Phosphine-induced oxidative damage in rats: role of glutathione.

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Abstract

Phosphine (PH(3)), generated from aluminium, magnesium and zinc phosphide, is a widely used pesticide. PH(3) induces oxidative stress in insects, mammalian cells, animals, and humans. The involvement of glutathione (GSH) in PH(3)-induced oxidative toxicity is controversial. GSH levels in various tested tissues were reduced in aluminium phosphide-poisoned rats and humans, while the levels remained unchanged in insects and mammalian cells. This study examines the effectiveness of endogenous GSH as a protective agent against PH(3)-induced oxidative damage in rats. The association of PH(3)-induced nephrotoxicity and cardiotoxicity with free radical production was also tested. Male Wistar rats, administered intraperitoneally (I.P.) with PH(3) at 4 mg/kg, were evaluated 30 min after treatment for PH(3) toxicity to organs. PH(3) significantly decreased GSH, GSH peroxidase and catalase, while significantly increased lipid peroxidation (as malondialdehyde and 4-hydroxyalkenals), DNA oxidation (as 8-hydroxydeoxyguaonsoine) and superoxide dismutase (SOD) levels in kidney and heart. These changes were significantly alleviated by melatonin (10 mg/kg I.P., 30 min before PH(3)), with the exception of SOD activity in heart tissue. The study also found that buthionine sulfoximine (1 g/kg I.P., 24 h before PH(3)) significantly enhanced the effect of PH(3) on GSH loss and lipid peroxidation elevation in lung. These findings indicate that (1) endogenous GSH plays a crucial role as a protective factor in modulating PH(3)-induced oxidative damage, and (2) PH(3) could injure kidney and heart (as noted earlier with brain, liver and lung) via oxidative stress and the antioxidant melatonin effectively prevents the damage.