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The effect of moderately and severely restricted dietary magnesium intakes on bone composition and bone metabolism in the rat.

Creedon A, Flynn A, Cashman K.

Department of Nutrition, University College, Cork, Republic of Ireland.

Abstract

Forty 3-week-old male rats, Wistar strain, average weight 59 g, were randomized by weight into five groups of eight rats each. Three groups were fed ad libitum on a semi-purified diet containing (per kg) 400 (adequate), 200 (moderately Mg-restricted) or 20 (severely Mg-restricted) mg Mg for 3 weeks while two groups were pair-fed with the Mg-adequate diet in the same quantities as those consumed by the two Mg-restricted groups respectively. While weight gains and food conversion efficiency values for the Mg-restricted groups were similar to those of the corresponding pair-fed control groups, serum and kidney Mg, and femoral dry weight were reduced by 70, 7 and 9% respectively in the severely Mg-restricted group and were unaffected in the moderately Mg-restricted group. Significant reductions were observed in urinary pyridinoline (Pyr) (by 44 and 34%) and deoxypyridinoline (Dpyr) levels (by 40 and 33%) (markers of bone resorption), serum osteocalcin levels (by 46 and 28%) (marker of bone formation), femoral Mg levels (by 52 and 14%) and osteocalcin mRNA levels (by 46 and 22%) compared with the corresponding pair-fed controls, in the severely and moderately Mg-restricted groups respectively, and these reductions, except for those in urinary Pyr and Dpyr, were more marked in the severely Mg-restricted group. Femoral Ca and P concentrations were unaffected by dietary Mg restriction. These results show that not only severe but also moderate dietary restriction of Mg over 21 d results in qualitative changes in bone (i.e. reduced Mg concentration) as well as in aberrant bone turnover in young growing rats (i.e. severely depressed rates of bone formation and bone resorption), which may impair bone development and bone strength.

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