Fluoride in dog food - Pets' health at risk?

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An independent laboratory test of popular dog food brands, commissioned by Environmental Working Group, revealed that the food we buy for our pets contains high levels of fluoride, a contaminant that may put dogs' health at risk.

Eight major national brands marketed for both puppies and adults contained fluoride in amounts between 1.6 and 2.5 times higher than the Environmental Protection Agency's maximum legal dose in drinking water, and higher than amounts associated with bone cancer in young boys in a 2006 study by Harvard scientists (Bassin 2006). All 8 brands contain bone meal and animal by-products, the likely source of the fluoride contamination.

Scientists have not studied the safety of high doses of fluoride for dogs.

Fluoride levels ranged between 7 and 11.2 milligrams (mg) of fluoride per kilogram (kg) of dog food, with an average of 8.9 mg/kg in the 8 contaminated brands. In contrast, 2 dog food brands, one with vegetarian ingredients and one made by a small manufacturer, did not contain detectable levels of fluoride.

Bone meal leads to high fluoride levels in dog food
Notes: Fluoride content of 10 brands of dog food as determined by Covance lab (Madison, Wisconsin) using method 944.08 (AOAC International). ND* - below the method's limit of detection (less than 0.2 mg/kg fluoride).

While scientists have not determined how much fluoride is safe for dogs, they have found that people who consume excessive fluoride often develop mottled teeth (dental fluorosis) and weakened bones, leading to more fractures. High fluoride consumption is also associated with reproductive and developmental system damage, neurotoxicity, hormonal disruption, and bone cancer (NRC 2006).

Most of the fluoride contamination in dog food comes from an unsavory mix of bone meal and various meat byproducts added to dog food. The 8 high-fluoride brands list ingredients that include chicken by-product meal, poultry by-product meal, chicken meal, beef and bone meal; these are basically ground bones, cooked with steam, dried, and mashed to make a cheap dog food filler. A smaller amount of fluoride in dog food comes from fluoridated tap water used to prepare the food at pet food plants.
### Results of fluoride tests in 10 dog food brands

<table>
<thead>
<tr>
<th>Dog food brand</th>
<th>Dog food marketed for</th>
<th>Fluoride concentration detected (mg/kg)</th>
<th>Meat by-product ingredients (and position on the label)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Adult dogs, all breeds</td>
<td>&lt; 0.2</td>
<td>none</td>
</tr>
<tr>
<td>2</td>
<td>All life stages</td>
<td>&lt; 0.2</td>
<td>none</td>
</tr>
<tr>
<td>3</td>
<td>All life stages</td>
<td>7.44</td>
<td>Chicken meal (1)</td>
</tr>
<tr>
<td>4</td>
<td>Adult large breed</td>
<td>9.02</td>
<td>Chicken meal (1)</td>
</tr>
<tr>
<td>5</td>
<td>All life stages</td>
<td>8.4</td>
<td>Chicken meal (1); Turkey meal (2); Lamb meal (5)</td>
</tr>
<tr>
<td>6</td>
<td>Adult dog</td>
<td>7.56</td>
<td>Poulty by-product meal (5); Lamb meal (8)</td>
</tr>
<tr>
<td>7</td>
<td>Puppy large breed</td>
<td>7</td>
<td>Chicken meal (1); Lamb meal (5)</td>
</tr>
<tr>
<td>8</td>
<td>Active adult</td>
<td>10</td>
<td>Chicken by-product meal (2)</td>
</tr>
<tr>
<td>9</td>
<td>Puppy large breed</td>
<td>11.2</td>
<td>Chicken by-product meal (2); Chicken meal (8)</td>
</tr>
<tr>
<td>10</td>
<td>All life stages</td>
<td>10.3</td>
<td>Beef and bone meal (1)</td>
</tr>
</tbody>
</table>

Fluoride occurs naturally in the earth's crust, rocks, and soil, and in some water supplies. But two-thirds of Americans — and their pets and livestock — are exposed to the chemical via tap water that is artificially fluoridated in an effort to prevent tooth decay (CDC 2006).

Fluoride is also found in certain foods, either due to processing or from natural accumulation by the plants grown in high-fluoride soils (Buzalaf 2004; Fein 2001; Heilman 1997; Jackson 2002; Rodrigues 2009).

