Original Article

Nutritional status in patients with ulcerative colitis in Isfahan, Iran

Hamid Kalantari, Sayyed Majid Barekat[1], Mohammad Reza Maracy[2], Leila Azadbakht[3], Zahra Shahshahan[4]

Departments of Gastroenterology, Isfahan Liver Disease Research Center, [1]Internal Medicine, School of Medicine, [2]Epidemiology and Biostatistics, School of Public Health, [3]Community Nutrition, School of Nutrition and Food Science, [4]Obstetrics and Gynecology, School of Medicine, Isfahan University of Medical Sciences, Isfahan, Iran

Abstract

Background: Malnutrition is common among patients with inflammatory bowel disease. The present study aimed to investigate the nutritional status of ulcerative colitis (UC) patients in Isfahan, Iran.

Materials and Methods: In this descriptive analytical cross-sectional study, between Dec 2011 and Jun 2012, 99 patients with UC were randomly selected and evaluated. Age, sex, duration of disease, body mass index (BMI) and laboratory parameters recorded for all patients. Nutritional risk index (NRI) was calculated and its association with patients' variables was assessed with regard to UC disease severity.

Results: Twelve patients out of 99 patients had mild UC and 87 patients had moderate to severe UC. Based on the NRI, 90.9% were not malnourished and 9.1% were at moderate to severe risk for malnutrition. Among laboratory parameters only, serum potassium level in patients with moderate to severe UC was significantly higher than those with mild UC ($P = 0.017$). Other laboratory parameters were similar between patients stratified by US status. Patients age s significantly correlate with serum vitamin D, immunoglobulin a (IgA) and potassium level ($P > 0.05$), also duration of disease was significantly correlate with Phosphorus ($P = 0.024$) among laboratory parameters.

Conclusion: In studied UC patients, malnutrition risk was based on degree of disease severity. Patients with moderate to severe UC were more at risk for malnutrition compared to the patients with mild UC. Furthermore, among laboratory parameters only serum potassium level was higher among patients with moderate to severe UC compared to others.

Key Words: Inflammatory bowel disease, malnutrition, nutritional risk index, ulcerative colitis

Address for correspondence:
Dr. Zahra Shahshahan, Department of Obstetrics and Gynecology, School of Medicine, Isfahan University of Medical Sciences, Isfahan, Iran.
E-mail: shahshahan@med.mui.ac.ir

Received: 27.09.2012, **Accepted:** 21.10.2012

Access this article online	
Quick Response Code:	Website: www.advbiores.net
	DOI: 10.4103/2277-9175.125812

INTRODUCTION

Inflammatory bowel disease (IBD) included ulcerative colitis (UC), Crohn's disease (CD) and indeterminate colitis. They are chronic inflammatory disorders that cause inflammation in the gastrointestinal tract and their etiology, and pathogenesis is not clearly understood.[1-3]

Copyright: © 2014 Kalantari. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

How to cite this article: Kalantari H, Barekat SM, Maracy MR, Azadbakht L, Shahshahan Z. Nutritional status in patients with ulcerative colitis in Isfahan, Iran. Adv Biomed Res 2014;3:58.

Age, race and geographical areas were reported to be associated with IBD in some epidemiological studies; however, the ultimate causes of IBD have not yet been recognized.[4,5] It is suggested that nutritional factors and dietary intake can be considered as significant etiological factors for both CD and UC.[6]

In patients with IBD, malnutrition is usually a common problem and weight loss is reported in ≈ 75% of hospitalized patients with IBD.[7,8] Duration, activity and geographical extent of the disease effect on the pattern and severity of malnutrition. Although the prevalence of malnutrition is high among hospitalized IBD patients, the prevalence of malnutrition in patients with UC is lower than in CD patients.[9-11] However, in these patients during periods of active disease, nutritional deficiencies can develop very fast. Therefore, nutritional care includes treatment or prevention of malnutrition and micronutrient deficiencies are important in the treatment of patients with IBD.[2,12]

