

Association of Dietary Factors With Ulcerative Colitis in India

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ABSTRACT

AIM: Western studies associate high intake of fat, animal protein, refined sugars and low intake of fruits and green vegetables with causation of ulcerative colitis. Indian data on such association is scanty.

METHODS: 50 consecutive patients of ulcerative colitis were compared to 50 age and sex matched normal controls with respect to their demographic and nutritional parameters (based on commonly consumed food items in the region) in this prospective case control study. Food groups enquired for were meat, fish, cereals, fruits, green leafy vegetables, fried foods, refined sugar and tea/coffee and their intake was estimated semiquantitatively by a questionnaire. Univariate and multivariate analysis of the parameters was carried out to detect the association of any with ulcerative colitis at significance level $p < 0.05$.

RESULTS: Low intake of fruits (odds ratio 0.28 for the lowest intake level) and high intake of refined sugar (odds ratio 1.78 for the highest intake level) were the only significant factors associated with occurrence of ulcerative colitis on both univariate and multivariate analysis. None of the patients were pure vegetarians.

CONCLUSION: This initial study showed association of ulcerative colitis with similar food items in India as in the West despite vast difference in dietary practices.

INTRODUCTION

Incidence of inflammatory bowel disease (IBD) is increasing all over the world as it has been in India in the last two decades^[1-4]. Etiology of IBD is multifactorial and includes a genetic predisposition which is acted upon by host and environmental factors like the microbiome, immune system, diet and nutritional status, smoking, superclean hygiene (hypersterile environment) and increased antibiotic intake in infancy. The issue of diet in causation of IBD is complex--- diet can alter gut microbiome (enterotype), modulate immune system (via altered IL-10, TGF Beta) or act through epigenetic mechanisms or food additives and allergy. Overall nutritional status of the host is also important. Though epidemiologic studies from the West indicate environmental factors to be more important in ulcerative colitis (UC) than Crohn's disease, evidence for causation is weak due to conflicting results of studies. Other methodology associated confounders in relation to diet include retrospective nature of studies and fallacy in dietary history recall, uncertainty about the exact time of onset of UC depending on symptoms, change in diet after symptom onset (without being involved in etiology)^[1]. This is compounded by extreme day to day variation in type, amount and frequency of food consumption in modern times (making estimate of average daily consumption extremely difficult if not entirely impossible), interplay of different dietary components together rather than a single item in disease causation and bias introduced by diet commonly consumed in a particular region.

Various dietary factors implicated in causation of UC in Western

studies include increased intake of animal protein (especially processed red meat) and margarine which are rich in linoleic acid, sugar and sugar containing foods, total fat and polyunsaturated fatty acids, omega 6 fatty acid and decreased intake of fruits and vegetables^[1,2]. The dietary practices in India are very different from the West. The present study endeavours to address some of the above dietary issues for UC in India as data is scarce and limited to animal studies^[5,6].

MATERIALS AND METHODS

This is a prospective case control study where the nutritional data of 50 consecutive patients of UC (who had their disease diagnosed by colonoscopy and biopsy) attending the gastroenterology clinic of the hospital from 2003 to 2013 were compared with 50 age and sex matched normal controls from the same region. Demographic parameters (Table 1) were noted. Dietary history before the index bleed per rectum was considered so it was prediagnosis and pretherapy for all subjects. Any patient with already long standing disease at entry was excluded as fallacious dietary recall was more likely. Patients suffering from other problems likely to curtail normal food intake before diagnosis of UC were also excluded. 5(10%), 15(30%) and 30(60%) patients had proctitis, left sided colitis and pancolitis respectively. As subjects do not measure the exact weight of the food items consumed, intake was estimated from dietary recall coupled to a food frequency questionnaire made on a semiquantitative scale arbitrarily depending on the predominant local dietary pattern (as given in table 2).

