MECHANISM OF OXIDATIVE DAMAGE AND SPECIES DIFFERENCE IN ERYTHROCYTES OXIDIZED BY SODIUM *n*-PROPYLTHIOSULFATE, A CAUSATIVE AGENT OF ONION INDUCED HEMOLYTIC ANEMIA

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Sodium *n*-propylthiosulfate (NPTS) is one of the causative agents of onion-induced hemolytic anemia. In this study, the mechanism of oxidative damage of erythrocytes by NPTS and the effect of NPTS on various mammalian erythrocytes were investigated.

A compound, 1-propanethiol, was formed when NPTS reacted with reduced glutathione (GSH) in the hemolysate from dogs. The compound caused oxidative damage to canine erythrocytes. After oral administration of NPTS (500 μmol/kg) to one dog, 1-propanethiol was detected in erythrocytes together with the formation of methemoglobin, but not in plasma. This result indicated that 1-propanethiol was also a causative agent of onion-induced hemolysis, though the oxidative effect of 1-propanethiol on hemoglobin was lower than that of NPTS, which oxidized hemoglobin through its reaction with GSH.

Next, the oxidative effects of NPTS on various erythrocytes were compared. Oxidative damage to erythrocytes from various mammals occurred in order of increasing oxidative damage as follows : cat, guinea pig, dog, some ruminants (cattle, sheep, goats), horse, rat, mouse and human. To clarify this species difference, the concentration of GSH and the activities of the enzymes superoxide dismutase, catalase, glutathione peroxidase, glutathione reductase and methemoglobin reductase in erythrocytes from those mammals were measured. Of these, erythrocytes from cats had the highest concentration of GSH, and human erythrocytes showed the highest activity of methemoglobin reductase. Furthermore, oxidative damage caused by NPTS to purified hemoglobins from cats and dogs was more prominent than that in humans when the hemoglobins were incubated with NPTS. Thus, the differences in the structure of hemoglobin and the activities of some enzymes involved in protecting biological systems from oxidative stress in erythrocytes in those mammals might be the cause of the species difference in the susceptibility of their erythrocytes to oxidative damage induced by NPTS.