IBD disease, especially CD, is associated with malnutrition. Duration of IBD disease, type of IBD (CD or UD) and involvement of small intestine may affect the form of malnutrition.[13] Studies showed that from 20% up to 85% of the patients with IBD suffer from malnutrition. Patients with CD, generally, develop protein-energy malnutrition and those with UD develop protein malnutrition.[14] Although multiple nutrient deficiencies are common in IBD, a large number of these deficiencies, aside from iron, folate and B12 deficiencies, which cause clinical manifestations, do not have clear clinical manifestations. However, many of these micronutrients are involved in bone density, thrombophilia, and carcinogenesis impact.[15] Folic acid deficiency has been observed and reported in half of the patients with IBD.[16] In the study of Ripoli *et al*., patients were followed up for 10 years at three-month intervals[17] and there was a significant decrease in BMI, protein, lipid, calcium (CA), iron and phosphorus (P) in studied groups. Unhospitalized patients developing UC had better nutritional status than those hospitalized and the nutritional status worsened during inflammation and disease activity.[18] In Jerome *et al*. studies, there has been no significant difference in regard to macronutrient reception between control and placebo group, but the level of beta-carotene, vitamins B1, B6, C and Magnesium (Mg) was lower.[19]

Few studies assess the nutritional status of UC patients in Iran. Therefore, the present study aimed to investigate the nutritional status of UC patients in Isfahan, Iran.

MATERIALS AND METHODS

In this descriptive analytical cross-sectional study, between Dec 2011 and Jun 2012, 99 patients with UC who referred to Clinic of Gastroenterology in AL Zahra Hospital in Isfahan, Iran were enrolled. Patients were considered to have UC based on a typical clinical presentation of ≥4 weeks and one of either surgical, standard clinical endoscopic or radiologic changes consistent with chronic UC. Patients between 14 and 80 years old with duration of disease more than 3 months were eligible, if they had no history of any other systemic disorders including diabetes mellitus, hyperthyroidism, chronic liver and renal disease, and no history of cancer. Also patients on vitamin B12, folic acid and oral multivitamin supplements, were excluded from the study. After participating patients were explained and informed of the purposes of the study; written informed consent was obtained from them all and the protocol for this study was considered and approved in Isfahan University of Medical Sciences.

Data collection included age, sex, and duration of disease, BMI and laboratory parameters which recorded for all patients. Laboratory parameters were measured from patients' blood samples as follow: Serum albumin, serum iron, hemoglobin (Hb), folic acid, A, B12, D and E vitamins, partial thromboplastin time (PTT), International normalized ratio, IgA, Ca, P, Mg, Zinc, Cu and K. BMI was calculated from weight and height (kg/m^2) and nutritional risk index (NRI) was calculated as: NRI = 1.519 _ serum albumin (g/L) +41.7 _ (current/usual body weight).[20] Based on NRI, at risk for malnutrition was defined as NRI fewer than 83.5 and patients with a NRI >97.5 were considered non-malnourished.

Montreal classification of severity of UC, which previously described[21] was used for classification of UC at the time of enrollment. Due to lesser number of patients with severe UC, patients with moderate and severe UC were analyzed in the combination group compared to patients with mild UC.

All analysis was done by SPSS-20 and data are presented as means ± 1SD, median [interquartile range] or number (%) based on the variables. age, duration of disease, BMI and laboratory parameters between patients with mild or moderate to severe UC compared by Mann-Whitney test. Sex and the number of patients with abnormal laboratory parameters were compared by Chi-square test between patients regard to UC status. Relationship between patients' age, disease duration and laboratory parameters were assessed by Spearman's Correlation Coefficient. Statistical significance was accepted at $P < 0.05$.

