

Malnutrition among Patients with Inflammatory Bowel Disease in Specialized Center in Egypt

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ABSTRACT

Background: Inflammatory bowel disease (IBD) is a long-term, relapsing disorder characterized by inflammation of gastrointestinal tract. Malnutrition affects up to 38% of those in remission and up to 70% of individuals with active IBD, which is quite common in this condition.

Objectives: This study aimed to evaluate nutritional deficiencies in IBD cases.

Patients and methods: This prospective cohort study comprised 90 Egyptian patients IBD, encompassing both ulcerative colitis (UC) and Crohn's disease (CD) recruited from Endemic Medicine Department, Helwan University from October 2023 to July 2024. Each patient was subjected to history taking, physical examination (Height, weight, body mass index), and laboratory investigations (Serum electrolytes, minerals, albumin, total protein) during activity and remission.

Results: The mean actual body weight showed a significant increase during remission ($P < 0.001$) in each group. The median of all serum electrolytes was significantly elevated during remission except for K and P in the CD group. The median vitamin D level showed a weak significant decrease in the CD group (19 ng/mL vs. 13 ng/mL, $P = 0.049$). All types of anemias can be found in IBD patients, with the predominance of microcytic type during activity (70.8% in the UC group and 64% in the CD group). Total protein and serum albumin were significantly increased during remission within each group.

Conclusion: All types of anemias can be found in IBD patients during activity or remission, micronutrient deficiencies are predominant during activity in both groups, and total protein and serum albumin were significantly increased during remission.

Keywords: Inflammatory bowel disease, Malnutrition, Anemia.

INTRODUCTION

Inflammatory bowel disease (IBD) is a chronic relapsing inflammatory disorder of the gastrointestinal (GI) tract [1]. IBD is broadly categorized into two major subtypes based on pathological features and disease manifestation: Ulcerative colitis (UC) and Crohn's disease (CD). While, CD can impact several GI tract locations, UC mostly affects the colon [2]. Patients with IBD have a mortality rate that is roughly 1.5–5 times higher than that of the general population, while patients with CD have the highest rates of morbidity and mortality. The main causes of death are infections, the disease's progression, surgical complications, involvement of multiple organs, and malnutrition [3]. Hospitalizations, poor clinical outcomes, therapeutic responsiveness, and quality of life are all linked to malnutrition and sarcopenia [4]. Along with the illness, these individuals are treated with powerful drugs like steroids and biological agents, which have a number of negative side effects. Therefore, the pharmacist needs to be on the lookout for any negative reactions [5].

Although the prevalence of IBD is rising across the Middle East and North Africa, epidemiological cohort studies and a reliable registry remain barriers to assess the current state of affairs [6]. Up to 70% of patients with active IBD and up to 38% of people in remission suffer

from malnutrition, which is quite common in this condition. Although they are distinct conditions, sarcopenia and malnutrition frequently coexist, sarcopenia is a syndrome characterized by low muscle mass and either diminished muscle strength or physical performance [7]. Early detection of malnourished patients may enable earlier management and have an impact on clinical outcomes because sarcopenia and malnutrition have been linked to higher hospitalizations, disease flare-ups, surgical needs, and post-operative problems in IBD patients [8].

By addressing malnutrition and micro and macronutrient deficiencies, reversing the metabolic pathological effects of the disease and nutrient deficiencies, increasing oral intake of nutritional supplements, and offering crucial and structured recommendations on particular dietary patterns to better manage symptoms and further limit damage to the digestive system, diet, and nutritional therapy play a significant role in the management of IBD patients' disease [9]. In order to enhance the nutritional status of IBD patients, dietary intervention and targeted nutritional counseling may be greatly aided by nutritional intake evaluation [9]. So, it is our objective to assess malnutrition in Egyptian patients with IBD.

PATIENTS AND METHODS

Design and population: This study was carried out in Helwan University Hospitals on 90 IBD patients from October 2023 to July 2024.

Patient selection: The study recruited participants of both sexes who were older than 18 and less than 65 years old, known (well-proven) IBD patients based on clinical, laboratory, endoscopic & histopathological diagnoses ^[10]. Patients have been evaluated on two occasions: After enrolment to the study (During disease activity), and after clinical remission. A Harvey-Bradshaw index score of ≤ 4 for CD was one of the specific criteria used to determine clinical remission ^[11] and a partial Mayo score of ≤ 2 points for UC (Mayo score minus the endoscopic component) ^[12].

