


ORIGINAL ARTICLE

Impact of dietary beliefs and practices on patients with inflammatory bowel disease: An observational study from India

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Abstract

Background and Aim: Patients with inflammatory bowel disease (IBD) are at a risk of nutritional deficits because of poor dietary beliefs and practices. There are no data on this aspect from Asia, which is experiencing a rise in IBD incidence. We aimed to establish dietary beliefs and practices in patients of IBD from India.

Methods: Patients with ulcerative colitis (UC) and Crohn's disease (CD) followed up between November 2016 and March 2017 were included. A questionnaire extracted information on the patients' sociodemographic, nutritional and disease profile, smoking and drinking habits, dietary beliefs and practices, current dietary preferences, intake and avoidance, dietary changes made after diagnosis of IBD, dietary changes made during relapse, frequency of consumption of major food groups, and the attitudes toward dietary advice.

Results: A total of 316 patients (218 UC and 98 CD; mean age: 38.5 ± 12.2 years) were included. Forty-four percent patients perceived food as a risk factor for IBD, 52% felt dietary habits to have a more important role than medicines in disease control, 77% reported certain foods improve symptoms during relapse, 86% had modified their diet since the diagnosis of IBD (UC > CD, $P = 0.04$), 90% imposed food restrictions, and <50% had received dietary counseling. About 40% of patients could not meet their dietary requirements and 66% had decreased their dietary intake since diagnosis, which further decreased during relapse (85%).

Conclusion: Dietary beliefs and practices play a central role in perception of disease in IBD patients. A large majority of them make dietary changes which can lead to undernutrition. Proper dietary counseling is required in these patients to prevent malnutrition.

Introduction

The pathogenesis of inflammatory bowel disease (IBD) involves a complex interaction of environment, genetics, and immune system, and diet forms an important part of environmental trigger.¹ Diet can influence pathogenesis and disease course in multiple ways: by acting as an antigenic stimulant and by modifying the gut microbiome.²⁻⁴ Diet is also perceived by many patients as an important trigger for relapse and many patients do modify their diet with various phases of disease activity which may compromise their nutritional status. There has been a steady rise in the prevalence of IBD in India and other Asian countries and as per a recent report, the projected disease burden of IBD in India is second highest in the world after USA.^{5,6}

Although no definite data exist to support a specific diet in Crohn's disease (CD) or ulcerative colitis (UC) patients,⁷ patients with IBD are seen to have a wide range of nutritional

deficiencies, even those who are in clinical remission.⁸⁻¹⁰ Those with IBD often report of certain food items to have caused an exacerbation of their symptoms. Consequently, numerous unsubstantiated recommendations exist on dietary modifications for patients with IBD.^{7,11} Likewise, there is a paucity of research in the literature describing the dietary patterns of patients with CD and UC, whether these patterns differ between disease types^{12,13} and there is no such report from Asia.

Thus, this study aims to establish the dietary beliefs, practices, and dietary counseling seeking attitude in patients with IBD.

Methods

Patients. This cross-sectional observational study, conducted at the IBD Clinic, Department of Gastroenterology at All India

Institute of Medical Sciences (AIIMS), New Delhi, from November 2016 to March 2017, included consecutive patients with IBD more >18 years and with any disease activity. Operated patients and those refusing consent were excluded from the study. Institute ethics committee approved the study.

Study design. At first, using other previous studies conducted on the topic as an archetype,^{12,13} a questionnaire was drafted. The questionnaire was devised to extract information on the patients' sociodemographic profile, nutritional profile, disease profile, smoking and drinking habits, dietary beliefs and practices, current dietary preferences, intake and avoidance, dietary changes made after diagnosis of IBD, dietary changes made during relapse, frequency of consumption of major food groups, and the attitudes toward dietary advice. All interviews were conducted by the same researcher in person. The questionnaire extracted the following information from the patients.

Sociodemographic profile. Sociodemographic profile included age, gender, place of residence (categorized into North India, East India, and West/Central India), total number of family members, education of head of household, occupation of head of household, total family income per month, patient's education level (professional or honors, graduate or postgraduate, intermediate or post-high school diploma/high school certificate, middle school certificate/primary school certificate, and illiterate), patient's occupation (profession/semi-profession, clerical/ shop owner/farmer, skilled worker/semi-skilled worker/unskilled worker, and unemployed), and patient's income per month. Kuppuswamy Scale^{14,15} was used to calculate the socioeconomic status.