Once ingested with food or water, fluoride accumulates in bones.

Topical application of fluoride on teeth is a common and effective means of preventing tooth decay. But ingested fluoride is well known to damage teeth and the musculoskeletal system (NRC 2006).

Three studies show that boys who drink fluoridated tap water between the ages of 6 and 8 face a heightened risk of osteosarcoma, the rare but deadly form of bone cancer associated with fluoride (Bassin 2006; Cohn 1992; DHHS 1991). Scientists suspect that boys' rapid growth may make them more susceptible to bone cancer (Bassin 2006).
Dogs may be even more vulnerable to osteosarcoma than humans. More than 8000 osteosarcoma cases occur in dogs each year in the U.S. and the actual number is probably higher, since not all cases are confirmed and registered (Mueller 2007). In contrast, osteosarcoma incidence in the U.S. population is 0.3 cases per 100,000 (NRC 2006), adding to approximately 900 cases annually. Thus, nearly 10 times more osteosarcomas occur in dogs compared to people.

A dog drinking adequate water would be exposed to 0.05-0.1 mg fluoride per kg of body weight daily, depending on the dog's water consumption. A 10-pound puppy that eats about a cup of dog food a day would ingest approximately 0.25 mg fluoride/kg body weight/day based on average fluoride content in the 8 contaminated brands tested by EWG. At that rate, the puppy would consume 2.5 times more fluoride than EPA's legal limit in drinking water.

When fluoride in drinking water is taken into consideration, a 10-pound puppy would be exposed to 3.5 times more fluoride than EPA allows in drinking water. Large breed puppies may be exposed to even more fluoride.

Whatever the size and the appetite of a dog, combined fluoride exposure from food and water can easily range into unsafe territory. And, unlike children, who enjoy a variety of foods as they grow up, puppies and adult dogs eat the same food from the same bag every day, constantly consuming more fluoride than is healthy for normal growth. Routine exposure to excessive fluoride can predispose dogs to health problems, along with high veterinary bills, later in life.

**Fluoride contamination in dog food exceeds safe levels**

*Notes: Fluoride dose corresponding to legal limit in drinking water (MCL of 4 mg/L) was calculated using EPA's default daily water intake rate of 2 L for a 70 kg adult (NRC 2006). Dogs' exposures to fluoride was calculated from fluoride concentrations in EWG's commissioned testing and recommended feeding amounts listed on dog food brand packaging.*

Food and products for pets receive little government oversight. They are subject to few standards or regulations. This situation may put pets’ health at risk. Americans have a right to expect pet food to be held to health and safety standards similar to those for human food, and to be free from contaminants that endanger pets' health. Yet, when it comes to finding pet foods free of dubious food additives, chemical pollutants or untested ingredients, pet owners are largely on their own, since the agency in charge of pet food oversight, the federal Food and Drug Administration (FDA), has little authority and few resources to ensure that products produced for pets are safe (FDA CVM 2007).

Pets are sentinels for all of us. The widespread contamination of pet food illustrates the urgent need for standards that require companies to prove their products are safe before they are sold. Updating public health laws to reflect the newest scientific research is a
critical step to protecting the health of all members of American households, whether they walk on two legs or four.

To protect pets from excessive fluoride exposures, dog owners can purchase pet foods that do not contain bone meal and other animal byproducts.

To safeguard the health of pets nationwide, the government should establish fluoride limits in pet food that would protect both puppies and large breeds more vulnerable to bone cancer.

Official Methods of Analysis of AOAC INTERNATIONAL (2000) 17th Ed., AOAC INTERNATIONAL, Gaithersburg, MD. Method 944.08 determines total fluoride content in a variety of samples, including fats and oils, raw materials, plant tissues, bones, water, and many types of foods. Fluoride is extracted from the ashed sample using perchloric acid distillation method. Fluoride levels are then determined using colorimetric detection method.

**Health Effects of Fluoride**

**Fluoride and dental health**

During the last 15-20 years there has been a revolution in our understanding of fluoride's effects on teeth. It is now well-established that fluoride exposure is directly and proportionately related to dental fluorosis, a range of adverse health effect that includes mottling, pitting, and weakening of the teeth (Fejerskov 1994; Heller 1997; NRC 2006). At the same time, fluoride helps prevent tooth decay (Aoba 2002; Featherstone 2000).

