

Toxicity of Electronic Cigarettes in Companion Animals



By Kia Benson, DVM
Associate Veterinarian, Clinical Toxicology

What comes to mind when you think of the following words? Summer berries. Vanilla Bean. Mango. Cheesecake. Almond. Chocolate. Blueberry. Luscious desserts and treats with which you can indulge yourself? Think again! These delectable sounding flavors are just a fraction of those currently available in *e-liquids*, the nicotine containing liquid used in electronic cigarettes.

With the surge in popularity of such devices that has taken place over the last few years, nicotine toxicity in our companion animals is very much on the rise. Let's take a more in-depth look at the hazards posed by e-cigarettes.

Electronic Cigarette Design

To understand how e-cigarettes are toxic to animals, we first need to understand the design and components of these devices.

Electronic cigarettes - also known as *e-cigs*, *vapes*, *tanks systems*, *vape pens*, or *electronic nicotine delivery systems (ENDS)* - are battery-operated devices used to create and inhale an aerosol composed of nicotine, flavorings, and other chemicals. The devices can take on many forms from looking like traditional cigarettes (called *cig-a-likes*), cigars, or pipes, or even everyday items like pens or USB memory sticks. Most are designed to be reusable with replaceable or refillable cartridges, though some are disposable.

The 4 main parts to an e-cigarette are: 1) a cartridge or reservoir filled with e-liquid, 2) a heating element (called an atomizer), 3) a power source (usually a battery), and 4) a mouthpiece used to inhale the e-liquid. Puffing or sucking on the mouthpiece triggers a sensor which, in turn, activates a heating element. The heating element then vaporizes the liquid nicotine solution held in the cartridge. Users inhale the resulting aerosol or vapor into their lungs, a practice known as *vaping*. Bystanders also breathe in this aerosol as a form of second-hand exposure.

The risk to humans from electronic cigarettes is much the same as with regular cigarettes - inhalation of nicotine plus carcinogens and toxic chemicals present in the vapor. Toxic nanoparticles of metals such as nickel, chromium, and cadmium have also been found in the vapor, and may come from the heating coils of the vaping device itself. However, the risk to animals from e-cigarettes often lies with ingesting the e-liquid itself.

Nicotine Risk

Most e-liquids contain nicotine, but there are non-nicotine liquids on the market as well (vaped for the flavor alone). E-liquids containing nicotine are made by extracting the nicotine from tobacco, and then mixing it together with a base (e.g. propylene glycol) plus some flavoring. Colorings and other chemicals (e.g. formaldehyde) may also be added. The e-liquids are then sold in pre-filled cartridges, or in large bulk bottles with which a user can refill empty cartridges.

The aroma of liquid nicotine in e-cigarettes can be alluring to animals (i.e. dogs), and flavored e-cigarettes might be even more enticing. Animals are exposed when they chew on pre-filled cartridges or bulk refill bottles containing an e-liquid, ingesting nicotine in the process. While dogs account for most of the exposures reported to Pet Poison Helpline, nicotine toxicity could occur in cats that ingest the e-liquid. The nicotine content of e-liquids can vary greatly from relatively low levels (8 milligrams nicotine per milliliter) to extra-high levels (59 milligrams nicotine per milliliter). In comparison, strong, unfiltered cigarettes contain about 36 mg of nicotine per cigarette, regular cigarettes contain 16 mg, and ultra-light contain 8 mg. The exposure to substantial doses of nicotine with ingestion of an e-liquid is possible, especially if a multi-pack of cartridges or a bulk refill bottle has been chewed. Severe nicotine toxicity and even death can result.

Signs of nicotine toxicity occur rapidly in companion animals ingesting an e-liquid due to the quick absorption of liquids in the GI tract. Signs can be seen within 15-30 minutes of ingestion of an e-liquid, versus 15-90 minutes after ingestion of more traditional forms of tobacco. Signs of nicotine toxicity can include vomiting, drooling, diarrhea, agitation, rapid breathing, high or low heart rate, abnormal rhythms to the heart, tremors, muscle weakness and wobbliness, high or low blood pressure, respiratory depression, and seizures. Coma, cyanosis and death are even possible with high-dose exposures.

Prompt treatment at a veterinary clinic is needed for nicotine toxicity. Home care is not advised even with exposure to small doses. Treatment that can be expected includes close monitoring for and treatment of both cardiac and neurologic abnormalities. Intravenous fluids, blood pressure and EKG monitoring, muscle relaxants, anticonvulsants, GI medications, and other drugs are often needed to treat an animal suffering from nicotine toxicity. Signs may last several hours in minor exposures up to 24 hours plus in severe cases.

Risk from Secondary Inhalation

Another major risk to companion animals from e-cigarettes is exposure to the aerosol or vapor generated during vaping. The vapor is often mistaken for water vapor, but it actually consists of nicotine, ultrafine particles that can be inhaled deep into the lungs, chemical flavorings linked to causing serious lung disease, volatile organic compounds, cancer-causing chemicals, and heavy metals such as nickel, tin, and lead. Respiratory irritation can result when animals breathe in the vapor from an e-cigarette, resulting in watery nose or eyes, a burning sensation in the nose/throat, nausea leading to drooling and/or vomiting, and even difficulty breathing (labored breathing, fast breathing, panting, coughing, or wheezing). Companion animals showing such signs need to be moved immediately into fresh air and require emergency veterinary treatment should their symptoms not quickly resolve once they are in fresh air. Animals with pre-existing respiratory issues (e.g. asthma, bronchitis, airborne allergies) are at greater risk for developing severe respiratory irritation from second hand exposure. Chronic exposure to the aerosol or vapor from e-cigarettes can cause permanent changes in the animal's lungs.

Pet owners and veterinary professionals are encouraged to consult with the veterinary toxicology specialists at Pet Poison Helpline if an animal is ever exposed to nicotine/tobacco in any form – electronic or traditional.

References:

<https://www.drugabuse.gov/publications/drugfacts/electronic-cigarettes-e-cigarettes>

https://www.cdc.gov/tobacco/basic_information/e-cigarettes/about-e-cigarettes.html

<https://www.medicalnewstoday.com/articles/216550.php>

Pet Poison Helpline internal database

Pet Poison Helpline, an animal poison control center based out of Minneapolis, MN is available 24/7 for pet owners and veterinary professionals that require assistance treating a potentially poisoned pet. The staff provides treatment advice for poisoning cases of all species, including dogs, cats, birds, small mammals, large animals and exotic species. As the most cost-effective option for animal poison control care, Pet Poison Helpline's fee of **\$59.00** per incident includes follow-up consultations for the duration of the poison case. Pet Poison Helpline is available in North America by calling **800-213-6680**. Additional information can be found online at www.petpoisonhelpline.com.