All studied patients have been subjected to the following:

History taking [Personal history (Age, sex, occupation, marital status, residence, and any special habits of medical importance e.g. smoking). History of present illness, which includes analysis of the recent complaint (Onset, course, duration, associated symptoms and what increase and decrease) including diarrhea, bleeding per rectum, tenesmus, abdominal pain, weight loss, and associated extraintestinal manifestations. Past history including drug intake, disease, operation, and allergy to any medications. Family history of similar conditions or any associated genetic or autoimmune diseases. Also, we collected IBD-specific drug history, including recently used regimens (Either standard or biological treatment) and the degree of compliance to treatment (The percentage of drugs received over the last month).

- Physical examination: Assessment of vital signs (blood pressure, pulse, and temperature). Anthropometric measures (Height, weight, and body mass index during activity and remission). General and local examination and rectal examination.

- Investigations: Laboratory investigations (CBC, serum albumin, serum iron, serum ferritin, total iron binding capacity, total protein, serum calcium; total and ionized; magnesium, phosphorous, sodium, potassium, vitamin D). Colonoscopy (Accepted within 6 months from inclusion): Regarding UC to detect extension and severity of mucosal inflammation. Concerning CD to define the location and behavior of the disease. Histopathological examination of colonic biopsies to confirm the diagnosis and assess disease severity for either UC or CD. Pelvi-abdominal ultrasound for the presence or absence of any abnormalities.

Ethical considerations: The study was done after being accepted by the Research Ethics Committee, Helwan University. All patients provided written informed consents prior to their enrolment. The consent form explicitly outlined their agreement to participate in the study and for the publication of data, ensuring protection of their confidentiality and privacy. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Statistical Analysis

Statistical analysis was performed using SPSS version 26.0 (SPSS Inc., Chicago, IL, USA). The Shapiro–Wilk test assessed data normality. Descriptive statistics were expressed as mean \pm SD for normally distributed data, and median (IQR) for non-normally distributed data. Qualitative variables were presented as number and percentage. Analytic statistics involved: Chi-square test for differences in qualitative variables, Fisher's exact test for small cell frequencies, independent Samples t-test for differences in means between groups, and Paired Samples t-test for within-group differences. For non-parametric data, the Mann-Whitney test assessed differences between groups, and the Wilcoxon test assessed within-group differences. $P \leq 0.05$ was considered statistically significant, and $P \leq 0.001$ was considered highly significant.

RESULTS

The study included 90 patients fulfilling the inclusion criteria with 65 of them (72.2%) diagnosed with UC and 25 (27.8%) with CD. Table (1) showed that the UC group's mean age was 33.2 ± 13.2 years, with members ranging in age from 18 to 64. Of them, over half were female (55.4%) and single (53.8%), roughly two-thirds were urban dwellers with a university degree or higher, 43.1% were manual laborers, and almost one-third were from the Delta region. The CD group's mean age was 29.4 ± 11.8 years ranged from 18 to 64 years, the majority were females (80%) and living in Urban (88%), 36% were married, about three-quarters had a university or higher educational degree, 48% did not have work, and 60% were from Greater Cairo region. Neither group had a statistically significant difference regarding any socio-demographic features ($P > 0.05$ all). The predominance of females in the CD group was observed and about to reach significance ($P = 0.051$).

Table (1) Demographic features of the studied patients

Variables		Ulcerative Colitis		Crohn's disease		Total		P-value
		n= 65	%	n= 25	%	n= 90	%	
Age (years)	Mean ± SD	33.2 ± 13.2		29.4 ± 11.8		32.2 ± 12.9		0.092
	Min – Max	18 – 64		18 – 64		18 – 64		
Gender	Male	29	44.6	5	20.0	34	37.8	0.051
	Female	36	55.4	20	80.0	56	62.2	
Marital status	Single	35	53.8	14	56.0	49	54.4	0.273
	Married	29	44.6	9	36.0	38	42.2	
	Divorced/ Widower	1	1.5	2	8.0	3	3.3	
Educational level	Intermediate school or less	21	32.3	6	24.0	27	30.0	0.608
	University degree or higher	44	67.7	19	76.0	63	70.0	
Occupation	Housewife	13	20.0	6	24.0	19	21.1	0.195
	Manual worker	28	43.1	5	20.0	33	36.7	
	Employed	2	3.1	2	8.0	4	4.4	
	None	22	33.8	12	48.0	34	37.8	
Place of residence	Urban	45	69.2	22	88.0	67	74.4	0.104
	Rural	20	30.8	3	12.0	23	25.6	
Geographical region	Greater Cairo	30	46.2	15	60.0	45	50.0	0.246
	Delta region	21	32.3	9	36.0	30	33.3	
	Upper Egypt	2	3.1	0	0.0	2	2.2	
	Canal region	12	18.5	1	4.0	13	14.4	