Fluoride is believed to have contributed to the decline of tooth decay (cavities, also called dental caries) in many developed countries (CDC 2008; Kumar 2008). On the other hand, early exposure to fluoride poses undeniable health risks to children (NRC 2006; Sohn 2008). In the U.S. and worldwide, about 30 percent of children who drink fluoridated water experience dental fluorosis (Brunelle 1987; Heller 1997; Khan 2005). Strong concerns have been also raised about fluoride exposure and the risk of bone cancer (osteosarcoma), adverse effects on the thyroid function, and lowered IQ in children (NRC 2006).

The risks of fluoride are especially high for infants, prompting the American Dental Association (ADA) to issue an "Interim Guidance on Fluoride Intake for Infants and Young Children." ADA recommended that in areas where fluoride is added to tap water, parents should consider using fluoride-free bottled water to reconstitute concentrated or powdered infant formula (ADA 2006).

Much of what is publicized today in caries prevention programs world-wide is derived from the theories generated in the 1950s and ‘60s when water fluoridation was actively promoted (Aoba 2002; Pizzo 2007). As we know now, the main benefits of fluoride for
dental health are derived from surface application on the teeth, not from ingestion (Aoba 2002; Featherstone 2000; Weyant 2004).

Fluoride works primarily via three topical mechanisms which include (1) inhibition of demineralization at the crystal surfaces inside the tooth, (2) enhancement of remineralization at the crystal surfaces (the resulting remineralized layer is has greater resistance to acid), and (3) inhibition of bacterial enzymes (Featherstone 1999). All of these mechanisms are post-eruptive, which means that they operate in the oral cavity after the permanent tooth emerges from the gum (Aoba 2002; Hellwig 2004).

In summary, the value of fluoride-containing toothpaste to dental health is clear (Bratthall 1996; Ismail 2008; Marinho 2008). Fluoride dental products significantly reduce the incidence of cavities (Adair 2001). In contrast, a substantial and growing body of peer-reviewed science strongly suggests that ingesting fluoride in tap water does not provide any additional dental benefits other than those offered by fluoride toothpaste, and may present serious health risks (Fejerskov 2004; Pizzo 2007; Zimmer 2003).

**Fluoride neurotoxicity**

Fluoride's effects on the nervous system and behavior have been actively debated over the past two decades (NRC 2006). Reports from China, India, and Iran have found that children in high fluoride areas had significantly lower Intelligence Quotient (IQ) compared to children in low fluoride areas (Seraj 2006; Tang 2008; Trivedi 2007). These studies examined adjacent areas with drinking water sources naturally high or low in fluoride. Of note, the high-fluoride areas in these studies had fluoride concentration similar to some naturally fluoridated areas in the U.S., indicating the relevance of the lower IQ/fluoride findings to the U.S. public health.

Fluoride exposure causes neurochemical and biochemical changes in the brains of laboratory animals (Li 2003; NRC 2006). Fluoride also increases the production of free radicals in the brain (Chouhan 2008; Zhang 2007; Zhang 2008). Studies of rats exposed to fluoride compounds reported distortions of brain cells and neuronal deformations, and neurodegeneration (Bhatnagar 2002; Shivashankara 2002; Varner 2002). These neurobiological effects are associated with developmental delays, behavioral problems, and possibly dementia in late adulthood (NRC 2006).

Reviewing the overall evidence for fluoride neurotoxicity, the NRC report concluded that the "consistency of study results appears significant enough to warrant additional research on the effects of fluoride on intelligence." That finding was echoed by a December 2006 study published in the prestigious peer-reviewed journal The Lancet that identified fluoride as an “emerging” neurotoxin (Grandjean 2006).

**Hormonal disruption**

Summarizing the current state of the science, the National Research Council described fluoride as an endocrine disruptor with especially significant effects on the thyroid and
parathyroid hormone function (NRC 2006). Fluoride effects on other hormonal organs, such as the pineal gland, the adrenals, the pancreas, and the pituitary also have been reported (NRC 2006).