Items enquired for were (a) rice, (b) wheat (chapati, nan, paratha, bread, puri), (c) meat, (d) fish, (e) fried foods, (f) commonly available and eaten fruits [including both citrus and non-citrus variety e.g mango, litchi, berries, banana, bael, custard apple, melon, date, raisins, grapes, jackfruit, apple, papaya, plum, guava, pomegranate] and (g) vegetables both raw and cooked including cruciferous vegetables [cabbage, broccoli, cauliflower], green leafy vegetables [amaranth, spinach, palak, coriander and curry leaves, mint, Ipomoea stem] and other vegetables [fig, brinjal, cucumber, tomato, onion, chilli varieties, plantain, beet, garlic, ginger, peas, ladies' fingers, carrot, pumpkin, gourd varieties, radish, beans, perbol, salads and mixed vegetables]. As the local custom is to eat at least some vegetable with each meal, such difference was measured only for green leafy vegetables. For each fruit or vegetable, a usual serving size was specified and the individuals were asked to estimate the usual frequency (number of times in a day, week, month, year i.e seasonal or year round) on average, during the previous year they had consumed that amount. Common household measures such as cups, bowls, spoons (for cooked vegetables), wedges (to estimate slices of fruits) were shown to assist the individuals in the estimation process. Data on the average seasonal availability (in months) of such fruit and vegetables were obtained from local vendors. These values were used to convert reported seasonal intakes into average daily intake throughout the year for each subject.

Naturally occurring sugar are (1) simple carbohydrates including monosaccharides [glucose, galactose and fructose found in fruits and vegetables] and disaccharides [lactose in milk, maltose in malt and sucrose found in sugarcane, beets, honey]. (2) complex carbohydrates e.g starch found in roots and tubers. Refined sugars (usually glucose and sucrose) are also added to food during processing or preparation e.g. colas, syrups, sweets, chocolates, bakery etc. Since most of the food items mentioned above contain sugar in some form and the practical impossibility of quantifying exact total sugar intake in an individual daily, we considered only the intake of refined sugar.

Table 1 Demographic parameters (univariate analysis).

Items	Cases	Controls	P value
Age+S,D (Range) in years	51.3+13.5 (18-75)	50.5+12.3 (20-73)	0.95
Sex			0.84
Male	30	30	
Female	20	20	
Socioeconomic status			0.79
High	3	4	
Middle	38	35	
Low	9	11	
Smoker	19	25	0.83
Non smoker	31	25	
Alcohol consumer	6	10	0.41
Teetotaler	44	40	
Appendectomy	1	1	1

Table 2 Univariate analysis of food items between cases and controls.

Items	Cases	Controls	P value
Rice			
>75% meals	21	21	
50-75% meals	22	20	0.87
25-50% meals	5	5	
<25% meals	2	4	
Wheat			
>75% meals	3	3	
50-75% meals	5	6	0.97
25-50% meals	22	23	
<25% meals	20	18	
Meat			
< 1 day/week	35	32	
1-2 days/week	13	16	0.93
3-4 days/week	1	1	
> 5days/week	1	1	
Fish			
< 1 day/week	5	6	
1-2 days/week	11	9	0.81
3-4 days/week	6	9	
> 5days/week	28	26	
Fried food			
< 1 day/week	23	24	
1-2 days/week	23	22	0.98
3-4 days/week	3	4	
> 5days/week	1	1	
Fruits			
< 1 day/week	27	19	
1-2 days/week	16	12	0.046*
3-4 days/week	4	14	
> 5days/week	3	5	
Green vegetables			
< 1 day/week	3	6	
1-2 days/week	33	19	0.05
3-4 days/week	11	20	
> 5days/week	3	5	
Sugar			
1-3 tsf/day	1	2	
4-6 tsf/day	28	14	0.043*
7-9 tsf/day	14	24	
> 10 tsf/day	7	10	
Tea/coffee			
1-2 cups/day	10	8	
3-5 cups/day	26	21	0.77
6-9 cups/day	10	16	
> 10 cups/day	4	5	

*significant at $p < 0.05$.

For this number of teaspoonful (tsf) of sugar added to tea/coffee, household daily cooking on average, consumption of sweets, colas, bakery was enquired. The average daily intake was calculated as for fruits and vegetables. Conversion to tsf was done by Formula 1 tsf = 5 gm. Number of cups of tea/coffee consumed per day was noted as also history of smoking, any amount of alcohol intake or appendectomy.

Statistics

Result were expressed as mean + standard deviation (S.D.) for continuous variables and proportions for discrete variables and data comparison was done by Student's 't' test and Kruskal Wallis test for multiple proportions respectively for these variables. Binary logistic regression analysis (with both forward and backward conditional method) was employed with all variables together (age, sex, socioeconomic status, smoking status, alcohol consumption, intake of rice, wheat, meat, fish, green vegetables, fried foods, fruits, sugar, tea/coffee) to detect true impact of any. A *p* value <0.05 was considered significant. Data were evaluated using SPSS version 13.

