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Mechanism of oxidative damage induced by alk(en)ylthiosulfates contained in onions and garlic

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Oxidative effects of three alk(en)ylthiosulfates, sodium *n*-propylthiosulfate (NPTS), sodium 2-propenylthiosulfate (2PTS) and sodium methylthiosulfate (MTS) which are thought to be causative compounds of the hemolytic anemia induced by onions or garlic, on canine erythrocytes was examined. Incubation of canine erythrocytes with each of the alk(en)ylthiosulfates resulted in an increase of the methemoglobin concentration and Heinz body count, and a decrease of the reduced glutathione (GSH) concentration in the cells. The erythrocytes possessing a high concentration of GSH (approximately five times the normal value), which are genetically determined, were more susceptible to the oxidative damage by these alk(en)ylthiosulfates than the normal canine erythrocytes. These observations indicate that GSH accelerates the oxidative damage to canine erythrocytes produced by these alk(en)ylthiosulfates. However, the extent of the oxidative damage to the cells produced by each of the alk(en)

ylthiosulfates was shown in order of the following: 2PTS > NPTS > MTS, while they reacted with nearly equimolar amount of GSH. In addition, the reaction of these alk(en)ylthiosulfates with GSH resulted in the production of 1-propanethiol (1PT) from NPTS, 2-propenethiol (2PT) from 2PTS and methanethiol (MT) from MTS, respectively. The amount of these thiols produced by the reaction corresponded with the extent of oxidative damage of erythrocytes induced by these alk(en)ylthiosulfates. Furthermore, each 1PT and 2PT was shown an oxidative damage to hemoglobin, which was more severe in 2PT than that in 1PT.

From these results, it was demonstrated that NPTS, 2PTS and MTS act as oxidants through their reaction with GSH, and suggested that the extent of the oxidative damage induced by these alk(en)ylthiosulfates is dependent on the oxidative effects of thiols produced by their reaction with GSH.