SD: Standard deviation, Min: Minimum, Max: Maximum, *: Significant P-value.

Table (2) showed different anthropometric measurements of patients (Height, actual and usual body weights, and BMI) during activity and remission that did not differ between both groups ($P > 0.05$ all). Within each group, the mean actual body weight showed a significant increase during remission ($P < 0.001$ both). In the UC group, a significant improvement in BMI during remission was observed. Those underweight during activity (20%) decreased to only 3.1% during remission, with a substantial increase in the overweight and obese group ($P=0.001$).

Table (2): Anthropometric measurements of the studied patients

Variables		Ulcerative Colitis		Crohn's disease		P-value
		Activity n= 65 (%)	Remission n= 65 (%)	Activity n= 25 (%)	Remission n= 25 (%)	
Height (cm)	Mean ± SD	166.6 ± 9.0		163.8 ± 10.8		0.212
	Min – Max	152 – 190		139 – 190		
Actual body Wt (Kg)	Mean ± SD	64.6 ± 11.7	72.9 ± 11.8	62.3 ± 17.9	69.2 ± 17.9	0.475 ^a
	Min – Max	35 – 90	52 – 102	18 – 100	23 – 100	0.261 ^b
	P-value ^c	<0.001*		<0.001*		
Usual body Wt (Kg)	Mean ± SD	72.5 ± 12.4		69.8 ± 19.4		0.437
	Min – Max	45 – 100		20 – 110		
BMI (Kg/m ²)	<18.5	13 (20.0)	2 (3.1)	5 (20.0)	3 (12.0)	0.210 ^a 0.171 ^b
	18.5-24.9	29 (44.6)	21 (32.3)	13 (52.0)	10 (40.0)	
	25-29.9	21 (32.3)	32 (49.2)	4 (16.0)	7 (28.0)	
	30 +	2 (3.1)	10 (15.4)	3 (12.0)	5 (20.0)	
	P-value ^c	0.001*		0.530		

Wt: Weight, BMI: Body mass index, IQR: Interquartile range, *: Significant P-value.

As regards CBC, iron profile, total protein, and S. albumin among the studied patients. In both groups, all patients were anemic during activity while during remission 16 patients out of 65 (24.6%) were improved in the UC group, and 5 patients out of 25 (20%) were improved in the CD group. During remission, the mean Hb level was significantly lower in the CD group ($P=0.009$). Within each group, the mean Hb level was significantly increased during remission ($P<0.001$ both). During activity, the predominant type of anemia in both groups was microcytic type (70.8% in UC group and 64% in CD group with their iron profile indicating iron deficiency anemia in majority of patients in both groups) that significantly improved (decreased) during remission (40.8% in UC group and 15% in CD group) ($P=0.001$ and

0.003 respectively). Macrocytic anemia was significantly evident in the CD group in both activity (20%) and remission (35%) when compared to the absence of macrocytic anemia in the UC group. Normocytic anemia was detected in 29.2% in patients with UC during activity and in 16% in patients with CD.

Iron profile, did not show significant differences between both groups ($P>0.05$ in all). Within each group, the total protein and S. albumin were significantly increased during remission than during activity ($P<0.05$ both). Also, it is notable that the median concentrations of total protein and S. albumin during activity were lower in patients of CD group than those in UC group but with no significant differences ($P>0.05$ both) (Table 3).

