



Original Article

Nutritional status and consumption of inflammatory and anti-inflammatory foods by patients with inflammatory bowel diseases



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ABSTRACT

Objective: Evaluation of nutritional status and consumption frequency of inflammatory and anti-inflammatory food by patients with inflammatory bowel diseases.

Methods: An observational study of the patients assisted by the interdisciplinary inflammatory bowel diseases ambulatory of UNIVALI-SC. The nutritional status of patients was evaluated and each patient was categorized according to his/her body mass index and also through a research questionnaire of the individual social-economy situation, life habits, and inflammatory and anti-inflammatory food consumption in a determinate period of time.

Results: Out of the 65 patients, 57% had Crohn's disease and 43% had ulcerative colitis. According to the disease activity, 71% were in remission and 29% in activity. Of the sample, 57% were classified as overweight. It was not possible to correlate nutritional status and type of inflammatory bowel diseases, nutritional status and income or nutritional status and level of education. The most inflammatory foods were beef (65%) and coffee (60%), while the anti-inflammatory ones were garlic (75%), olive oil (54%), and sweet potatoes (23%). There was no association between the most consumed inflammatory and anti-inflammatory food and body mass index.

Conclusion: According to the results, most of the patients were overweight. The most commonly consumed inflammatory foods were beef and coffee and the anti-inflammatory ones were garlic, olive oil, and sweet potatoes.

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Estado nutricional e consumo de alimentos inflamatórios e anti-inflamatórios por pacientes portadores de doenças inflamatórias intestinais

R E S U M O

Palavras-chave:

Doença de Crohn
Retocolite ulcerativa
Doenças inflamatórias intestinais
Consumo de alimentos

Objetivo: Avaliar o estado nutricional e a frequência de consumo de alimentos inflamatórios e anti-inflamatórios por portadores de doenças inflamatórias intestinais.

Metodologia: Estudo transversal com indivíduos assistidos pelo ambulatório interdisciplinar de doenças inflamatórias intestinais da UNIVALI-SC. Avaliados por meio do estado nutricional e classificados de acordo com o índice de massa corporal, bem como através de um questionário contendo dados socioeconômicos, hábitos de vida e frequência do consumo de alimentos inflamatórios e anti-inflamatórios.

Resultados: Dos 65 pacientes, 57% eram portadores de doença de Crohn e 43% de retocolite ulcerativa. De acordo com a atividade da doença, 71% encontravam-se em remissão e 29% em atividade. Da amostra, 57% foram classificados como acima do peso. Não foi possível correlacionar estado nutricional e o tipo de doenças inflamatórias intestinais, estado nutricional e renda ou estado nutricional e escolaridade. Os alimentos inflamatórios mais consumidos foram carne de gado (65%) e café (60%), já os anti-inflamatórios foram alho (75%), azeite de oliva (54%) e batata doce (23%). Não houve associação entre os alimentos inflamatórios e anti-inflamatórios mais consumidos e o índice de massa corporal.

Conclusão: Segundo os resultados, observou-se que a maioria dos pacientes apresentava excesso de peso. Os alimentos inflamatórios mais consumidos foram carne de gado e café e os anti-inflamatórios foram alho, azeite de oliva e batata doce.

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Introduction

Inflammatory Bowel Diseases (IBD), consisting of Crohn's disease (CD) and ulcerative colitis (UC), is characterized by chronic mucosal infection, need for frequent hospitalization and poor quality of life.¹ IBD symptoms may include abdominal pain, diarrhea, fatigue, weight loss, among others. These symptoms have a direct impact on patients' quality of life, as they are altered in their eating habits, psychological well-being and social aspects, such as relationships, school, work, and leisure.²

Both CD and UC present important nutritional changes, which are mainly related to disease activity. One purpose of diet therapy in IBD is the consumption of foods that decrease disease activity and improve nutritional status.³ Nutritional orientation is an important factor in intestinal microbiota homeostasis, as it directly influences organ composition and function, as well as providing immunity to the host by regulating and releasing intestinal hormones.⁴