Nutritional profile. Body mass index (BMI) was used as an indicator of nutritional status. BMI was further classified into three broad categories of <18.5, 18.5–25, and >25 to aid statistical analysis.

Disease profile. Disease profile included type of disease, age at appearance of first symptoms, age at diagnosis, comorbidities such as diabetes mellitus, hypertension, thyroid disease, or heart disease, and disease activity indices. The Simple Clinical Colitis Activity Index (SCCAI)¹⁶ was utilized for UC and Crohn's Disease Activity Index (CDAI)¹⁷ for CD.

Personal habits. Personal habits included smoking (whether the patient has never smoked, is an ex-smoker, or a current smoker) and alcohol (whether the patient never drinks, is an ex-drinker, or a current drinker).

Dietary beliefs and behavior. These were established with the help of 15 questions to be answered by the patients in either a yes, no, or don't know. To aid statistical analysis, patients who answered "don't know" for questions 1, 6, 7, 8, 13, 14, and 15 were not considered when analyzing the results for associations. Patients were asked about their previous and current dietary preference, that is: vegetarian, non-vegetarian, or egg vegetarian. Information was also gathered about particular food items excluded and any dietary changes after diagnosis of IBD and during relapse.

Current dietary intake. The numbers of major meals and minor meals currently consumed per day were asked. Additionally, the frequency of consumption of major food groups was assessed. Patients who reported to have consumed a food item seldom than once a month were considered to not be consuming that item. For each of the food items, the patients were categorized into three major categories according to the frequency of consumption, that is not consuming the food item at all, consuming the food item for less than 16 days/month (not meeting the dietary requirement), and consuming the food item for more than 16 days/month (meeting the dietary requirement).

Statistical analysis. Student's *t*-test was used for comparison of mean in case of parametric continuous variables, Wilcoxon rank-sum test was used to compare the median in case of non-parametric continuous variables, and the chi-square (χ^2) test was used for comparison of categorical variables. One-way ANOVA was used to analyze the results where parametric continuous variables were compared with categorical variables with more than two groups and Kruskal–Wallis test was used to compare non-parametric categorical variables with categorical variables with more than two groups. Data were analyzed using Stata software (version 11.0) (StataCorp., College Station, TX, USA). A *P*-value of <0.05 was considered as statistically significant.

Results

Clinical, sociodemographic, and personal characteristics. A total of 316 patients participated in the study (Table 1). Of these 316 patients, 54.1% were males and 70% had UC. The mean age of the entire cohort was 38.5 ± 12.2 years. The time elapsed between appearance of first symptoms and diagnosis was slightly longer in CD patients ($P < 0.001$). There was no statistically significant difference in the age, gender, duration of disease, comorbidities, and BMI between the two IBD subtypes.

A total of 28 (8.9%) patients were ex-smokers and 7 (2.2%) were current smokers. Seventeen (5.4%) had quit drinking while four (1.3%) said they still drink. There were significantly more CD patients who reported to be ex- or current smokers ($P = 0.008$), while there was no significant difference in the number of ex- or current drinkers.

Majority of the patients were from North India (245, 77.5%). Highest level of education was high school for 98 (31.0%) respondents and college for 97 (30.7%). The patient's education, patient's occupation, socioeconomic status, and total number of family members were statistically insignificant between UC and CD patients, whereas the patient's income ($P = 0.001$) and the per capita income ($P = 0.028$) were slightly higher for CD patients.

Dietary beliefs. Two hundred and thirty-eight (75.3%) patients believed that dietary behavior is perceived to cause weakness, malnutrition, and other deficiency disorders (Question 1) (Table 2). One hundred and forty (44.3%) patients perceived food as a risk factor for IBD (Question 6). Dietary habits were perceived to have a more important role than medicines in the control of IBD in 165 (52.2%) patients (Question 7). IBD was

Table 1 Clinical, dietary, and personal profile of the patients with inflammatory bowel disease