Table (3): Laboratory findings of the studied patients

Variables		Ulcerative Colitis		Crohn's disease		P-value
		Activity n= 65 (%)	Remission n= 65 (%)	Activity n= 25 (%)	Remission n= 25 (%)	
Hb (g/dl)	Mean \pm SD	10.6 \pm 1.6	12.4 \pm 1.2	10.0 \pm 1.6	11.6 \pm 1.2	0.112 ^a
	Min – Max	6.8 – 13.1	10 – 15.2	7 – 12.4	9.9 – 14.1	0.009* ^b
	P-value ^c	<0.001*		<0.001*		
Type of anemia	Microcytic	46 (70.8)	20/49 (40.8)	16 (64.0)	3/20 (15.0)	0.001* ^a
	Normocytic	19 (29.2)	29/49 (59.2)	4 (16.0)	10/20 (50.0)	<0.001* ^b
	Macrocytic	0 (0.0)	0 (0.0)	5 (20.0)	7/20 (35.0)	
	P-value ^c	0.001*		0.003*		
	Normal (<20)	26 (40.0)		4 (16.0)		0.045*
	Abnormal (>20)	39 (60.0)		21 (84.0)		
S. Iron (μ g/dl)	Median [IQR]	40 [24.3 – 58]		33 [18.3 – 42.6]		0.165
	Min – Max	8 – 153		10 – 72		
S. Ferritin (ng/ml)	Median [IQR]	18 [9.7 – 94]		13 [7 – 100]		0.513
	Min – Max	2 – 947		5 – 317		
TIBC	Mean \pm SD	318.8 \pm 69.9		320.9 \pm 62.2		0.946
	Min – Max	180 – 503		230 – 435		
S. Albumin (g/dl)	Median [IQR]	4.0 [3.8 – 4.3]	4.1 [4 – 4.4]	3.9 [3.6 – 4.2]	4.1 [3.8 – 4.4]	0.371 ^a
	Min – Max	3.1 – 5.4	3.7 – 5.5	1.9 – 5	2.8 – 5	0.333 ^b
	P-value ^c	<0.001*		0.002*		
Total protein	Mean \pm SD	7.4 \pm 0.5	7.5 \pm 0.5	7.1 \pm 0.8	7.2 \pm 0.7	0.154 ^a
	Min – Max	6.4 – 8.2	6.4 – 8.3	5.2 – 8.1	5.4 – 8.3	0.228 ^b
	P-value ^c	<0.001*		0.009*		

Hb: Hemoglobin, S. Iron: Serum iron, S. Ferritin: Serum ferritin, TIBC: Total iron-binding capacity, S. Albumin: Serum albumin, *: Significant P-value.

Table (4) showed serum micronutrient findings among patients during activity and remission. All serum electrolytes (Ca, Mg, Na, K, and P) did not show significant differences between both groups either during activity or during remission ($P>0.05$ all). However, within each group, the median of all serum electrolytes was significantly elevated during remission except for K and P in the CD group.

Table (4): Serum micronutrients findings of the studied patients

Variables		Ulcerative Colitis		Crohn's disease		P-value
		Activity	Remission	Activity	Remission	
Total S. Ca (mg/dl)	Median [IQR]	8.9 [8.6 – 9.2]	9.1 [8.8 – 9.3]	8.9 [8.4 – 9]	9.1 [8.9 – 9.2]	0.285 ^a
	Min – Max	6.9 – 10.1	7 – 10.2	7 – 10.3	7.3 – 10.3	0.677 ^b
	P-value ^c	<0.001*		<0.001*		
Ionized S. Ca (mg/dl)	Median [IQR]	1.1 [1 – 1.1]	1.1 [1.1 – 1.2]	1.0 [0.9 – 1.1]	1.1 [1 – 1.1]	0.110 ^a
	Min – Max	0.9 – 4.7	0.9 – 4.7	0.9 – 4.7	0.9 – 1.3	0.172 ^b
	P-value ^c	<0.001*		0.003*		
Mg (mg/dl)	Median [IQR]	1.9 [1.7 – 2.1]	2 [1.9 – 2.1]	1.8 [1.7 – 2]	1.9 [1.8 – 2.1]	0.252 ^a
	Min – Max	1.6 – 2.6	1.6 – 2.6	1.6 – 2.6	1.6 – 2.6	0.219 ^b
	P-value ^c	<0.001*		0.002*		
Na (mEq/L)	Median [IQR]	137 [135 – 139]	138 [137 – 139]	138 [135.5 – 140]	138 [137 – 140]	0.108 ^a
	Min – Max	130 – 143	135 – 144	135 – 144	135 – 144	0.387 ^b
	P-value ^c	<0.001*		0.219		
K (mEq/L)	Median [IQR]	3.9 [3.7 – 4.1]	4.0 [3.8 – 4.3]	3.8 [3.7 – 4.2]	4.0 [3.8 – 4.3]	0.884 ^a
	Min – Max	2.3 – 4.6	3.4 – 4.9	3.3 – 4.8	3.6 – 4.8	0.931 ^b
	P-value ^c	<0.001*		0.002*		
P (mg/dl)	Median [IQR]	3.3 [2.95 – 3.9]		3.3 [3.0 – 3.9]		0.678
	Min – Max	2.5 – 5.2		2.5 – 4.7		