The study was approved by the hospital ethics committee and all patients consented to be included in study.

RESULTS

None of our patients were pure vegetarians and all used mustard oil as most common cooking medium. Demographic parameters are expressed in Table 1. There was no difference of smoking, alcohol consumption, socioeconomic status and appendectomy rates between cases and controls. Among patients with UC, the difference between number of smokers and non smokers was not statistically significant (*p*=0.09). However number of smokers in the severe group (7/30=23.3%) was much lower than the mild (4/5=75%) and moderate (8/15=53.3%) groups. Table 2 shows relation of intake of different food items to UC. Though number of UC cases appears to increase with higher rice, fish and lower wheat, meat and fried food intake, but these differences are not significant compared to controls highlighting the importance of predominant dietary pattern of the area in introduction of bias. Low intake of fruit and high intake of sugar were the only significant factors on univariate analysis showing an association with UC whereas a low intake of green leafy vegetables tended towards an association with UC.

On multivariate analysis, low intake of fruit (*p*=0.03) and high intake of sugar (*p*=0.02) were the only significant factors. The odds ratio (confidence interval) for development of UC was 0.28 (0.15-0.65) for the lowest fruit intake and 1.78 (1.03-6.4) for the highest sugar intake.

DISCUSSION

A clear rise in number of cases of UC in previously low incidence areas (Asia) and in successive generation of migrants from these countries to high incidence Western countries clearly implicates adaptation to Western lifestyle (hence a possible role of diet) in the initiation and progression of the disease. There is also considerable epidemiological evidence showing correlations between incidence of UC and various dietary components. But association does not imply causation.

In the West, the factors having the strongest association with UC are increased intake of animal protein (especially processed red meat but not eggs or dairy products) and margarine which are rich in linoleic acid. Other factors implicated in causation of UC are high intake of total fat, polyunsaturated fatty acids (fish), omega 6 fatty acid, sugar and sugar containing foods and a decreased intake of fruits and vegetables. However evidence from interventional nutritional studies are much weaker.

The dietary practices in India are very different from the West. Raw cereals (rice and wheat) are the staple diet among majority of Indians. Apart from the pure vegans, most consume some vegetables portions also in their main meals. Among the non vegans, few consume meat every day. There is usually a daily variation between meat, fish or egg.

Apart from the cereals, most other food items are lightly fried before further cooking. Food is rarely consumed in processed form. There is culinary variation also among different regions of the country.

One should be aware of the predominant dietary pattern of a particular area which might influence the outcome of a study. For example the predominant food in the present study region is rice and fish with some vegetable but less of wheat and meat. Vegetables are rarely consumed in green, boiled form (which contains most of the protective ingredients), they are mostly fried lightly in oil with spice before cooking in water. This is well made out in the present study with progressively increasing number of UC cases with higher intakes of rice, fish and lower intakes of meat and wheat which is the reverse of the expected pattern. However this bias is eliminated after comparing with controls and regression analysis. Similarly it is interesting to note the dietary factors implicated in causation of UC in Western studies mentioned above are the predominant food consumed in these countries. But diet definitely affects symptom and course after IBD onset^[7-8].

The present study identified a significant probability of low fruit and high refined sugar intake to be associated with UC similar to other (including Asian) studies^[9-13]. The possible mechanism of protection is by antioxidant vitamins and fibres contained in these foods. Oxidative stress has been shown to induce tissue damage in IBD^[14]. Fibre affects the microbiome and may promote development of a favourable enterotype. It has been shown to block bacterial interaction with gut mucosa (including mucosa associated *E.coli*), a factor important in pathogenesis of IBD^[15]. It is also a source of short chain fatty acid after fermentation by colonic bacteria which is a nutrient for colonocyte^[16]. The mechanism by which high intake of refined food (like sugar here) causes UC is unclear. However meat and fish did not show any association unlike what is shown in studies from the West.

In conclusion, notwithstanding the small number of patients and other limitations of nutritional studies mentioned above, this initial proof of concept study shows an association of some food items with UC in India similar to the West. Despite vast difference in food practices, this commonality of food groups associated with UC might provide a stronger impetus for future community based nutritional studies involving larger number of patients to investigate causality.

CONFLICT OF INTERESTS

There are no conflicts of interest with regard to the present study.

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