Some foods such as pumpkin, sardines, olive oil and garlic, for example, are classified as anti-inflammatory foods and by consuming them there may be reductions in inflammatory processes and extra-intestinal manifestations, promoting a major impact on quality of life of IBD patients.⁵

Method

This is a descriptive, cross-sectional quantitative study in which individuals diagnosed with IBD were evaluated,

assisted by the Interdisciplinary IBD Outpatient Clinic of the Family and Community Health Unit (Unidade de Saúde Familiar e Comunitária – USFC) of Itajaí, SC, from August 2017 through June 2018.

The inclusion criteria were age over 18 years, written informed consent, and having a diagnosis of IBD. The study design was approved by the Research Ethics Committee, Opinion number 2.164.418, in August 2017.

Data collection was performed using a questionnaire, which included patients' identification, socioeconomic characteristics, lifestyle and health habits, type of IBD, signs and symptoms, seizure frequency, and disease activity data.

The socioeconomic classification of the evaluated patients was performed using the Brazil Economic Classification Criterion (Critério de Classificação Econômica Brasil), proposed by the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística – IBGE) and updated by the Brazilian Association of Research Companies (Associação Brasileira de Empresas de Pesquisa – ABEP), considering data such as family income and education.^{6,7}

Nutritional status was assessed by body weight measurements using a digital scale (WISO® W801) with 180 kg capacity and 0.1 kg accuracy. Subjects were evaluated wearing light clothing without shoes, standing in a static position in the center of the scale platform. Height (cm) was measured with the subject in the standing position, using a 2.00 m anthropometric ruler attached to a mechanical scale (WELMY® R-110). The anthropometric assessment was performed using the Body Mass Index (BMI) indicator and the nutritional status was classified according to the criteria proposed by the World

Health Organization for adults in order to obtain the nutritional diagnosis.⁸ For statistical purposes, nutritional status was re-categorized into normal weight and overweight.

To assess the frequency of inflammatory and anti-inflammatory food consumption, we applied a semi-quantitative Food Consumption Questionnaire, adapted from Odierno et al.⁹, dividing these foods into three categories of consumption: (1) non-consumption; (2) consumption up to 3 times a week; (3) consumption 3 or more times a week, which were tabulated and presented as a percentage of consumption.

Data collected in the research were tabulated with the aid of Microsoft Excel[®] and Word[®] software programs. The results are presented in tables, and statistical analysis was performed using the Statistica 13[®] software. Quantitative variables were calculated as means and standard deviations. Categorical variables were described by their absolute and relative frequencies. The association between categorical variables was tested using Pearson's chi-square test and, for quantitative variables, Spearman correlation was used. Differences were considered significant when $p \leq 0.05$.

Results

Sixty-five IBD patients were interviewed, most of them female (66%), with a mean age of 48 years. According to Table 1; 57% had CD and 43% had UC, and disease remission and disease activity were seen in 71% and 29%, respectively.

Among all patients evaluated, 43% ($n = 28$) were classified as eutrophic and 57% ($n = 37$) as overweight. The majority, 65% ($n = 42$), reported losing weight in the 6 months prior to the interview, and 38% (25) reported an average weight gain of 6 kg. It is noteworthy that 100% of patients received guidance from nutritionists.

The symptoms most frequently reported by UC patients were abdominal pain and distension, while CD patients reported abdominal and joint pain. The average time since diagnosis was 6.33 years.

Only 23% of the patients used biological medicines.

Of the participants who reported consuming alcohol (29%; $n = 19$), the average consumption was 0.35 drinks per week and the most cited drink was beer.

The frequency of consumption of anti-inflammatory and inflammatory foods is presented in Tables 2 and 3. The inflammatory foods most consumed by patients were beef (65%) and coffee (60%) and the anti-inflammatory ones were garlic (75%), olive oil (54%), and sweet potato (23%).