RESULTS

Studied patients had the mean age of 38.3 ± 12.4. Fifty five patients (51.5%) were male and 48 patients (48.5%) were female. In total 99 patients were evaluated 12 patients had mild UC and 87 patients had moderate to severe UC. The comparison of age, sex, BMI and disease duration are shown in Table 1, stratified by UC status. Patients with mild UC were younger and more proportion of them were female than those with moderate to severe UC, also disease duration in patients with mild UC was longer than those with moderate to severe UC. However, these differences were not statistically significant ($P > 0.05$).

According to the NRI, 90 patients (90.9%) were not malnourished and nine patients (9.1%) were at moderate to severe risk for malnutrition. Age and disease duration in patients at moderate to severe risk for malnutrition were higher than patients who were not malnourished. All patients at moderate to severe risk for malnutrition had moderate to severe UC, whereas, all patients with mild UC were not malnourished [Table 2] but statistical significant were not observed ($P > 0.05$)

In Table 3, results for comparison of laboratory parameters between patients with mild or moderate to severe UC are shown. As shown in the table, only, k in patients with moderate to severe UC was significantly higher than those with mild UC ($P = 0.017$). Other laboratory parameters were similar between patients stratified by UC status. The proportion of patients with laboratory parameters below or upper the reference values are shown in Figure 1. Albumin, iron, folic acid, B12, vitamin D, PTT, P, Zinc and Cu defined as abnormal if these were below the reference values, and Hb, vitamin A, IgA, Ca, Mg and K defined as abnormal if these were greater than the reference values. The proportion of patients with abnormal laboratory parameters was not statistically significant between patients, stratified by UC status ($P > 0.05$).

Relationship between patients' age and duration of disease with laboratory parameters are shown in Table 4. Based on results age was significantly