Variables	Ulcerative colitis (n = 218)	Crohn's disease (n = 98)
Age (years)	37.64 ± 12.23	40.5 ± 14.59
Gender (male), n (%)	118 (54.13)	53 (54.08)
Age at which symptoms appeared (years)	31.45 ± 11.18	34.22 ± 14.22
Age at diagnosis (years)	32.76 ± 10.98	37.03 ± 14.65*
Duration of disease (years)	6.19 ± 5.97	6.28 ± 4.93
Comorbidities, n (%)		
Diabetes mellitus	7 (3.21)	6 (6.12)
Hypertension	4 (1.83)	4 (4.08)
Thyroid disease	3 (1.38)	3 (3.06)
Heart disease	1 (0.46)	0 (0.00)
Crohn's Disease Activity Index, n (%)		
Remission (<150)		50 (51.02)
Mild (150–220)		22 (22.45)
Moderate (220–450)		25 (25.51)
Severe (>450)		1 (1.02)
Simple Clinical Colitis Activity Index, n (%)		
Remission (0–2)	130 (59.63)	
Active disease (>2)	88 (40.37)	
Vegetarian	115 (52.75)	40 (40.82)
Non-vegetarian	78 (35.78)	47 (47.96)
Eggetarian	25 (11.47)	11 (11.22)
BMI (kg/m ²)	21.60 ± 4.33	20.98 ± 4.29
BMI (kg/m ²), n (%)		
<18.5	55 (25.23)	34 (34.69)
18.5–25	118 (54.13)	53 (54.08)
>25	45 (20.64)	11 (11.22)
Smoking, n (%)		
Never smoked	199 (91.28)	82 (83.67)
Ex-smoker	18 (8.26)	10 (10.20)*
Currently smoking	1 (0.46)	6 (6.12)*
Alcohol, n (%)		
Never/occasional	207 (94.95)	8 (8.08)
Ex-drinker	10 (4.59)	7 (7.14)
Current drinker	1 (0.46)	3 (3.06)

* $P < 0.05$, P -values were >0.05 for rest of the comparisons.

Continuous variables are expressed as mean ± SD. Numbers in parentheses indicate percentage.

BMI, body mass index.

thought to affect appetite and pleasure in eating in case of 208 (65.8%) patients (Question 8). Two hundred and forty-four (77.2%) patients reported that certain foods improve symptoms in case of relapse (Question 13) including lentils (especially split green gram), khichdi (a South Asian preparation made from lentils and rice), oatmeal, curd, buttermilk, rice, Indian flatbread, bottle gourd, and sponge gourd (Table 2).

Dietary practices. Most respondents were vegetarian (155, 49.1%) and 125 (39.6%) were non-vegetarians; the rest were eggetarian (Table 1). There was no difference in the dietary preferences of the UC and CD patients (Table 2). Two hundred and eleven (66.8%) patients reported taking vitamin and mineral

supplements/injections. Alternative therapies or herbal medications for IBD were reported by 83 (26.3%) patients. Nutritional supplements were being taken by 21 (6.7%) patients and fiber supplements by 70 (22.2%) patients. A significantly more number of UC patients were taking fiber supplements as compared to CD patients ($P = 0.049$). Most patients (227, 71.8%) shared the same menu as the other members of the family. Two hundred and forty-eight (78.5%) refused outdoor dining for fear of causing relapse. Two hundred and seventy-one (85.76) patients had modified their diet since the diagnosis of IBD (UC > CD, $P = 0.04$). Food restrictions were imposed by 284 (89.9%) patients in the belief that this could prevent a relapse (Table 3). While more CD patients avoided raw fruits ($P = 0.002$), more UC patients avoided dairy products ($P = 0.013$). Restricting a particular food item was associated with other items as well, the details of which are mentioned in Tables S1 and S2 (Supporting information). One hundred and forty-one (44.6%) patients reported to have received dietary advice and 285 (90.2%) were keen on receiving nutritional advice (Table 2). Most patients also restricted common Indian spices and condiments and some patients restricted sugar (46, 14.6%) and cooking oil (31, 9.8%) (Table 4). The number of major meals consumed per day at the time of questionnaire was 2.70 ± 0.61 , whereas minor meals were 1.09 ± 1.08 (Table 5). Most of the patients met their dietary requirements for cereals (312, 98.7%), whereas dietary requirements for other food items were not met by many patients (Table 4).