It was not possible to find a statistically significant association between nutritional status and type of IBD ($p = 0.97$), nutritional status and income ($p = 0.15$), and nutritional status and education ($p = 0.94$).

There was no correlation between the most consumed anti-inflammatory and inflammatory foods and BMI.

Discussion

Although the etiopathogenesis of IBD is still unknown, it is believed that diet has a significant influence on the development and progression of these diseases, as well as

epidemiological interactions, diet versus microbiota, with its protective/aggressive factors, and life habits.¹⁰

In this series, females account for 66% of the sample. A study by Betteridge et al.¹¹ assessing more than 35,000 IBD patients, found that the proportion of women is higher in both CD and UC. This prevalence is possibly due to hormonal factors that may interfere with the expression of inflammatory processes and disease.¹²

Income is an important variable to be evaluated, as it makes evident the possibility of acquiring the necessary items for self-care, such as food. Parente¹³ identified an average monthly income of R\$ 1,731.80 when analyzing the demographic characteristics and clinical phenotypes of IBD patients in Northeastern Brazil. This value, as well as that found in the present research, which was above R\$ 1,597.00 of nominal monthly household income per capita in 2017 in the state of SC according to the IBGE,⁶ may have contributed to the remission status of most respondents. This income may be related to education, since most patients had some access to education and have at least 8–10 years of schooling.

Some risk factors such as smoking and alcoholism increase the predisposition to IBD development. Although none of the patients interviewed reported smoking, 22% claimed to be former smokers. It is known that in CD, smoking is associated with more complications, increased steroid use, as well as a greater need for surgical treatment.¹⁴ In addition, certain chemical materials produced by tobacco can modify the way blood flows through the intestines, causing a restriction of blood flow within the intestinal walls.

Regarding alcoholism, 29% of respondents drunk alcohol. Alcohol intake irritates the gastrointestinal tract mucosa, leading to abdominal distension and increased susceptibility to bacterial infections. Although the average consumption among patients is small, the effects that alcohol can have on health may be severe and worsen the disease prognosis.¹⁵

Abdominal pain and distension are the most reported symptoms in the literature.^{16,17} Joint pain, which was reported as one of the three main complaints of patients, is also common because CD and UC involve other organs and systems through extraintestinal manifestations. The frequency of these manifestations ranges from 21% to 47% and is more common in CD patients.¹⁸

Patients lack differentiated attention to nutritional aspects. Studies show that nutritional status is associated with the severity with which IBD develops, resulting in a negative prognosis and impaired immune competence in these patients.¹⁹

Although all patients were evaluated by the nutritionists of the outpatient multidisciplinary team, 57% ($n = 37$) were diagnosed as overweight. Factors such as medication and lifestyle may directly influence this classification.

Diet is an important factor in improving nutritional status.²⁰ Some foods have anti and pro-inflammatory action, which makes diet a relevant factor also in the context of IBD prevention, treatment, development, and worsening.⁹

Beef was the most consumed inflammatory food by patients. Filippo et al.²¹ found a decrease in fecal short-chain fatty acids in Italian people eating a diet high in this animal protein. The byproducts of these acids (e.g., butyrate) are known to act by strengthening the mucosal barrier and reducing the risk of inflammation.^{22,23} Another study has

Table 1 – Characterization of patients treated at the Inflammatory Bowel Disease outpatient clinic of a School Health Service, Itajaí, SC, 2018.

Variables	UC		CD		Total	
	n	%	n	%	n	%
Smoking						
Yes	0	0	0	0	0	0
No	28	43	37	57	65	100
Former smoker	10	15	9	14	19	29
Alcoholism						
Yes	9	14	10	15	19	29
No	19	29	27	42	46	71
Most used drugs						
Mesalazine	22	34	15	23	37	57
Azathioprine	7	11	18	28	25	39

Income: Class C = from R\$ 1,874 to R\$ 9,370; Class D = from R\$ 937 to R\$ 1,874; Class E = up to R\$ 937. Education: Class A = 11 or more years; Class B = 8–10 years; Class C = 4–7 years; Class D = <4 years.

