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ORIGINAL ARTICLE

Altered status of antioxidant vitamins and fatty acids in patients with inactive inflammatory bowel disease☆

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Summary
Background & aims: Data regarding the nutritional status, antioxidant compounds and plasma fatty acid (FA) composition in inactive IBD are conflicting. We compared plasma levels of antioxidants and FA of patients with inactive IBD with active IBD and controls.
Methods: Plasma levels of vitamin C, vitamin E, carotenoids, saturated, monounsaturated and polyunsaturated FA, inflammatory markers and nutritional status were determined after an overnight fast in 132 patients with quiescent IBD (40.6 ± 13.2 years, 87F/45M), 35 patients with active disease (37.9 ± 12.1 years, 25F/10M) and 45 age- and BMI-matched healthy controls (38.1 ± 10.5 years, 39F/6M). Results are expressed as mean ± SD or median [25th percentile;75th percentile].

Abbreviations: AAG, acid-alpha-1 glycoprotein; CAI, ulcerative colitis activity index; CD, Crohn's disease; CDAI, Crohn's disease activity index; DRI, daily reference intake; EFA, essential fatty acids; FA, fatty acids; IBD, inflammatory bowel disease; MUFA, monounsaturated fatty acids; PUFA, polyunsaturated fatty acids; SFA, saturated fatty acids; SGA, subjective global assessment; UC, ulcerative colitis.

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Results: Body mass index (BMI) was normal in inactive ($23.9 \pm 4.7\,kg/m^2$), active IBD ($22.7 \pm 4.2\,kg/m^2$) and controls ($22.3 \pm 1.9\,kg/m^2$). Compared with controls patients with quiescent IBD showed significantly decreased plasma levels of carotenoids (1.85 [1.37;2.56] vs 1.39 [0.88;1.87] μmol/L) and vitamin C (62.3 [48.7;75.0] vs 51.0 [36.4;77.6] μmol/L), increased levels of saturated FA (3879 [3380;4420] vs 3410 [3142;3989] μmol/L) and monounsaturated FA (2578 [2258;3089] vs 2044 [1836;2434] μmol/L) and similar levels of vitamin E and polyunsaturated FA. Results in active disease were similar to inactive disease.

Conclusion: This study shows that antioxidant status and FA profile in a larger population of IBD patients are disturbed independently from disease activity and despite normal overall nutritional status.

Introduction

Crohn's disease (CD) and ulcerative colitis (UC) are inflammatory bowel disease entities (IBD) with still unknown aetiology. Past clinical trials indicated that oxidative stress plays an important role in the initiation and progression of these diseases.[1,2] The increased generation of reactive oxygen species or the exhaust of endogenous and exogenous capacity in active disease may lead to a lack of antioxidants as well as to lipid peroxidation in cellular membranes. An impairment of membrane fluidity and membrane proteins is the consequence. Furthermore, an altered profile of polyunsaturated fatty acids, the main target of reactive oxygen species and precursors of eicosanoids, appears as a significant parameter in the inflammatory process.[2–5]

Previous studies investigated nutritional antioxidants and fatty acids mostly in patients with active IBD and with small sample sizes. Compared to healthy controls reduced levels of total plasma zinc,[3,6] selenium[6–8] as well as β-carotene,[3,9] total carotenoids,[10–12] vitamin C[2,3,9,12] and vitamin E[13] have been reported. Abnormal serum and mucosal fatty acid patterns have been described in some publications, however, with inconsistent results.[2,14–17] Some of the inconsistencies might be explained by differences in the inflammatory status and small sample sizes. In summary, data on antioxidant micronutrients and fatty acid profiles for inactive IBD are scarce and not conclusive. Additionally, recent studies suggest[27,28] that improvement of medical therapies over the past decades led to a generally good nutritional status of IBD patients with inactive disease. Therefore, it is important to know whether micronutrient deficits and metabolic alterations still persist in the presence of apparently normal overall nutritional status.

The aim of the present study was to examine overall nutritional status, antioxidant micronutrients, plasma fatty acids and inflammatory markers in an adequately sized cohort of IBD patients in remission and to compare results with healthy controls and patients with active IBD. We hypothesized that even patients with quiescent IBD show alterations in antioxidant micronutrients and fatty acids as compared to healthy controls, though less pronounced than in active disease and that these alterations are associated with inflammatory activity.

Materials and methods

Patients

In total, 167 IBD patients (CD: $n = 100$, 37.7 ± 11.3 years; UC: $n = 67$, 42.8 ± 14.6 years) between 18 and 70 years were recruited in three centers (Berlin, Germany, $n = 145$; Vienna, Austria, $n = 15$; Bari, Italy, $n = 7$) from September 2004 to February 2006.

The diagnosis was based on histological, endoscopic and radiological findings. One hundred and thirty two patients were in a quiescent phase of disease, which was defined by Crohn's Disease Activity Index (CDAI)[18] <150 or Ulcerative Colitis Activity Index (CAI)[19] ≤ 5 and 35 patients were in an active phase of disease, which was defined by CDAI ≥ 150 or CAI >5. Disease duration ranged between 7.8 [3.2;13.8] years for CD and 9.0 [5.5;14.5] years for UC. The ileocolon (41.3%) or the upper gastrointestinal tract (30.4%) was the most common disease site in CD patients. Fifty-nine percent of UC patients had a pancolitis and 41% a distal colitis. None of the patients had an extensive small bowel resection; 44.2% of CD and 10% of UC patients had intestinal resections.

Exclusion criteria for patients were severe concomitant disease, celiac disease, pregnancy, ostomy, deliberate adherence to an extreme diet (vegan, macrobiotics, etc.) and supplementation of micronutrients or fatty acids of more than one DRI (daily reference intake) value per day.

Healthy controls

Forty-five age- and BMI-matched healthy controls were recruited from the general population of Berlin. Health was defined as absence of acute or chronic disease, no acute or chronic medication and all standard routine blood parameters within the normal range. Exclusion criteria were smoking, deliberate adherence to an extreme diet (vegan, macrobiotics, etc.) and supplementation of micronutrients or fatty acids of more than one DRI value per day.

The study was approved by the ethics committee of the coordinating center Charité — Universitatsmedizin Berlin, Germany, and by the local ethics committees of each study center. All IBD patients and healthy controls gave informed consent.