Changes in diet after diagnosis of IBD and during relapse. Eight (2.5%) patients (all UC) changed their dietary preferences from non-vegetarian to vegetarian and eight (2.5%, seven UC and one CD) changed from a non-vegetarian diet to an eggetarian diet after the diagnosis of IBD. One hundred and fifty-two (48.1%) patients reported an increase, whereas 28 (8.9%) reported a decrease in water consumption (Table 6). Most patients (209, 66.14) had decreased the amount of food consumed per sitting since their diagnosis. Average number of major meals consumed per day was 2.89 ± 0.57 prior to diagnosis and 2.70 ± 0.65 after diagnosis (Table 6).

Majority of patients reported a decrease in the amount of food consumed per sitting in the relapse state (267, 84.49%). When in remission, patients reported to consume an average of 2.71 ± 0.65 major meals per day which dropped to 1.62 ± 1.15 during relapse (Table 6).

Factors affecting dietary behavior

Age. Mean age of those not meeting their dietary requirements of cereals was significantly higher (55.75 ± 8.30) as compared to those who were adequate with their consumption (38.31 ± 12.96) ($P = 0.0077$).

Gender. More male respondents (62.68% vs 43.97% females [$P = 0.003$]) believed diet could be the initiating factor for IBD and that dietary habits have a more important role than medicines in the control of IBD (59.41% vs 47.06% females [$P = 0.031$]).

Socioeconomic status. Patients belonging to higher socioeconomic classes were more often found to be taking alternative therapies or herbal medications for IBD: upper (46.67%), upper middle

Table 2 Results on dietary beliefs and practices in patients with IBD

	Variables	Ulcerative colitis (n = 218)	Crohn's disease (n = 98)
Q1. Do you believe that your dietary behavior can cause weakness, malnutrition, and other deficiency disorders?	Yes	160 (73.39)	78 (79.59)
	Don't know	1 (0.46)	1 (1.02)
Q2. Do you take any vitamin and mineral supplements/ injections?	Yes	139 (63.76)	72 (73.47)
Q3. Do you take any alternative therapies or herbal medications for IBD (ayurvedic, homeopathic, choorans, and chawanprash)?	Yes	59 (27.06)	24 (24.49)
Q4. Do you take nutritional supplements?	Yes	11 (5.05)	10 (10.20)
Q5. Do you take fiber supplements?	Yes	55 (25.23)	15 (15.31)
Q6. Do you believe that diet could be the initiating factor for IBD?	Yes	98 (44.95)	42 (42.86)
	Don't know	36 (16.51)	22 (22.45)
Q7. Do you consider dietary habits to have a more important role than medicines in the control of IBD?	Yes	114 (52.29)	51 (52.04)
	Don't know	8 (3.67)	2 (2.04)
Q8. Do you think that IBD affects your appetite and pleasure in eating?	Yes	147 (67.43)	61 (62.24)
	Don't know	2 (0.92)	0 (0.00)
Q9. Do you share the same menu as the other members of the family living under the same roof?	Yes	150 (68.81)	77 (78.57)
Q10. Do you refuse outdoor dining for fear of causing relapse?	Yes	175 (80.28)	73 (74.49)
Q11. Have you modified your diet since the diagnosis of your IBD?	Yes	193 (88.53)	78 (79.59)*
Q12. Do you tend to avoid certain foods?	Yes	198 (90.83)	86 (87.76)
Q13. During a relapse in IBD, do certain foods improve your symptoms?	Yes	174 (79.82)	70 (71.43)
	Don't Know	4 (1.83)	0 (0.00)
Q14. Have you received any advice on your diet?	Yes	91 (41.74)	50 (51.02)
	Don't know	1 (0.46)	0 (0.00)
Q15. Would you be keen on receiving some nutritional advice?	Yes	199 (91.28)	86 (87.76)
	Don't know	2 (0.92)	0 (0.00)

* $P < 0.05$.

IBD, inflammatory bowel disease.

(28.47%), lower middle (17.95%), and upper lower (23.53%); none of the patients belonging to the lower socioeconomic class were taking alternative therapies or herbal medications ($P = 0.028$).

Total number of family members. Those with fewer family members considered dietary habits to have a more important role than medicines in the control of IBD ($P = 0.02$).