Table 2 – Frequency of anti-inflammatory food consumption of patients in the Inflammatory Bowel Diseases outpatient clinic of a School Health Service, Itajaí, SC, 2018.

Foods	Consumption ≥3 times a week		Consumption <3 times a week		Non-consumption	
	n	%	n	%	n	%
Pumpkin	6	9	42	65	17	26
Garlic	49	75	8	12	8	12
Tuna fish	3	5	19	29	43	66
Olive oil	35	54	7	11	23	35
Sweet potato	15	23	35	54	15	23
Yam	2	3	13	20	50	77
Green tea	11	17	7	11	47	72
Ginger	8	12	22	34	35	54
Guava	5	8	24	37	36	55
Honey	9	14	24	37	32	49
Walnuts	11	17	18	28	36	55
Omega 3	4	6	3	5	58	89
Propolis	5	8	6	9	54	83
Salmon	1	2	18	28	46	71
Sardine	7	11	29	45	29	45
Chia Seed	8	12	9	14	48	74

Table 3 – Frequency of inflammatory food consumption by patients in the Inflammatory Bowel Diseases outpatient clinic of a School Health Service, Itajaí, SC, 2018.

Foods	Consumption ≥3 times a week		Consumption <3 times a week		Non-consumption	
	n	%	n	%	n	%
Black coffee	39	60	2	3	24	37
Mate	8	12	9	14	48	74
Chocolate	2	3	23	35	40	62
Smoked foods	8	12	24	37	33	51
Chili	5	8	7	11	53	82
Beef	42	65	20	31	3	5
Monosodium glutamate (ajinomoto)	7	11	8	12	50	77
Lactose milk	7	11	8	12	50	77
Sweets	17	26	34	52	14	22

also shown that IBD patients have smaller amounts of fecal butyrate-producing bacteria compared to healthy people.²⁴

In a prospective study with 67,581 patients, Jantchou et al.²⁵ assessed the role of dietary macronutrients in the etiology of IBD and concluded that such bacterial changes may be a consequence of a diet rich in animal protein, increasing the risk of incident IBD.

Coffee was the second most consumed inflammatory food by respondents. Caffeine, an alkaloid present in coffee, has a mechanism of action structurally similar to that of the highly energetic adenosine molecule, which upon binding breakdown releases energy to cellular activities and can then connect to its receptors (A1, A2A), blocking them and triggering stimulating action.^{9,26}

Cited above as a proinflammatory substance, caffeine when administered during an acute inflammatory process in rats increased tissue damage evidenced by increased mRNA levels of TNF-alpha, TNF-beta, lymphotoxin-beta, IL-6, and IFN-gamma cytokines in the spleen and increased IFN-gamma in peripheral blood.⁹

Corroborating the present study findings, Ide and Lau²⁷ in an in vitro study reported that aged garlic extract and one of its main compounds (S-allylcysteine) inhibited Tumor Necrosis Factor- α (TNF- α) induced nuclear factor- κ B activation. Lee et al.²⁸ investigated four garlic sulfur compounds and found that all four considerably suppressed the production of inflammatory mediators, such as Nitric Oxide (NO), Prostaglandin E2 (PGE 2), IL-1 β and IL-6 interleukin expressions, and TNF- α messenger RNA (mRNA), showing that garlic can be considered a favorable therapeutic agent for IBD management.

Olive oil was one of the most consumed anti-inflammatory foods by respondents and its use is considered positive. Lundin et al.²⁹ reported that unsaturated fats increase the levels of Streptococci, Lactobacillus, Bifidobacterium, and Akkermansia muciniphila, which inhibit the Toll-like Receptor (TLR) molecules responsible for the recognition of microbial structures and signal generation, resulting in the production of proinflammatory cytokines.

Regarding sweet potato, Ishiguro et al.³⁰ reported that the roots are rich in polyphenols, derived from caffeoylquinic acids, which have anti-inflammatory activity.

