

Prolonged magnesium deficiency causes osteoporosis in the rat.

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Abstract

BACKGROUND:

Peroral magnesium (Mg) administration, used as the only treatment in postmenopausal osteoporosis, has been shown to cause a significant increase of BD.

OBJECTIVES:

To gauge the role of magnesium deficiency in the etiology of osteoporosis, we compared rats fed a Mg deficient diet daily with rats fed a Mg adequate diet over a period of one year.

METHODS:

Sprague-Dawley female rats (mean weight 110, SD 23 g) were divided into two groups of 8 and randomly assigned to an identical semisynthetic diet, containing either 2000 ppm (group A) or 200 ppm Mg (group B). Urine samples were collected every 3 months and blood samples at end of trial. After sacrifice, L3-L5 vertebrae and the femoral regions were examined for bone density (BD) using dual energy X-ray absorptiometry. The femurs were examined for bone fragility, the tibias by histomorphometry and the mineral contents of the bones was estimated.

RESULTS:

The mean BD of L3-L5 vertebral bone (BDL) was significantly higher in group than in the Mg deficient group B ($p = 0.035$, 1 tail). The BD of the femoral region (BDF) was also significantly higher in group A ($p = 0.045$, 1 tail). The stiffness of the femur, as determined by resistance to bending, was slightly greater in group A than in group B, but after correction to diminish the influence of the difference in bone dimensions in the two groups, the stiffness (ie loss of elasticity) in group B became significantly greater than that in group A ($p = 0.024$). The force needed to break the bone (F-max) was significantly higher in group A, than in group B ($p = 0.024$) and remained so after correction, although no longer significantly. In Group B, the diminution of the trabecular bone volume, in relation to tissue volume (BV/TV) and the increase in the degree of trabecular interconnection (TBPf) indicated osteoporosis, and focal osteoporosis of the metaphyseal spongy bone was seen on microscopy.

CONCLUSION:

Experimentally induced prolonged Mg deficiency causes osteoporosis in rats.