Disease activity. IBD affected the appetite and pleasure in eating more so for those in relapse (75%) as compared to those in remission (62.8%) ($P = 0.04$). Patients in relapse made more modifications in their diet and were avoiding certain food more

(92.65% vs 80.56% of those in remission [$P = 0.002$]; 94.85% vs 86.11% [$P = 0.011$], respectively).

Body mass index. More underweight (BMI < 18.5 kg/m²) patients believed that dietary behavior can cause weakness, malnutrition, and other deficiency disorders (83.91% vs 72.69%, $P = 0.038$); dietary habits have a more important role than medicines in the control of IBD (55.81% vs 42.27%, $P = 0.033$); and IBD affects their appetite and pleasure in eating (75.00% vs 62.83%, $P = 0.041$). Underweight patients were more likely to be taking nutrition supplements (13.48% vs 3.96%, $P = 0.002$).

Table 3 Food exclusion pattern in patients with IBD

Food items	IBD (n = 316)	Ulcerative colitis (n = 218)	Crohn's disease (n = 98)	P-value
Spicy	268 (84.8)	188 (86.24)	80 (81.63)	0.291
Greasy and fatty food	264 (83.5)	184 (84.40)	80 (81.63)	0.539
Raw vegetables	93 (29.4)	63 (28.90)	30 (30.61)	0.757
Raw fruits	50 (15.8)	25 (11.47)	25 (25.51)	0.002
Whole pulses	105 (33.2)	69 (31.65)	36 (36.73)	0.375
Dairy products	149 (47.2)	113 (51.83)	36 (36.73)	0.013
Coffee	177 (56.0)	130 (59.63)	47 (47.96)	0.053
Tea	99 (31.3)	73 (33.49)	26 (26.53)	0.218
Carbonated beverages	199 (62.9)	135 (61.93)	64 (65.31)	0.565
Alcohol	19 (90.5)	11 (100)	8 (80)	0.119

p value between Ulcerative colitis and Crohn's disease.

IBD, inflammatory bowel disease.

Table 4 Data on restriction of condiments and spices and adequacy of particular food items in patients with inflammatory bowel disease

	Ulcerative colitis (n = 218)	Crohn's disease (n = 98)
Restriction of condiments and spices		
Red chili	141 (64.68)	53 (54.08)
Garam masala	137 (62.84)	48 (48.98)
Chaat masala	187 (85.78)	78 (79.59)
Dried mango powder	191 (87.61)	79 (80.61)
Ready-made spices	155 (71.10)	63 (64.29)
Sugar	31 (14.22)	15 (15.31)
Oil for cooking	23 (10.55)	8 (8.16)
Adequacy of particular food items		
Cereals	217 (99.54)	95 (96.94)
Pulses	128 (58.72)	60 (61.22)
Vegetables	142 (65.14)	59 (60.20)
Fruits	116 (53.21)	54 (55.10)
Milk and milk products	136 (62.39)	73 (74.79), P = 0.035
Sugars	185 (87.68) [†]	80 (86.96) [‡]
Oils	195 (89.45)	90 (91.84)
Meat and eggs	25 (24.27) [§]	22 (37.93) [¶]

[†]n = 211.[‡]n = 92.[§]n = 103.[¶]n = 58.

Discussion

The present study has evaluated the dietary beliefs and practices in a large cohort of IBD patients in a tertiary care center from North India. This is the first such report from Asia, especially when this region is experiencing a rise in disease burden of IBD.⁶ Diet is an important component of the management plan of any disease and in case of IBD there are many perspectives to diet as perceived by both patient and the physician: as a

triggering agent for IBD, as a part of therapeutic strategy, and as a component of nutritional plan.

