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Dietary calcium intake in patients with inflammatory bowel disease

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Abstract

Background & aims: Osteopenia and increased risk for fractures in IBD result from several factors.
Aim of the study: To investigate the dietary intake of calcium in IBD patients.
Methods: A 22-item quantitative validated frequency food questionnaire was used for quantifying dietary calcium in relation to gender and age, in 187 IBD patients, 420 normal- and 276 diseased controls.
Statistical analysis: Mann–Whitney, chi-square- and T-tests.
Results: The mean calcium intake was 991.0 ± 536.0 (105.8% Recommended Daily Allowances) and 867.6 ± 562.7 SD mg/day (93.8% RDA) in healthy and diseased controls, and 837.8 ± 482.0 SD mg/day (92.7% RDA) in IBD, $P < 0.001$. Calcium intake was high in celiac disease (1165.7 ± 798.8 SD mg/day, 120% RDA), and non-significantly lower in ulcerative colitis than in Crohn's disease (798.7 ± 544.1 SD mg/day vs 881.9 ± 433.0). CD and UC females, but not males, had a mean calcium intake well under RDA. In all study groups the intake was lower in patients believing that consumption of lactose-containing food induced symptoms, versus those who did not (105.8% vs 114.3% RDA in normal controls; 100.4% vs 87.6% RDA in IBD).
Conclusions: Diet in IBD patients contained significantly less calcium than in healthy controls. Gender and age, more than diagnosis, are central in determining inadequate calcium intake, more so in IBD. Self-reported lactose intolerance, leading to dietary restrictions, is the single major determinant of low calcium intake. Inadequate calcium intake is present in one third of IBD patients and represents a reversible risk factor for osteoporosis, suggesting the need for tailored nutritional advice in IBD.

Abbreviations: BMD, bone mass density; Ca, calcium; CD, Crohn's disease; FFQ, food frequency questionnaire; IBD, inflammatory bowel diseases; RANKL–OPG, receptor activator of nuclear factor kappa-B ligand–osteoprotegerin; RDA, recommended dietary allowance; UC, ulcerative colitis.

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1. Introduction

Inflammatory bowel diseases (IBD) are associated with increased incidence of osteopenia and osteoporosis, with reported frequencies 28–77% and 18–42%, respectively.[1–6] The risk of low-trauma fractures in patients with Crohn's disease (CD) is correspondingly increased by 30%, and 20% in ulcerative colitis (UC), compared to normal controls.[7,8]

The pathogenesis of IBD associated bone loss is not fully understood, but several factors are involved in the process, mainly through their effect on the RANKL–OPG system.[9] Pro-inflammatory cytokines, malnutrition associated with low body mass index and prolonged/high-dose administration of corticosteroids are considered to be of prime importance. The inflammatory component is relevant in both diseases, while malnutrition/malabsorption is more important in CD and corticosteroid treatment in UC.[10–15] Although glucocorticoid use, beside age, is the most well-recognized risk factor for osteoporosis in IBD, reduced bone mineral density (BMD) is also observed in the absence of steroid use.[16] Vitamin D deficiency is common in adults and children with IBD, especially CD,[17–20] and a graded relative risk in CD, but not in UC, has been reported to correlate with areas of low sunlight exposure.[21]

Irrespective of other factors influencing bone metabolism, the minimum daily calcium dose necessary to prevent a negative balance is 1000 mg of elemental calcium for men and premenopausal women, and 1200–1500 mg for postmenopausal women and men older than 60 years.[22] IBD patient diet has been reported to contain less than the recommended daily intake of calcium and vitamin D,[23] but this issue has been less frequently addressed at than other possible mechanisms of osteoporosis and osteopenia. Aim of the present study has been that of investigating the dietary intake of calcium in a large series of patients regularly followed in our tertiary referral Center for IBD.

