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Author(s)	KOBAYASHI, Kiyomi
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THE HEMOLYTIC EFFECT OF ONIONS ON CANINE ERYTHROCYTES
ASSOCIATED WITH INHERITED HIGH Na, K-ATPase ACTIVITY

Kiyomi KOBAYASHI

*Department of Veterinary Internal Medicine
Faculty of Veterinary Medicine
Hokkaido University, Sapporo 060, Japan*

Some dogs possess erythrocytes characterized by inherited high Na, K-ATPase activity, high potassium (K) and low sodium (Na) concentration, in addition to high accumulations of reduced glutathione (GSH), glutamate and aspartate (HK dogs; Maede, Y., Inaba, M. & Taniguchi, N. (1983). *Blood*, 61: 493). The present study demonstrated that HK dogs fed onions (10g/kg) for 6 days showed severe hemolytic anemia even after 1–2 days, while normal dogs (LK dogs) exhibited moderate symptoms of anemia at 5–7 days. Methemoglobin concentration in HK dogs increased about 3-fold between 1 and 3 days, but thereafter it decreased to the normal level. In contrast, methemoglobin concentration in LK dogs showed no significant changes during the period of onion feeding.

The number of Heinz body-containing erythrocytes in HK dogs increased to 23% at the first day and reached the highest level (62%) at 4 days. In LK dogs, Heinz bodies began to increase at 2 days and reached the highest level (58%) at 4 days. In HK dogs, the concentration of erythrocyte GSH decreased about 18% between 1 and 3 days. The concentration of erythrocyte oxidized glutathione (GSSG) increased 11-fold at the first day, but thereafter, it returned rapidly to the normal level. In LK dogs, GSH and GSSG concentrations in erythrocytes were almost unchanged during the period of onion administration. When erythrocytes from both HK and LK dogs were incubated with onion extract for 2 to 4 hours, the increases of both methemoglobin concentration and Heinz body formation and the decrease of GSH concentration were more prominent in HK dog erythrocytes (HK cells) than in LK dog erythrocytes (LK cells). In addition, the activities of catalase and superoxide dismutase in HK cells were significantly higher ($P < 0.01$) than those LK cells. There was no significant difference in the activity of NADH-methemoglobin reductase between HK and LK cells. However, the Michaelis-constant of NADH-methemoglobin reductase (K_m for NADH) was $79.7 \mu\text{M}$ in HK cells and $41.7 \mu\text{M}$ in LK cells. Furthermore, catalase was inhibited by onion extract in HK cells but not in LK cells.

These results indicate that HK cells more susceptible to hemolytic substances, such as onions, than LK cells. This may be due to anomalies of NADH-methemoglobin reductase and catalase of HK cells.