Almost half of our patients perceived food as a risk factor for IBD and felt diet to be more important than medicines in the control of IBD. Because of this, food restrictions were imposed by ~90% of patients, 85% patients had modified their diet after the diagnosis of IBD, and 78% patients refused outdoor eating for fear of causing relapse. Among the restricted food items, spices, greasy, and fatty foods were the most common being restricted in ~80% of patients. This was followed by carbonated beverages, coffee, dairy products, tea, and whole pulses being avoided in 30–60% of patients. Raw fruits and vegetables were avoided in 15–30% of patients. Jowett *et al.* in a study from UK showed that 68% of patients believed that diet was relevant to their disease, 49% avoided certain foods, and 39% thought certain foods triggered a relapse.¹⁸ Zallot *et al.* reported that 16% of patients felt that the diet could initiate the disease and 60% believed that food could be a trigger for relapse and 22% reported refusing outdoor dining for fear of causing relapse.¹³ In a recent study from UK,¹² Limdi *et al.* reported a similar proportion of patients thought diet to be a risk factor for IBD, but unlike our study lower numbers felt diet to be more important than medicines in disease control (28% vs 52%). Lower proportion of patients in that study had modified their diet (57% vs 85%) and restricted their food (68% vs 90%) in comparison to the present study. The proportion of patients who avoided outside food was much higher in the present study as compared to studies by Limdi *et al.* and Zallot *et al.* (78% vs 22% vs 22%). Unlike the previous studies, we also analyzed the dietary practices in relation to disease activity: patients in relapse made more modifications in their diet and were avoiding certain food more.

About two-third of the patients took vitamin and mineral supplements in the present study. One-fourth of the patients took alternative medicines for IBD and the proportion of patients taking alternative medicines was highest in the highest socioeconomic subgroup. Nutritional and fiber supplements were taken by 6.7% and 22% patients, respectively. Fiber intake was more in UC than in CD patients. In the recent study from UK,¹² 40%

Table 5 Dietary practices at the time of administration of questionnaire

	Variables	Ulcerative colitis (n = 218)	Crohn's disease (n = 98)
Number of meals per day	Major meals	2.71 ± 0.59	2.66 ± 0.66
	Minor meals	1.07 ± 1.12	1.14 ± 0.99
Frequency of consumption of major food groups (days/month)	Roti	29.58 ± 2.83 (n = 214)	29.81 ± 1.86 (n = 94)
	Rice	17.87 ± 11.90 (n = 204)	19.75 ± 11.72 (n = 92)
	Washed pulses	16.87 ± 10.93 (n = 204)	17.43 ± 11.04 (n = 98)
	Whole pulses	8.04 ± 6.78 (n = 157)	6.48 ± 4.78 (n = 62)
	Root vegetables	18.27 ± 10.53 (n = 211)	17.92 ± 10.36 (n = 93)
	Green leafy vegetables	12.73 ± 9.40 (n = 191)	10.43 ± 8.66 (n = 86)
	Other vegetables	10.43 ± 8.78 (n = 191)	11.48 ± 9.41 (n = 90)
	Milk	23.17 ± 10.61 (n = 103)	26.07 ± 8.96 (n = 69)
	Curd	18.28 ± 11.74 (n = 174)	19.05 ± 11.95 (n = 75)
	Paneer	5.27 ± 6.58 (n = 143)	5.09 ± 5.51 (n = 70)
	Fruits	19.40 ± 11.32 (n = 202)	21.15 ± 10.54 (n = 86)
	Non-vegetarian food	6.07 ± 6.86 (n = 67)	8.47 ± 9.27 (n = 43)
	Egg	10.63 ± 10.60 (n = 83)	12.28 ± 11.34 (n = 53)
Beverage intake	Coffee (days/month)	8.92 ± 11.13 (n = 49)	8.95 ± 10.41 (n = 41)
	Number of cups of tea/day	2.02 ± 1.32 (n = 160)	2.19 ± 1.45 (n = 76)

Table 6 Changes in dietary practices after the diagnosis of IBD and during relapse

	Ulcerative colitis (n = 218)		Crohn's disease (n = 98)	
	Pre-diagnosis	Post-diagnosis	Pre-diagnosis	Post-diagnosis
Changes in dietary practices after the diagnosis of IBD				
Dietary preferences				
Non-vegetarian to vegetarian		8 (3.67)		0 (0.00)
Non-vegetarian to eggetarian		7 (3.21)		1 (1.02)
Water intake				
No change		90 (41.28)		46 (46.94)
Increased		109 (50.00)		43 (43.88)
Decreased		19 (8.72)		9 (9.18)
Amount of food consumed per sitting				
No change		67 (30.73)		20 (20.41)
Increased		13 (5.96)		7 (7.14)
Decreased		138 (63.30)		71 (72.45)
Number of major meals per day	2.90 ± 0.57	2.72 ± 0.65	2.86 ± 0.57	2.66 ± 0.67
Changes in dietary practices during relapse				
	Remission	Relapse	Remission	Relapse
Amount consumed per sitting				
No change		32 (14.68)		11 (11.22)
Increased		3 (1.38)		3 (3.06)
Decreased		183 (83.94)		84 (85.71)
Number of major meals per day	2.73 ± 0.64	1.71 ± 1.15	2.66 ± 0.67	1.42 ± 1.15

Values expressed as frequency (%) and mean±SD.