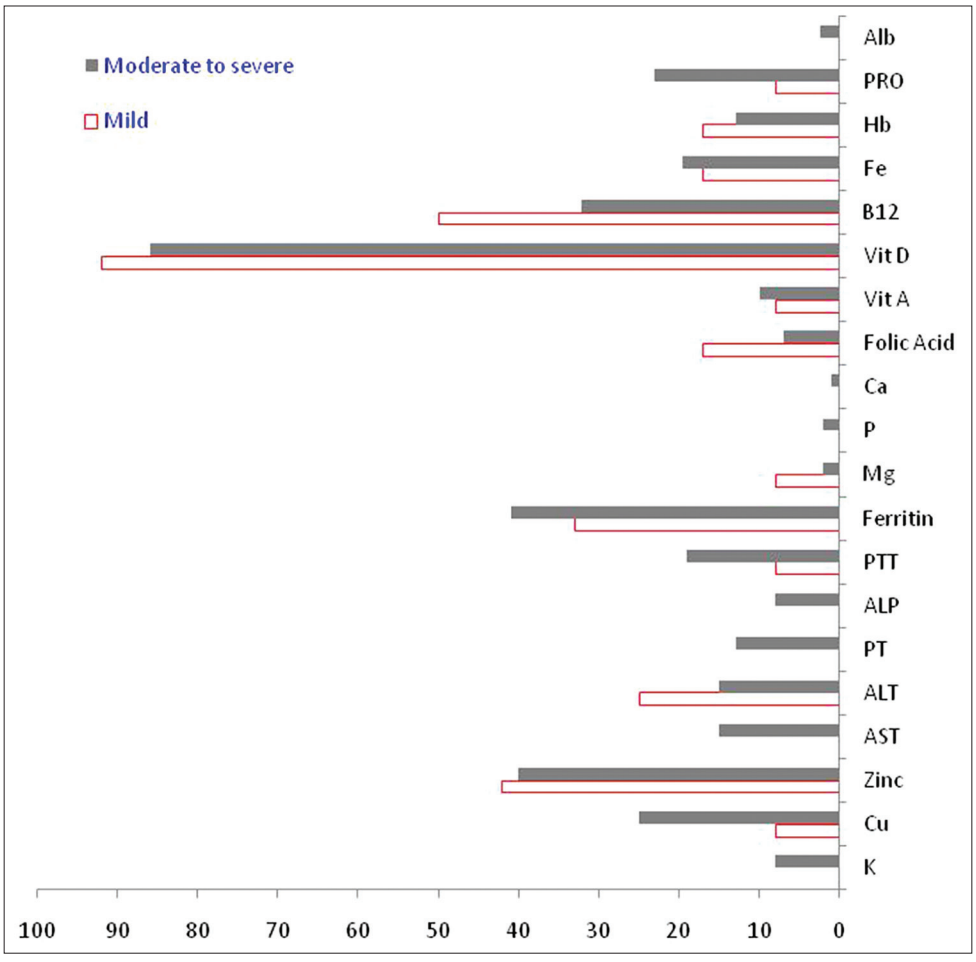

Figure 1: The proportion of patients with laboratory parameters below or upper the reference values in 99 patients, stratified by ulcerative colitis status ($P > 0.05$)

Table 1: Age, disease duration, BMI and sex in 99 patients with ulcerative colitis

Variables	Total	Ulcerative colitis				*P* value
		Mild (*n*=12)		Moderate to severe (*n*=87)		
Age (year)	38.3±12.4	34.5±11	32 (26.2-45.2)	38.8±12.6	32 (26.2-45.2)	0.3*
Duration of disease (month)	7±4.1	7.7±3.6	8 (5.2-10)	6.9±4.2	6 (3-10)	0.41*
BMI (kg)	24.4±4	24.4±3.1	23.6 (22.9-26.6)	24.4±4.1	24.7 (21.2-27.1)	0.75*
Sex						
Male	51 (51.5)	3 (6)		48 (94)		0.1†
Female	48 (48.5)	9 (19)		39 (81)		

Data are mean±SD, median [interquartile range] and number (%), *P* values resulted from *Mann-Whitney test and †Chi-square test, BMI: Body mass index, prothrombin

Table 2: Association between nutritional risk index with patients' age, disease duration, and ulcerative colitis status

Variables	Nutritional risk index				*P* value
	Non-malnourished (*n*=90)		At moderate to severe risk for malnourished (*n*=9)		
Age (year)	37.6±11.9	32 (26.2-45.2)	44.9±16.1	32 (26.2-45.2)	0.13*
Disease duration (month)	6.7±3.7	8 (5.2-10)	10.1±6.5	6 (3-10)	0.1*
Ulcerative colitis					
Mild	12 (100)		0		0.59†
Moderate to severe	78 (89.7)		9 (10.3)		

Data are mean±SD, median [interquartile range] and number (%), *P* values are resulted from *Mann-Whitney test and †Chi-square test

Table 3: Comparison of laboratory parameters regard to patients ulcerative colitis status

