No. 06D3 - 08D3

DNA Microarray Analysis on Effects of Magnesium Deficiency and Dietary Magnesium and Calcium Ratio in Rats

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Summary

Magnesium (Mg) is involved in a variety of biochemical processes in the body. A number of studies have reported the effects of Mg deficiency on carbohydrate, lipid, protein, vitamin and mineral metabolism. However, comprehensive information remains unavailable on the relationship between Mg deficiency and nutrient metabolism studied under well-controlled and reproducible experimental conditions.

We performed transcriptome analysis to comprehensively understand the effects of dietary-Mg deficiency in rat liver and femur.

In the 1st study, weanling male Wistar rats were dichotomized and fed a control diet or a Mg-deficient diet (MD) group for 4 weeks. During the feeding period, rats in both groups were pair fed to ensure that they consumed equal amounts of their respective diets. DNA microarray analysis demonstrated significant between-group differences with regard to various items. The MD diet led to the up- or down-regulation of 734 genes. All these data suggest that dietary Mg deficiency induces (1) a decrease in protein utilization; (2) changes in the overall hepatic gene expression, especially the expression of the genes involved in carbohydrate, lipid, and amino acid metabolism; and changes in even the transcription levels of these genes. In the 2nd study, gene expression showing the recovery by 7 day-feeding of a control (C) diet from Mg deficiency, that appeared by 28 day-feeding of a Mg deficient diet, was discussed. It is indicated that the hepatic gene expression pattern tends to return to the original state in association with enhancing the dietary Mg amount up to the normal level. The 80% of those gave a reverse direction of expression change when the MD diet was replaced with the C diet. In the 3rd study, femoral gene expressions related with bone formation and bone resorption were slightly changed by Mg deficiency.