2. Materials and methods

Our study included 187 IBD outpatients, 95 female and 92 male, mean age 47.1 ± 16.3 SD (96 UC and 91 CD) in our Institution, who accepted to take part in the survey. Diagnosis of UC and CD was based on the usual clinical, endoscopical, histological and imaging criteria. Type and activity of the diseases and site/extent of lesion were classified according the Montreal classification.[24]

Information on the diet during the week prior to observation was acquired using a 22-item quantitative validated FFQ, administered by a dietician.[25] The questionnaire provides detailed information on all the high calcium containing aliments most frequently used in the Italian diet (milk and milk derivatives, pasta and rice, meat and fish, eggs, legumes, fruit, vegetables, ice cream/chocolate, mineral and tap water). The frequency of consumption for each food item in the previous week was assessed and the "usual" serving size was evaluated for each patient using a photographic atlas of food portions.[26] To estimate daily calcium intake from diet, frequency and serving size for each food consumed were multiplied by the nutrient content of that food.[27] The participants were also asked about dietary supplements of calcium, allowing quantification of the total intake of the nutrient. Data were compared to the Recommended Daily Allowances (RDA) calculated for the Italian population[28] in relation to age and gender, and expressed as percent of RDA. These values are in the same order as those indicated in the American RDA.[29] The only major difference is an increased need for higher calcium intake versus younger age groups suggested for males >60 and females >50 years, in the Italian RDA.

The same FFQ was administered to 695 controls, subdivided into 2 groups: 420 normal controls, 270 female and 150 male, mean age 39.7 ± 16.1 SD (medical staff, family members of patients visited for non-gastroenterological problems) and 276 patients with differing diseases, 219 female and 57 male, mean age 43.6 ± 15.8 SD. This group was further classified as follows: 147 outpatients with non-gastroenterological diseases (105 female, 42 male), 36 patients with celiac disease (29 female and 7 male), 93 patients with lactose malabsorption/intolerance (82 female, 11 male). Celiac disease was diagnosed on the base of serology (anti-transglutaminase antibodies) and histological findings in duodenal biopsies. Lactose malabsorption/intolerance was diagnosed on the basis of a positive hydrogen breath test after an oral load of 25 g lactose, in the presence or absence of clinical symptoms during or in the 6 h following the test.[30]

The prevalence of lactose malabsorption in the background Italian population is high, ranging from 45 to 71%.[31,32] Thus, all IBD patients and controls were specifically requested to state whether they had abdominal symptoms following the intake of milk and lactose-containing milk derivatives and, if so, whether this had implications on their usual diet.

Statistical analysis was performed using the 2010 SPSS statistical package (SPSS Inc. Chicago, IL, USA). Data were compared using the *T*-Test for normally distributed parameters, the Mann–Whitney Test for skewed data and the chi-square test for proportional data.

3. Results

3.1. Demographics

The group of 420 healthy controls was composed as follows: 270 female and 150 male, mean age 39.7 ± 16.1 SD years, mean weight 65.8 ± 12.8 SD kg and mean height 166.8 ± 14.6 SD cm. The diseased control group was composed by 276 patients, 219 female 57 male, mean age 43.6 ± 15.8 SD years, mean weight 62.6 ± 11.8 SD kg and mean height 163.5 ± 12.9 SD cm. Demographics and physical characteristics of the 187 IBD patients (95 female and 92 male, mean age 47.13 ± 16.3 SD years, mean body weight 68.7 ± 13.8 SD kg, mean height 167.9 ± 9.5 SD cm) are similar, and non-significantly different, from those of control patients, with the exception of gender. The proportion of females was significantly higher in both control groups ($P < 0.001$) versus IBD patients.

3.2. Calcium intake in inflammatory bowel disease and controls

The mean calcium intake in inflammatory bowel disease was 837.8 ± 482.0 SD mg/day corresponding to 92.7% of RDA. In healthy controls mean calcium intake was 991.0 ± 536.0 SD mg/day corresponding to 105.8% of RDA. Considering together all diseased controls, the mean calcium intake