Variables	Ulcerative colitis				*P* value*
	Mild (*n*=12)		Moderate to severe (*n*=87)		
Alb (g/L)	43.2±3.6	43.5 (40-46.5)	43.1±4.1	43 (40-45.2)	0.96
PRO	8±0.41	8 (7.6-8.3)	8.1±0.6	8.2 (7.8-8.5)	0.33
Hb (g/dL)	14.2±1.9	14.2 (12.5-14.8	14.3±1.7	14.5 (13.5-15.4)	0.45
Fe (μg/dL)	72.1±40.5	62 (48.2-88)	71.4±43.9	66 (47-87)	0.92
B12 (μg/dl)	232.4±56.2	224 (196-270)	262.2±118.1	243 (195-319)	0.42
Vitamin D (μg/dl)	16.7±8.2	17 (9.2-23.7)	21.6±13.3	18 (14-23)	0.22
Vitamin A (μg/dl)	43.6±16.5	39.5 (32.8-50)	52.4±22.9	46 (41-55)	0.07
Vitamin E (mg/dl)	9.1±1.3	9.3 (8-10)	9.2±2.1	8.5 (8-9.9)	0.34
Folic acid (ng/ml)	8.6±3.2	8.3 (6-10.8)	9.8±3.6	9 (7.5-11.7)	0.38
Ca (mg/dl)	9.7±0.37	9.6 (9.5-9.9)	9.5±0.56	9.5 (9-9.9)	0.19
P (mg/dl)	3.6±0.69	3.7 (2.9-4.2)	3.4±0.74	3.2 (2.6-4)	0.21
Mg (mmol/l)	2.6±0.51	2.6 (2.2-2.9)	2.6±0.28	2.6 (2.5-2.9)	0.62
International normalized ratio	1±0.03	1 (1-1)	1±0.04	1 (1-1)	0.59
Partial thromboplastin time	35.2±4.7	35 (32.5-38.7)	34.9±9.7	34 (31-37)	0.34
Protrombin time	14.3±1.2	14.5 (13.2-15.3)	13.8±1.5	14 (13-15)	0.22
IgA (mg/dl)	201.1±63.7	194 (131-274)	209.8±64.6	211 (176-246)	0.73
Zinc (μg/dl)	70.6±11.1	70 (64.5-76.7)	78.2±56.2	72 (65-80)	0.59
Cu (μg/dl)	94.1±24.1	87 (73-116)	97.6±32.9	96 (76-124)	0.61
K (mmol/l)	3.9±0.2	3.9 (3.8-4.1)	4.2±0.37	41 (3.9-4.4)	0.017

Data are mean±SD, and median [interquartile range), *P* values are resulted from *Mann-Whitney test, PRO: Prothrombin, IgA: Immunoglobulin A, Hb: Hemoglobin, Mg: Magnesium, Ca: Calcium, P: Phosphorus

correlate with vitamin D, IgA and K ($P > 0.05$), also duration of disease was significantly correlate with P ($P = 0.024$) among laboratory parameters.

DISCUSSION

Results of the present study that aimed to investigate the nutritional status of UC patients in Isfahan, Iran, showed that in study population, most of the patients (88%) had moderate to severe UC. Patients with moderate to severe UC were older than the patients with mild UC. Duration of disease, BMI and laboratory parameters (except the value of serum potassium level) in patients with moderate to severe was similar to patients with mild UC. Value of serum potassium level in moderate to severe UC patients was significantly more than patients with mild UC (P value = 0.017). All 12 patients with mild UC had normal nutrition and were not at risk for malnourished, but 10% of patients moderate

Table 4: Correlation between patients' age and disease duration with laboratory parameters in 99 patients with ulcerative colitis

Variables	Age		Disease duration	
	Spearman's correlation coefficient	*P* value	Spearman's correlation coefficient	*P* value
Alb (g/L)	−0.15	Ns	−0.011	Ns
PRO	−0.186	Ns	−0.016	Ns
Hb (g/dL)	0.016	Ns	−0.071	Ns
Fe (μg/dL)	−0.036	Ns	−0.017	Ns
B12 (μg/dl)	0.140	Ns	0.157	Ns
Vitamin D (μg/dl)	0.306	0.002	0.061	Ns
Vitamin A (μg/dl)	0.085	Ns	−0.28	Ns
Vitamin E (mg/dl)	0.178	Ns	0.057	Ns
Folic acid (ng/ml)	0.136	Ns	0.135	Ns
Ca (mg/dl)	−0.019	Ns	−0.07	Ns
P (mg/dl)	−0.031	Ns	−0.229	0.024
Mg (mmol/l)	0.034	Ns	−0.018	Ns
Partial thromboplastin time	−0.093	Ns	−0.150	Ns
Protrombin time	−0.036	Ns	−0.143	Ns
IgA (mg/dl)	0.201	0.049	0.087	Ns
Zinc (μg/dl)	−0.085	Ns	0.013	Ns
Cu (μg/dl)	0.052	Ns	0.053	Ns
K (mmol/l)	0.311	0.002	0.058	Ns