Conclusion

From the results obtained, it was possible to observe that most patients were overweight. This may be related to the fact that most respondents were experiencing disease remission and because it is an outpatient population.

There was no correlation between nutritional status and income, education and type of IBD, as well as no correlation between the most consumed anti-inflammatory and inflammatory foods and BMI.

The inflammatory foods most consumed by the patients were beef and coffee, while the anti-inflammatory foods were garlic, olive oil, and sweet potatoes.

Given the importance of diet therapy in IBD, further studies are suggested to provide more support for the treatment of these patients.

Conflicts of interest

The authors declare no conflicts of interest.

REFERENCES

1. Limketkai BN, Iheozor-Ejiofor Z, Gjuladin-Hellon T, Parian A, Matarese LE, Bracewell K, et al. Dietary interventions for induction and maintenance of remission in inflammatory bowel disease. *Cochrane Database Syst Rev*. 2019;2:CD012839.
2. Czuber-Dochan W, Morgan M, Hughes LD, Lomer MCE, Lindsay JO, Whelan K. Perceptions and psychosocial impact of food, nutrition, eating and drinking in people with inflammatory bowel disease: a qualitative investigation of food-related quality of life. *J Hum Nutr Diet*. 2019; <http://dx.doi.org/10.1111/jhn.12668> [Epub ahead of print].
3. Santos LAA, Dorna MS, Vulcano DSB, Agustini L, Franzoni LC, Gondo FF, et al. Terapia nutricional nas doenças inflamatórias intestinais: artigo de revisão. *Nutrire*. 2015;40:383-96.
4. Rizzello F, Spisni E, Giovanardi E, Imbesi V, Salice M, Alvisi P, et al. Implications of the westernized diet in the onset and progression of IBD. *Nutrients*. 2019;11:1033.
5. Medina-Remón A, Casas R, Tresserra-Rimbau A, Ros E, Martínez-González MA, Fitó M, et al. Polyphenol intake from a Mediterranean diet decreases inflammatory biomarkers related to atherosclerosis: a substudy of the PREDIMED trial. *Br J Clin Pharmacol*. 2016;83:114-28.
6. Brasil. Rendimento nominal mensal domiciliar per capita - IBGE. Disponível; 2017. Acesso em: 10 nov. 2018 <https://cidades.ibge.gov.br/brasil/sc/panorama>
7. ABEP Critério Brasil. Disponível; 2016. Acesso em: 01 jul. 2017 <http://www.abep.org/criterio-brasil>
8. Ministério da Saúde (BR). Orientações para a coleta e análise de dados antropométricos em serviço de saúde. Brasília: Ministério da Saúde; 2011.
9. Odierno KF, Coelho BEHB, Matos CH. Perfil nutricional e consumo de alimentos inflamatórios e antiinflamatórios de pacientes atendidos no ambulatório de psoríase de uma unidade de saúde-escola de Itajaí, SC. *Demetra*. 2015;10:1017-30.
10. Khalil H, Chan SSM, Lochhead P, Ananthakrishnan AN, Hart AR, Chan AT. The role of diet in the aetiopathogenesis of inflammatory bowel disease. *Nat Rev Gastroenterol Hepatol*. 2018;15:525-35.
11. Betteridge JD, Armbruster SP, Maydonovitch C, Veerappan GR. Inflammatory bowel disease prevalence by age, gender, race, and geographic location in the U.S. Military Health Care Population. *Inflamm Bowel Dis*. 2013;19:1421-7.
12. Figueroa CC, Quera RO, Valenzuela JE, Jensen CB. Inflammatory bowel disease: experience of two Chilean centers. *Rev Med Chil*. 2005;133:1295-304.
13. Parente JML. Características demográficas e fenótipos clínicos das doenças inflamatórias intestinais no nordeste do Brasil [tese de doutorado]. Campinas: Universidade Estadual de Campinas; 2014.
14. Cushing KC, Chiaplunker A, Li A, Sung YJ, Geisman T, Chen LS, et al. Smoking Interacts with CHRNA5, a nicotinic acetylcholine receptor subunit gene, to influence the risk of IBD-related surgery. *Inflamm Bowel Dis*. 2018;24:1057-64.
15. Cannon AR, Kuprys PV, Cobb AN, Ding X, Kothari AN, Kuo PC, et al. Alcohol enhances symptoms and propensity for infection in inflammatory bowel disease patients and a murine model of DSS-induced colitis. *J Leukoc Biol*. 2018; 1-13.
16. Barbosa KBF, Costa NMB, Alfenas RCG, De Paula SO, Minim VPR, Bressan J. Estresse oxidativo: conceito, implicações e fatores modulatórios. *Rev Nutr*. 2010;4:629-43.
17. Maynard NF. Punica granatum e Curcuma longa no tratamento da inflamação intestinal. Lagarto: Monografia (Graduação em Nutrição) - Universidade Federal de Sergipe; 2017.
18. Fonseca AR, Ferreira ASP, Rodrigues LMF. Manifestações extraintestinais em pacientes com doença inflamatória intestinal. *Rev Pesq Saúde*. 2016;17:92-5.
19. Salviano FN, Burgos MGPA, Santos EC. Perfil socioeconômico e nutricional de pacientes com doença inflamatória intestinal internados em um hospital universitário. *Arq Gastroenterol*. 2007;44:99-106.
20. Siena LR, Marrone L. A influência da alimentação na redução ou no agravamento dos sintomas apresentados em pacientes portadores de fibromialgia. *Rev Saúde Pesquisa*. 2010;3:339-43.

