

亜鉛欠乏によるラット白血球系細胞の分布の変動

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Zinc-Deficiency Induced Changes in the Distribution of Rat White Blood Cells

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Introduction: Zinc is known to play an important role in immune regulation, gene transcription and other fundamental physiological processes. Zinc is also a cofactor for more than 300 enzymes such as alcohol dehydrogenase (ADH), superoxide dismutase (SOD), RNA polymerase, alkaline phosphatase and carbonic anhydrase. Among the zinc enzymes, there are oxidoreductases, transferases, hydrolases, lyases, isomerases and ligases. Therefore, general cell functions are influenced by the zinc concentration. However, the effects of zinc-deficiency on immune response system from the point of view of the distribution changes of the number of total white blood cells (WBCs) are still primarily unknown. Therefore, the effects of zinc deficiency on the number of total WBCs, neutrophil, eosinophil, basophil, monocyte and lymphocytes (T lymphocyte, B lymphocyte and NK cell) were studied in rats.

Material and Methods: The weaned male rats were randomly divided into zinc deficient diet (ZDD: 0.7mg zinc/kg diet) group and the control diet (CON: 34.8mg zinc/kg diet) group, and were pair-fed for 4 weeks. The number of lymphocyte subsets (T lymphocyte, B lymphocyte and NK cell), visceral organ weights, serum zinc, corticosterone and IL-6 concentrations were also determined.

Results and Discussion: In the final day of experiment, the body weight was 0.71 times lower in ZDD group than in CON group. Total food intake was no significant difference between two groups. However, the body weight gain, food

efficiency, total water intake and total zinc intake of ZDD group during the experiment period were 0.44 times, 0.45 times, 0.74 times and 0.02 times markedly lower than that of CON group, respectively. Plasma zinc concentrations were 0.17 times lower in ZDD group than in CON group. Zinc deficiency increased duration-dependently the number of total WBCs, granulocytes (neutrophil, eosinophil and basophil) and monocyte in 2-4 weeks without changing the number of lymphocytes, T lymphocyte, B lymphocyte and NK cell. The relative weights of thymus and adrenals were 0.63 times lower and 1.60 times higher in ZDD group than in CON group, respectively. Zinc deficiency increased serum corticosterone concentration to 1.46 times without changing serum IL-6 concentration, as compared with those of CON group. From these results, zinc deficiency increased the number of granulocytes and monocyte without changing the number of lymphocytes, T lymphocyte, B lymphocyte and NK cell. These results also suggest that zinc deficiency induces stress responses and the responses may be in part participated in increased actions of the number of granulocytes and monocyte during zinc deficiency, and induces thymus atrophy and adrenal hypertrophy.

Reference: Someya Y, Tanihata J, Sato S, Kawano F, Shirato K, Sugiyama M, Kawashima Y, Nomura S, Tachiyashiki K and Imaizumi K: Zinc-deficiency induced changes in the distribution of rat white blood cells. *J Nutr Sci Vitaminol*, 55: 162-169 (2009)