NS: Not significant, Ca: Calcium, P: Phosphorus, Mg: Magnesium, PRO: Prothrombin, IgA: Immunoglobulin A

to severe UC, were at moderate to severe risk for malnourished. we find significant positive correlation between patients' age with the value of vitamin D, IgA and K, which means older patients, specially whom with moderate to severe UC, had higher value of serum vitamin D, IgA and K. Furthermore, positive correlation was found between duration of patients' disease with the value of P, whereas, increasing in duration of disease cause to increase in the level of P. The proportion of abnormal laboratory parameters in patients with moderate to severe UC was similar to patients with mild UC.

Previous studies showed that IBD affects equally both sexes and in the present study most of the patients were male (51%). However, previous studies by Rocha *et al*.,[12] found that 40% out of IBD patients were male and Oliveira *et al*.,[22] found that 37% out of UC patients were male.

In most of the previous studies, nutrition status was compared between UC patients with CD patients and healthy subjects. In Ghoshal *et al*.,[23] study 62 patients with IBD (55 UC and seven CD patients) and 42 healthy subjects were evaluated for nutrition using dietary survey. Authors reported that protein, iron and BMI in IBD patients were lower among the IBD patients than among the healthy subjects. Patients with CD had a lower level of Hb and serum total protein compare to UC and CD patients and serum albumin, BMI, CA and iron were comparable between UC and CD patients. In the present study, CD patients and healthy subjects were not included, but in UC patients' protein, iron, BMI, Hb, serum albumin and CA in compare to the reference values were not statistically significant between patients, stratified by UC status.

Another study[24] reported that, in 76 IBD and 30 healthy subjects, all investigated nutritional parameters except mean corpuscular volume (MCV), tryglicerides and serum total protein level were significantly different in UC and CD patients compared to control subjects also they found that serum albumin level and BMI were the most predictive parameters of malnutrition and concluded that these two parameters are simple and convenient methods for the assessment of the nutritional status in UC and CD patients. In our study, all laboratory parameters except k in UC patients were similar based on degree of disease severity but healthy subjects were not assessed in our study to compare with UC patients. Authors in Mijac *et al*.[24] study, reported that in patients with active IBD, the prevalence of under nutrition was 25-69.7% and severe under nutrition was 1.3-31.6%. In the present study, 96 UC patients severe under nutrition have been detected in 9.1% of them.

Folic acid and vitamin B12 deficiencies due to malnutrition, malabsorption and anti-folate medications are quite common in UC and CD patients, and the deficiency of these key nutrients leads to increased homocysteine levels in UC and CD patients.[20,25,26] It was showed that the value of folic acid in UC patients is lower than that of the healthy subjects,[27] in our study the value of folic acid in UC patients was not compared with healthy subjects but we found that disease severity could not be affected

on the value of folic acid in these patients. As said, it is known that, several factors in IBD patients include inadequate intake, increased consumption or folate malabsorption in patients using medications might be associated deficiency of folic acid.[28] Furthermore, Akbulut *et al*.[27] reported that vitamin B12 levels were found to have decreased in UC patients compared to control group; however, this findings did not attain statistical significance. Our finding showed in UC patients the mean of vitamin B12 levels similar to Akbulut *et al*.[27] study.

Pappa *et al*.[29] study identified vitamin D deficiency in 34.6% of children and young adults with IBD. Furthermore, other studies[30] reported the prevalence of vitamin D deficiency lower than Pappa *et al*.[29] study. In present study, vitamin D deficiency was observed in 87% of UC patients, which was higher than Pappa *et al*.[29] and Sentongo *et al*.[30] However, studied population in these studies included UC and CD patients.

