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Effects of Dietary Magnesium Deficiency in the Mice with Special Reference to Flow Cytometry Examination

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Summary

According to the Dietary Reference Intakes for Japanese (2010), adult men and women are recommended to take Magnesium (Mg) 340 mg/day and 290 mg/day, respectively. Actual Mg intakes in Japanese have been taken lower than those recommendations. Therefore, many Japanese are suffered from chronic insufficient Mg. In the United States in 2010, it has been also reported that inadequate intake of magnesium is approximately 60% among adult population, associating with increasing of obesity, arteriosclerosis, hypertension, osteoporosis, diabetes, and cancer. Physiological importance of Mg even though it is recognized, the mechanism of disease onset by impairing the chronic immune function under conditions of Mg deficiency has not been clear. Therefore, in the present study, we examined the effects of Mg deficiency on immunocompetent cells in diabetic mice by flow cytometry.

Four-week-old male ICR mice, intraperitoneally administered two times (weight 100 mg/kg) of streptozotocin, were induced type 2- diabetes. Mice were divided into 4 groups (Control group, Diabetes Mellitus (DM) group, Mg deficient group, and DM + Mg deficient (DM+Mg) group) with 6 animals in each group fed the basal diet (AIN-93G, using a mixture of minerals, including magnesium oxide), or the Mg deficient diet for 10 days. Food intake and body weight were measured daily and after the autopsy, blood, thymus and spleen were collected and weighed. Blood glucose and Mg concentrations were measured. In addition, the blood, spleen and thymus were applied to a surface analysis by flow cytometry.

First Experiment: We confirmed mice were suffered from diabetes based on the blood glucose concentrations, while Mg deficiency was not observed. It was clearly shown the effects of diabetes on thymic T cells. The percentages of cells CD4 + CD8 + were lower than Control group indicating the immature cells increased. These results suggested that cells of CD4 + CD8 + were damaged and then the percentage of CD4 + positive and CD8 + positive relatively increased.

Second Experiment: We confirmed mice were suffered from Mg deficiency, while DM+Mg group mice were suffered from diabetes, but not in DM only group. In the spleen, compared with in Control group (P=0.047), Mg deficient group (P=0.026), and DM group (P=0.013) respectively, T cells in DM + Mg deficient group was significantly higher. B cells in DM + Mg deficient group showed a significantly lower value (P=0.036) compared to the Mg deficient group. NK cells in DM + Mg-deficient group showed a significantly lower value (P=0.018) compared with the Control group. Diabetes or Mg deficiency were suggested increasing T cells than B cells,

which forms a system of defense was limited by immunocompetent cells. In the present study, there was no enlargement of the thymus and spleen occurring under Mg deficient condition because the Mg deficient level was too mild considering that the mouse would have died due to lack of Mg. However, the impact of DM on immune function was observed clearly. It is necessary to examine the effects of stronger Mg-deficient diet on the immune function in diabetic mice.