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On Drugs and Therapeutics

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IN BRIEF

Melamine

Melamine present in infant formula and other milk products has been associated with widespread illness and some deaths among infants in China. It was also identified in pet food sold in North America after a large number of pets became ill and some died. In both the infants and the pets, renal injury appeared to be the cause.¹

Melamine (C₃H₆N₆) is a heterocyclic compound, two-thirds nitrogen by weight, that is slightly soluble in water. When combined with formaldehyde, it forms melamine resin, which has a wide variety of industrial applications including the manufacturing of kitchenware, whiteboards and laminate flooring.¹ Because of its nitrogen content, melamine has been illegally added to products such as milk, wheat gluten and rice protein to factitiously boost the apparent protein content; common assays for protein content do not distinguish between amino-acid nitrogen and non-protein nitrogen.

Melamine itself is relatively nontoxic; the FDA has established, based on an extrapolation from studies in rats, a tolerable daily intake of 0.63 mg/kg/day.¹ However, the combination of melamine with cyanuric acid (a water disinfectant and/or impurity associated with melamine production that itself is also nontoxic) results in the formation of insoluble crystals that precipitate in renal tubules following ingestion and may cause acute renal failure.²⁻⁴ Infants may be especially sensitive to this mechanism of toxicity.

Treatment of humans or animals poisoned with these compounds is largely supportive. Hemodialysis may be indicated, depending on the degree of renal failure. Whether hemodialysis removes melamine or related compounds is unknown.

1. U.S. Food and Drug Administration. Interim safety and risk assessment of melamine and its analogues in food for humans. October 3, 2008. Available at www.cfsan.fda.gov/~dms/melamra3.html. Accessed October 14, 2008.

2. CA Brown et al. Outbreaks of renal failure associated with melamine and cyanuric acid in dogs and cats in 2004 and 2007. *J Vet Diagn Invest* 2007;19:525.
3. RL Dobson et al. Identification and characterization of toxicity of contaminants in pet food leading to an outbreak of renal toxicity in cats and dogs. *Toxicol Sci* 2008; 106:251.
4. World Health Organization. Melamine and cyanuric acid: toxicity, preliminary risk assessment and guidance on levels in food. September 25, 2008. Available at www.who.int/foodsafety/fs_management/Melamine.pdf. Accessed October 14, 2008.

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