In Nguyen *et al*.[31] study, among IBD patients with malnutrition the crude mortality rate was significantly more than IBD patients who did not have malnutrition (2.7% vs. 0.5% respectively, $P \leq 0.0001$). However, in this study, administrative data do not cover the clinical detail to adjust for IBD-specific disease severity and they could not assess the effect of combination of malnutrition and disease severity on mortality rate among in these patients. In the present study, malnutrition in UC patients was find regard to disease severity but we did not follow the patients and our data do not cover detail about rate of mortality among studied patients. Therefore, we were limited in how we could assess the risk of mortality based on degree of malnutrition and disease severity. Sample size may be to be another limitation of the present study, because of the small number of patients with mild UC can be cause of low power to detect small differences between patients with mild UC or moderate to severe UC regard to NRI status. Therefore, further studies with larger group of UC patients are and healthy subjects necessary to be done to compare nutrition status and laboratory parameters as risk factors and their association with mortality, morbidity and other variables in these patients based on degree of disease severity and in contrast to healthy subjects.

Overall, the results of this study revealed that in studied UC patients, risk for malnutrition was similar based on degree of disease severity. Patients with moderate to severe UC were at moderate to severe risk for malnutrition more than patients with mild UC. Furthermore, among laboratory parameters, only K maybe was defined as a marker in patients with moderate to severe UC compare to patients with mild UC, however, further studies are required to be done.

REFERENCES

1. Podolsky DK. Inflammatory bowel disease. N Engl J Med 2002;347:417-29.
2. Hartman C, Eliakim R, Shamir R. Nutritional status and nutritional therapy in inflammatory bowel diseases. World J Gastroenterol 2009;15:2570-8.
3. Lucendo AJ, De Rezende LC. Importance of nutrition in inflammatory bowel disease. World J Gastroenterol 2009;15:2081-8.
4. Bernstein CN, Shanahan F. Disorders of a modern lifestyle: Reconciling the epidemiology of inflammatory bowel diseases. Gut 2008;57:1185-91.
5. Bernstein CN, Rawsthorne P, Cheang M, Blanchard JF. A population-based case control study of potential risk factors for IBD. Am J Gastroenterol 2006;101:993-1002.
6. Cashman KD, Shanahan F. Is nutrition an aetiological factor for inflammatory bowel disease? Eur J Gastroenterol Hepatol 2003;15:607-13.
7. Van Patter WN, Bargen JA, Dockerty MB, Feldman WH, Mayo CW, Waugh JM. Regional enteritis. Gastroenterology 1954;26:347-450.
8. Lanfranchi GA, Brignola C, Campieri M, Bazzocchi G, Pasquali R, Bassein L, *et al*. Assessment of nutritional status in Crohn's disease in remission or low activity. Hepatogastroenterology 1984;31:129-32.
9. Royall D, Greenberg GR, Allard JP, Baker JP, Jeejeebhoy KN. Total enteral nutrition support improves body composition of patients with active Crohn's disease. JPEN J Parenter Enteral Nutr 1995;19:95-9.
10. Stokes MA. Crohn's disease and nutrition. Br J Surg 1992;79:391-4.
11. Teahon K, Pearson M, Smith T, Bjarnason I. Alterations in nutritional status and disease activity during treatment of Crohn's disease with elemental diet. Scand J Gastroenterol 1995;30:54-60.
12. Rocha R, Santana GO, Almeida N, Lyra AC. Analysis of fat and muscle mass in patients with inflammatory bowel disease during remission and active phase. Br J Nutr 2009;101:676-9.
13. Goh J, O'Morain CA. Review article: Nutrition and adult inflammatory bowel disease. Aliment Pharmacol Ther 2003;17:307-20.
14. Gassull MA, Cabré E. Nutrition in inflammatory bowel disease. Curr Opin Clin Nutr Metab Care 2001;4:561-9.
15. Gassull MA. Review article: The role of nutrition in the treatment of inflammatory bowel disease. Aliment Pharmacol Ther 2004;20:79-83.
16. Jahnsen J, Falch JA, Mowinckel P, Aadland E. Bone mineral density in patients with inflammatory bowel disease: A population-based prospective two-year follow-up study. Scand J Gastroenterol 2004;39:145-53.
17. Reimund JM, Arondel Y, Escalin G, Finck G, Baumann R, Duclos B. Immune activation and nutritional status in adult Crohn's disease patients. Dig Liver Dis 2005;37:424-31.
18. Ripoli J, Miszputen SJ, Ambrogini Jr O, Carvalho Ld. Nutritional follow-up of patients with ulcerative colitis during periods of intestinal inflammatory activity and remission. Arq Gastroenterol 2010;47:49-55.
19. Filippi J, Al-Jaouni R, Wiroth JB, Hébuterne X, Schneider SM. Nutritional deficiencies in patients with Crohn's disease in remission. Inflamm Bowel Dis 2006;12:185-91.
20. Papa A, De Stefano V, Danese S, Chiusolo P, Persichilli S, Casorelli I, *et al*. Hyperhomocysteinemia and prevalence of polymorphisms of homocysteine metabolism-related enzymes in patients with inflammatory bowel disease. Am J Gastroenterol 2001;96:2677-82.
21. Satsangi J, Silverberg MS, Vermeire S, Colombel JF. The Montreal classification of inflammatory bowel disease: Controversies, consensus, and implications. Gut 2006;55:749-53.
22. Oliveira GS, Almeida NP, Mello AC, Dantas LO, Queiroz AP, Fernandes RD, *et al*. Sulphasalazine tolerability in patients with ulcerative colitis in Salvador-Bahia. GED 2007;26:74-8.
23. Ghoshal UC, Shukla A. Malnutrition in inflammatory bowel disease patients in northern India: Frequency and factors influencing its development. Trop Gastroenterol 2008;29:95-7.
24. Mijac DD, Janković GL, Jorga J, Krstić MN. Nutritional status in patients