21. Filippo CD, Cavalieri D, Paola MD, Ramazotti M, Poullet JB, Massart S, et al. Impact of diet in shaping gut microbiota revealed by a comparative study in children from Europe and rural Africa. *PNAS*. 2010;107:14691-6.
22. Topping DL, Clifton PM. Short-chain fatty acids and human colonic function: roles of resistant starch and nonstarch polysaccharides. *Physiol Rev*. 2001;81:1031-64.
23. Singh RK, Chang HW, Yan D, Lee KM, Ucmak D, Wong K, et al. Influence of diet on the gut microbiome and implications for human health. *J Transl Med*. 2017;15:73.
24. Kang S, Denman SE, Morrison M, Yu Z, Dore J, Leclerc M, et al. Dysbiosis of fecal microbiota in Crohn's disease patients as revealed by a custom phylogenetic microarray. *Inflamm Bowel Dis*. 2010;16:2034-42.
25. Jantchou P, Morois S, Clavel-Chapelon F, Boutron-Ruault MC, Carbonnel F. Animal protein intake and risk of inflammatory bowel disease: the E3N prospective study. *Am J Gastroenterol*. 2010;105:2195-201.
26. Alves RC, Casal S, Oliveira B. Benefícios do café na saúde: mito ou realidade? *Quím Nova*. 2009;32:2169-2180.
27. Ide N, Lau BH. Garlic compounds minimize intracellular oxidative stress and inhibit nuclear factor-kappa b activation. *J Nutr*. 2011;131:1020S-6S.
28. Lee DY, Li H, Lim HJ, Lee HJ, Jeon R, Ryu JH. Anti-inflammatory activity of sulfur-containing compounds from garlic. *J Med Food*. 2012;15:992-9.
29. Lundin A, Bok CM, Aronsson L, Bjorkholm B, Gustafsson JA, Pott S, et al. Gut flora, Toll-like receptors and nuclear receptors: tripartite communication that tunes innate immunity in large intestine. *Cell Microbiol*. 2008;10:1093-103.
30. Ishiguro K, Yahara S, Yoshimoto M. Changes in polyphenolic content and radical-scavenging activity of sweetpotato (*Ipomoea batatas* L.) during storage at optimal and low temperatures. *J Agric Food Chem*. 2007;55:10773-8.