IBD, inflammatory bowel disease.

of patients were on vitamin supplements and only 6% of patients were on alternative medicines. More than 70% of patients shared the same menu as other members of the family in the present study as well as studies by Limdi *et al.* and Zallot *et al.*^{12,13}

Three-fourth of our patients believed dietary behavior to cause weakness, malnutrition, and other deficiency disorders. In two-third patients, IBD was thought to affect appetite and pleasure in eating and three-fourth patients thought that certain foods improve symptoms in case of relapse including lentils, khichdi, oatmeal, curd, buttermilk, rice, Indian flatbread, bottle gourd, and sponge gourd. In the earliest study by Jowett *et al.*,¹⁸ 22% of patients felt that fiber-rich foods were helpful for their colitis. In the study by Zallot *et al.*,¹³ one-third felt that dietary behavior in IBD can cause nutritional and vitamin deficiency, and half felt that disease had changed their pleasure of eating. In the UK study also, 73% of patients felt that disease had changed their pleasure in eating.¹² However, as compared to present study, only 16% felt that certain foods can improve their symptoms in case of relapse including high and low fiber food and starch-rich foods.

Most of the patients had decreased their dietary intake after the diagnosis of IBD and this further decreased to almost half during the phase of relapse. Many patients changed their dietary preference from non-vegetarian to vegetarian/eggetarian after diagnosis of IBD. Because of the decrease in nutritional intake, except for cereals, the dietary requirements of other food items were not met by many patients. Similarly, Zallot *et al.*¹³ also showed that there was a significant decrease in appetite during relapse with only one-fourth of the patients having a normal diet, and decrease in appetite was also documented in the study by Limdi *et al.*¹²

Only half of the patients had received any advice regarding their diet as compared to 33%, 73%, and 50% patients in the studies

by Jowett *et al.*, Zallot *et al.*, and Limdi *et al.*, and more than 90% patients in the present study and 67% patients in the study by Limdi *et al.* were keen on receiving any nutritional advice.

Therefore, in general, the dietary beliefs, behavior, and practices in patients with IBD are similar between West and the East, with a few differences in the proportion of patients with such beliefs and behaviors. These differences could be explained by differences in the populations and ethnicity. Most of the patients in the recent study from UK were non-vegetarians (88%) as compared to only 40% patients in the present study. In the same study, the results from the Asian-British population matched the Indian data with a similar proportion believing diet to have a more important role than medicines in the control of IBD (52% vs 49%), and similar proportion restricting their diet (89% vs 90%) and refusing outdoor dining (76% vs 49%) as compared to the entire cohort.

These dietary behaviors do have a major impact on the nutritional status and quality of life of these patients. The diet of these patients was inadequate in up to 40% of patients in terms of pulses, fruits, vegetables, and dairy products and up to 25% of patients were undernourished (BMI < 18.5 kg/m²), with CD patients being more undernourished than UC patients (35% vs 25%). BMI underestimates the nutritional status in comparison to other nutritional parameters such as body fat and lean mass. Therefore, the proportion of patients with undernourishment would have been more than estimated.

The study is limited by its origin from a tertiary care single center which would have led to a referral bias with sicker and more undernourished patients and would not directly reflect overall IBD population of India. However, this is the first such study from Asia and highlights the importance of dietary counseling in patients with IBD.

To conclude, many IBD patients do not meet their dietary requirements because of dietary beliefs and practices; only half receive any dietary advice and there is a need for proper dietary intervention to optimize the management of IBD patients.

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Supporting information

Additional supporting information may be found in the online version of this article at the publisher's website:

Table S1 Patterns of food exclusion in patients with inflammatory bowel disease during any state of disease activity.

Table S2 Patterns of food exclusion in patients with inflammatory bowel disease during remission.