

ENVIRONMENTAL TOXICOLOGY: CONSIDERATIONS FOR EXOTIC PETS

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Abstract

Wherever companion exotic animals are housed, they may be exposed to potential toxins either inside or outside their primary enclosures. The relatively small body size of many exotic pets may increase their susceptibility to toxicants that they may encounter. Contaminants that are either absorbed by or deposited on the surfaces of plant- and animal-based food items or present in water may be subsequently ingested and absorbed, which often adversely affects the animal's health. Copyright 2015 Elsevier Inc. All rights reserved.

Key words: environmental contaminants; pesticides; airborne toxicants; toxic metals; toxic plants; mycotoxins

Wherever companion exotic animals are housed, they may be exposed to potential toxins either inside or outside their primary enclosures. Almost any substance can be toxic if a susceptible animal is sufficiently exposed. The relatively small body size of many exotic pets may increase their susceptibility to toxicants that may be found around a house. Antitampering packaging (child-resistant caps and bottles) that are manufactured to reduce potentially toxic exposures in children may be easily opened by ferrets, rabbits, rodents, and birds. In the outdoor environment, normal habits and behaviors may place the animal in contact with water, soil, animals, and plants, which may serve as possible sources of toxin exposure. Contaminants that are either absorbed by or deposited on the surfaces of plant- and animal-based food items or present in water may be subsequently ingested by companion exotic animals.

Toxic effects to an animal's health can occur due to acute and/or chronic exposures to a particular substance. Acute toxicity may be defined as a single exposure to a toxic substance that results in adverse effects to a susceptible animal. An example of acute toxicity is the rapid development of cardiac arrhythmias and convulsions following oral contact with poison excreted from a cane toad (*Rhinella marina*). Chronic toxicity is the result of prolonged or multiple exposures to a specific toxin over a period of time (≥ 3 months or more). Repeated ingestion of lead paint chips or dust in older

buildings is an example of how an animal would develop a chronic toxicosis.

Bioaccumulation is the ability of contaminants to accumulate in living organisms. Biomagnification specifically describes bioaccumulation of contaminants from the diet, leading to increased bioconcentrations with higher trophic position in a food web.¹ Simply stated this means that herbivores can concentrate ingested contaminants in their tissues and that these can be subsequently ingested and further concentrated by carnivorous species that feed on the contaminated prey. The concept of bioaccumulation along with

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diet, inhalation, and transdermal absorption should be considered as potential routes of exposure to environmental contaminants for companion exotic animals.

ROUTES OF EXPOSURE FOR AN EXOTIC PET ANIMAL

- Oral
 - Companion exotic animals can be exposed to toxicants through contaminated foods. With formulated diets (e.g., pellets and seed mixes), quality control and monitoring programs may vary among manufacturers. Adulteration of pet foods can occur owing to inadequate screening of raw materials for potential toxicants (e.g., melamine), equipment-related mixing errors, and formulation mistakes that result in the presence of excessive amounts of nutrients such as vitamin D3.² Although commercially available food products are regulated by the Food and Drug Administration, problems still occur. Moreover, foods harvested or collected from an owner's back yard or another location, such as fruits and plant materials, insects, and invertebrates, are not regulated or inspected; therefore, they may be considered potential sources of environmental contaminants. Similarly, municipal water supplies are variably monitored for contaminants, but water collected from individual wells and local streams and ponds are not and may serve as a source of chemical toxicants.
 - Stones, branches, logs, moss, and other natural enrichment items are potential sources of environmental contaminants in the form of herbicides, pesticides, or heavy metal residues if chewed or ingested by exotic pets.
- Dermal
 - Any potential toxicant that an animal walks or sleeps on, swims through, or brushes against can potentially be absorbed through the skin and cause either local or systemic effects. When these toxic substances become adhered to feet, wings, feathers, skin, or hair and are later ingested during normal grooming, the contaminant can be ingested or contact the oral mucosa.
- Respiratory

- Inhaled toxicants can occur as gases, vapors, fumes, dusts, and small particulates. The efficiency of the avian respiratory tract makes birds especially susceptible to gases or fumes. The ability of toxic substances to be absorbed systemically by the lungs or across gills rather than just causing local effects depends on the specific toxicant's blood-gas coefficient. This ratio describes the solubility of a given toxicant in blood. Exotic pets are at the greatest risk for inhaling respiratory toxicants when they are either indoors or in an enclosed space and cannot escape to contaminant-free air. Although animals in outdoor enclosures are able to benefit from the ability of surrounding air to dilute any introduced toxic substances, the venting of exhaust or other potentially harmful airborne toxicants, concentrated directly into an outdoor enclosure, can still harm the confined animal(s).

Fish and other aquatic pets are at risk to toxins that taint their environment. Toxicities in pet fish are frequently attributed to poor water quality.³ Chlorine and chloramine toxicity can occur with the use of untreated tap water or secondary to the owner's use of a chlorine-based cleaning product (e.g., bleach).⁴ A complete case history is important for aquatic species that are presented with a suspected toxicosis. The case history should include information about the water source, including type of piping used and containers in which the water may be stored before animal exposure, along with any recent treatments or possible, contaminants. If possible, at least 1 L of water should be collected for potential toxicology testing.

SPECIFIC ENVIRONMENTAL TOXICANTS

- Pesticides
 - Insecticides
 - Organochlorine (OC) pesticides
 - Until its worldwide ban in the 1970s, dichlorodiphenyltrichloroethane (DDT) was one of the most popular and effective pesticides. Due to the ability of OC pesticides to persist in the environment for hundreds of years and accumulate in the lipids of cell membranes, DDT and other OC residues can still be found in contemporary plants and animals.⁵ Foods from

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