

Dietary Magnesium Deficiency and Calcium Doubled Induced Histological and Functional Damages of Rat Heart Muscles

Takako Ikeda ¹, Takayoshi Imazawa ², Yukiko Nakanishi ³, Hiroko Inage ³, Mikiko Suzuki ³

¹Showa Women's University of Life Sciences,

²National Institute of Biomedical Innovation of Senior Researcher,

³Showa Women's University Graduate School of Human Life Sciences Ymazakipan-Endowed Chair of Nutrition Research Laboratory on Aging

Summary

Epidemiologically, it has been suggested that dietary magnesium /calcium imbalance is associated with the risk of heart diseases. In the present study, the effects of magnesium deficiency and/or calcium on ultrastructure and function of myocardial cells were investigated in rats. Male Sprague-Dawley rats were divided into 4 groups, and respectively fed basal diet (AIN-93G) alone (control group), calcium-doubled AIN-93G diet (calcium-doubled group), magnesium-deficient AIN-93G diet (Mg-deficiency group) and magnesium-deficient/ calcium-doubled AIN-93G diet (Mg-deficiency/calcium-doubled group). After 2 weeks on these diets, indirect calorimetric measurements by continuous registration of oxygen consumption and carbon dioxide exhalation were recorded every 6 minutes for 18 hours. After 3 weeks, final body weight, weight gain and serum Mg concentration were significantly decreased due to the Mg-deficient diet. There was no significant difference in mean respiratory quotient (RQ) between 4 groups during the experimental periods and registration periods. However, the mean energy expenditure by oxygen consumption and carbon dioxide exhalation in calcium-doubled group and Mg-deficiency /calcium-doubled group showed a tendency to increase as compared to the control group and Mg-deficiency group values. Ultrastructurally, degenerative changes of organelle including swelling and vacuolation of mitochondria were observed in myocardial of rats fed Mg-deficiency /calcium-doubled diet for 3 weeks. Our results thus suggest that dietary magnesium deficiency gives rise to retrogressive changes in the heart, and concurrent calcium overintake synergistically enhances the myocardial injury due to magnesium deficiency.