S. Ca: Serum calcium, Ionized S. Ca: Ionized serum calcium, Mg: Magnesium, Na: Sodium, K: Potassium, P: Phosphorus, *: Significant P-value.

The median vitamin D level showed a weak significant decrease in the CD group (19 ng/mL vs. 13 ng/mL, P = 0.049).

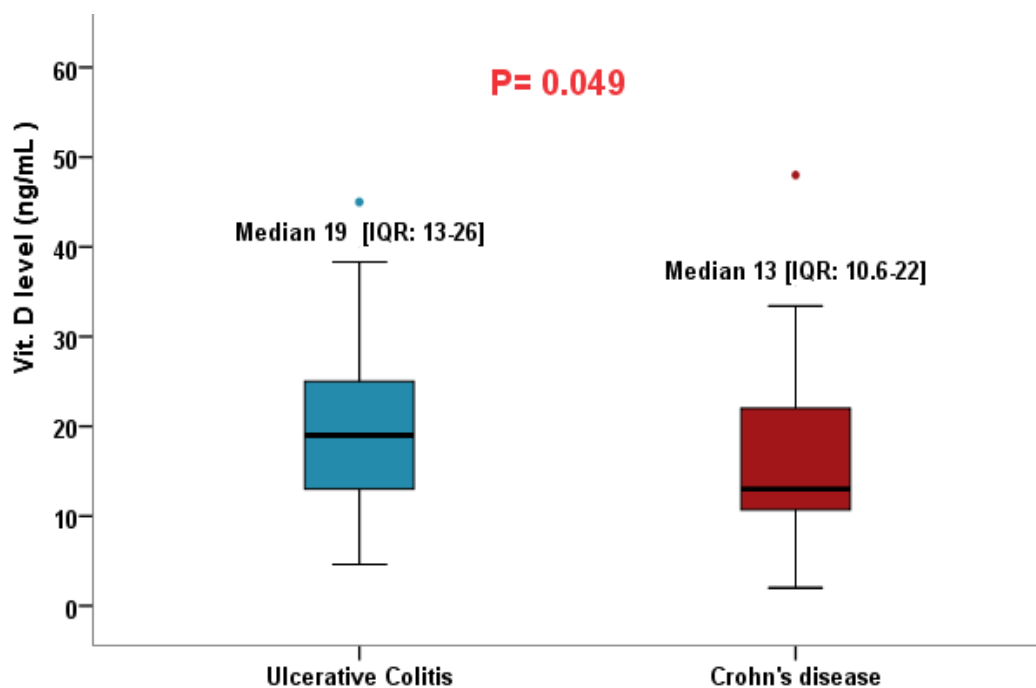


Figure (1): Serum Vit. D levels among the studied patients

DISCUSSION

IBD is a complex disorder associated with a dysregulated immune response to environmental triggers in the genetically susceptible host [1]. The frequency of this condition is increasing dramatically around the world, with the greatest increases in developing countries and young children [13]. Up to 70% of patients with active IBD and up to 38% of individuals in remission suffer from malnutrition. Sarcopenia, a syndrome closely associated with malnutrition, is characterized by low muscle mass and either diminished muscle strength or athletic performance [7]. Our study aimed to describe malnutrition in Egyptian patients with IBD during remission and activity.