Effects of fluoride on the thyroid was first reported 150 years ago (Gedalia 1963; Maumene 1854). Fluoride's potential to impair thyroid function is most clearly illustrated by the fact that until the 1970s, doctors in Europe used fluoride as a thyroid-suppressing medication for patients with Graves's disease and symptoms of hyperthyroidism (Galletti 1957; Litzka 1937). 10 studies conducted between 1941 and 1999 found an association between endemic goiter (enlargement of the thyroid gland) and fluoride exposure in countries as diverse as India, South Africa, Kenya, England, and Nepal. Fluoride anti-thyroid effects appear to be especially severe in cases of iodine deficiency, a condition that is on the rise in the United States (NRC 2006).

Fluoride exposure may pose especial risk to the pineal gland, a part of the brain responsible for production of melatonin and maintenance of day-night cycles and sleep patterns and a range of other physiologic functions. The pineal gland is a unique area of the brain which undergoes calcification with age (Akano 2003). Melatonin is produced by the uncalcified pineal gland tissue and higher calcification is associated with decreased melatonin production (Kunz 1999; Mahlberg 2009). As with other calcifying tissues, the pineal gland accumulates fluoride: an aged pineal gland has 600 times more fluoride compared to the muscle tissue (Luke 2001). In animal studies, fluoride impact on the pineal gland caused lower melatonin production, earlier sexual maturation, and altered day-night activity cycle (Luke 1997).

Today, many people living in communities with fluoridated tap water are ingesting doses of fluoride that fall within the range of doses shown to alter thyroid function, elevate the levels of thyroid-stimulating hormone, calcitonin and parathyroid hormone, impair glucose tolerance and increase prevalence of goiter (NRC 2006). The National Research Council report summarized 23 studies that have observed adverse hormonal effects of fluoride at concentrations of 1-4 mg/L in drinking water.

**Fluoride link to bone cancer**

Fluoride is known to cause different types of genetic damage in mammalian cells, especially chromosomal aberrations (Zeiger 1993). Genetic toxicity of fluoride and its ability to stimulate active, uncontrolled division of bone cells have been long considered as potential contributors to carcinogenicity effects (NRC 2006). Three human epidemiological studies and two long-term animal studies found a link between fluoride and bone cancer (Bassin 2006; Cohn 1992; DHHS 1991; Maurer 1990; Maurer 1993; NTP 1990).
Fluoride and Osteosarcoma

Fluoride in naturally or artificially fluoridated water has been linked with osteosarcoma in young boys and teenagers less than 20 years of age (NRC 2006). Osteosarcoma accounts for about 3% of all childhood cancers, and occurs with an incidence of 0.3 cases per 100,000, more commonly in boys than in girls (NRC 2006). While rare, this cancer is deadly – the 5-year mortality rate is around 50%, and nearly all survivors have limbs amputated, usually legs. Similar to young boys, dogs are well known to be at risk from osteosarcoma (Ru 1998).

Osteosarcoma is the most common primary bone tumor in dogs; it is estimated to occur in over 8,000 dogs each year in the U.S., primarily in larger breeds (Chun 2003; Dernell 2001; Priester 1980; Withrow 1991). According to a recent expert review, the actual incidence is probably higher, since not all cases are confirmed and registered (Mueller 2007). Large dogs with fast growing bones are especially at risk. Only 5% of all osteosarcomas develop in dogs weighing less than 30 pounds and giant dogs generally develop osteosarcoma at a younger age compared to smaller-sized dogs and (Cooley 1997; Misdorp 1979).

Scientists are still trying to understand the full spectrum of causes for canine osteosarcoma. Mutagenic effects of radiation, multiple minor traumas, metallic implants, and genetic predisposition have been suggested as possible risk factors for osteosarcoma (Mueller 2007). Yet, one of the very plausible scientific links points to fluoride as a possible causative agent for osteosarcoma in both large dogs and young boys.

Three factors likely contribute to fluoride's ability to produce bone cancer: fluoride accumulates in the bones (NRC 2006); fluoride is an active mitogen (a substance that stimulates cell division) that causes a rapid proliferation of bone-building cells known as osteoblasts (Gruber 1991; Kleerekoper 1996; Whitford 1996); fluoride's cancer-promoting effects are especially significant in young boys whose bones grow more rapidly than for any other group (Bassin 2006).