with active inflammatory bowel disease: Prevalence of malnutrition and methods for routine nutritional assessment. Eur J Intern Med 2010;21:315-9.
25. Koutroubakis IE, Dilaveraki E, Vlachonikolis IG, Vardas E, Vrentzos G, Ganotakis E, *et al*. Hyperhomocysteinemia in Greek patients with inflammatory bowel disease. Dig Dis Sci 2000;45:2347-51.
26. Romagnuolo J, Fedorak RN, Dias VC, Bamforth F, Teltscher M. Hyperhomocysteinemia and inflammatory bowel disease: Prevalence and predictors in a cross-sectional study. Am J Gastroenterol 2001;96:2143-9.
27. Akbulut S, Altiparmak E, Topal F, Ozaslan E, Kucukazman M, Yonem O. Increased levels of homocysteine in patients with ulcerative colitis. World J Gastroenterol 2010;16:2411-6.
28. Chowers Y, Sela BA, Holland R, Fidder H, Simoni FB, Bar-Meir S. Increased levels of homocysteine in patients with Crohn's disease are related to folate levels. Am J Gastroenterol 2000;95:3498-502.
29. Pappa HM, Gordon CM, Saslowsky TM, Zholudev A, Horr B, Shih MC, *et al*. Vitamin D status in children and young adults with inflammatory bowel disease. Pediatrics 2006;118:1950-61.
30. Sentongo TA, Semaeo EJ, Stettler N, Piccoli DA, Stallings VA, Zemel BS. Vitamin D status in children, adolescents, and young adults with Crohn disease. Am J Clin Nutr 2002;76:1077-81.
31. Nguyen GC, Laveist TA, Brant SR. The utilization of parenteral nutrition during the in-patient management of inflammatory bowel disease in the United States: A national survey. Aliment Pharmacol Ther 2007;26:1499-507.

Source of Support: Isfahan University of Medical Sciences, **Conflict of Interest:** None declared.