditary predisposition.

There is no single cause for dietary deficiency in inflammatory bowel disease patients. Major causes include insufficient food consumption, poor digestion, excessive nutrient loss through the digestive tract, elevated basal metabolic rate, and drug use.

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