The science supporting the link between fluoride and bone cancer in boys is compelling, and includes 3 focused epidemiological studies (Bassin 2006; Cohn 1992; DHHS 1991), 2 long-term animal studies (Maurer 1991; Maurer 1993; NTP 1990), a wealth of mechanistic information on the effect of fluoride on the developing bone (reviewed in NRC 2006), and a new study published in 2009 that detected higher fluoride levels in osteosarcoma patients compared to 2 other groups: patients with bone-forming tumors other than osteosarcoma, and people serving as "controls" in the study who were experiencing musculo-skeletal pain but did not have tumors (Sandhu 2009).

The incidence of many cancers in dogs is higher than in humans and the progression is usually faster (Mueller 2007). A dog's diet, especially during the early growth spurt, is a likely contributor to their overall cancer risk. While human infants and young children can eat a variety of foods, puppies and adult dogs eat the same dry dog food, often high
in fluoride, every day. This high level of fluoride exposure may well be a contributing factor to osteosarcoma in dogs and an avoidable health risk that dog owners can control.

References


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**Dog Food Contaminated with Levels of Fluoride Above EPA's Legal Limit for Humans**

WASHINGTON, D.C -- Eight of 10 dog food brands tested by an independent laboratory commissioned by Environmental Working Group (EWG) contain fluoride in amounts up to 2.5 times higher than the Environmental Protection Agency’s (EPA) national drinking water standard.


The eight dog foods, all of them major national brands, were found to contain significantly more fluoride than levels implicated by a 2006 Harvard study in bone cancer in young boys.

In all eight cases, the likely sources of excess fluoride were bone meal and animal byproducts.

“Due to a failed regulatory system and suspect practices by some in the pet food industry, countless dogs may be ingesting excessive fluoride that could put them at risk,” Olga Naidenko, Ph.D, lead researcher of the EWG-sponsored study, said.

Moreover, Naidenko said, the fact so many popular national pet food brands contain previously undetected health hazards is one more symptom of the federal food safety system’s overall laxity.

“Our findings point to the need for basic health protections that require companies to prove their products are safe before they are sold,” Naidenko said. “Bringing public health laws in line with the newest scientific research is a critical step in protecting the health of all members of American households, whether they walk on two legs or four.”
The eight high-fluoride brands disclosed contents including chicken by-product meal, poultry by-product meal, chicken meal, beef and bone meal. Any ingredient described as “animal meal” is basically ground bones, cooked with steam, dried, and mashed to make a cheap dog food filler. A small fraction of fluoride in dog food comes from fluoridated tap water added to solid ingredients at pet food plants.

Fluoride occurs naturally in some water supplies. But two-thirds of Americans -- and their pets and livestock-- drink water that has been artificially fluoridated on grounds it improves dental health.

Fluoride is also found in certain foods, those from plants grown in high-fluoride soils or those to which the chemical is introduced during processing. Once ingested with food or water, fluoride accumulates in the bones.

An average dog who drinks adequate water daily would be exposed to 0.05 to 0.1 milligrams of fluoride per kilogram of body weight, depending on the dog's weight and water consumption. But those dogs who eat food high in fluoride, day in and day out, may be exposed to unsafe levels of fluoride.

For example, a 10-pound puppy that eats about a cup of dog food a day would consume 0.25 milligrams of fluoride per kilogram of body weight per day, an amount five times higher than the ”safe” level set by the Agency for Toxic Substances and Disease Registry (ATSDR) of the U.S. Department of Health and Human Services.

Pet food should be held to the same health and safety standards as human food and should be free of contaminants that may endanger pets' health. Yet, the federal Food and Drug Administration (FDA)has little authority and few resources to ensure that products produced for pets are safe.

The bottom line: when it comes to dubious food additives, chemical pollutants or untested ingredients in pet food, pets and their owners are mostly on their own.

NOTE: If your dog’s food contains bone meal and other meat by-products, EWG recommends switching to brands free of these ingredients in order to minimize your dog’s exposure to harmful pollutants, including fluoride.

EWG is a nonprofit research organization based in Washington, DC that uses the power of information to protect human health and the environment. http://www.ewg.org