In the current study, the mean age among UC patients was 33.2 years old, while among CD, their mean age was 29.4 years old. Moreover, female predominance was found in the CD group which was about to reach significance ($P = 0.051$). According to a recent pooled analysis of population-based studies involving 17 different patient cohorts from 16 different regions of Europe, North America, Australia, and New Zealand, women's puberty may be a trigger for the onset of CD because, while the risk of developing the illness is 20% lower for girls than for boys between the ages of 10 and 14, it significantly increases for women between the ages of 25 and 29 and especially after the age of 35 [14]. In the epidemiology of CD, gender-related variations were observed, while they were less pronounced in UC. There was no gender-based difference in the epidemiology of UC, according to studies done in both East and West countries. Conversely, CD exhibits sex-specific disparities, with women predominating in the United States and Europe. Conversely to what occurs in Asian countries, where males are more prone to CD [15].

According to these data, CD incidence is not solely sex-related, rather, environmental factors including the westernization of lifestyle may be crucial in the pathophysiology of IBD. As no statistically significant difference between both groups was found regarding any of the socio-demographic features ($P > 0.05$) [16]. Features of malnutrition represented by micronutrient deficiencies, one of the most prevalent is anemia. The results of our study have demonstrated that all patients were anemic during activity. During remission, 75.4% were anemic in the UC group, while 80% were anemic in the CD group with the mean Hb level significantly lower in the CD group. The obtained results are to great extent in line with **Woźniak et al.** [18] who reported anemia in 66.7% of patients with CD and 56.4% with UC [17]. While Gaetano Bergamaschi and his team reported lower prevalence rates of anemia (13.6%). This may be attributed to the fluctuating course of the disease, the duration of the disease or lifestyle factors, and the administration of supplementation during the disease course. In the

Swedish IBSEN study, anemia was more common in patients with CD than UC [19]. This is compatible with our finding regarding low Hb levels in CD. Different types of anemias were documented in the literature. Among our study, we found that during activity, the most common type of anemia in both groups was microcytic (70.8% in the UC group and 64% in the CD group). The iron profiles indicated iron deficiency anemia in the majority of patients in both groups. This condition significantly improved during remission, with 40.8% in the UC group and 15% in the CD group showing improvement ($P = 0.001$ and 0.003 respectively). Similar findings were reported by **Bengi et al.** [20] who indicated that iron deficiency anemia (IDA) was the most prevalent form of anemia at 29.9%.

To a lesser extent, macrocytic anemia was significantly evident in CD group in both activity (20%) and remission (35%) when compared to the absence of macrocytic anemia in the UC group. Normocytic anemia was detected in 29.2% in patients with UC during activity and in 16% in patients with CD. These results are compatible with **Bengi et al.** [20] who reported that the frequencies of chronic disease anemia and mixed anemia were 8% and 3.4%, respectively. In addition, vitamin B₁₂/folic acid deficiency anemia was observed in 14% of the patients with CD predominance.

As regards protein status, serum total protein & albumin were significantly increased during remission than during activity ($P < 0.05$) in each group, with lower median concentrations of serum total protein and albumin in Crohn's group in activity than in the UC group but without significant difference. This is in line with earlier research that showed that CD and UC patients had significantly lower albumin concentrations than healthy subjects (HS). CD patients had significantly lower median albumin concentrations than UC patients during activity and patients had significantly higher albumin levels during remission [21], [22], [23]. According to some published data, there were no appreciable variations in albumin levels between healthy controls (HC) and those with the disease [24]. Moreover, it was observed a correlation between serum total protein and clinical outcome. An albumin concentration of less than 20 g/L and a total protein concentration of less 60 g/L were associated with operative outcomes in 60% of cases [25].

Observation of micronutrient status among the current status, we observed a weak significant decrease of vitamin D in the CD group during activity, with no significant differences between both groups. While serum electrolytes (Ca, Mg & K) were significantly elevated during remission within each group. **Lomer et al.** [26] and **Grunbaum et al.** [27] observed similar outcomes, reporting that CD patients had lower vitamin D concentrations than healthy individuals (HSs) [26], [27].

CONCLUSION

All types of anemias were found in IBD patients during activity or remission, microcytic anemia predominance during activity of CD, and macrocytic anemia presence during CD activity and remission. Micronutrient deficiencies were predominant during activity in both IBD groups. The total protein and serum albumin were significantly increased during remission than during activity within each of IBD group.

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