Potential Contaminants of Pet Food:
A Report to the AAFCO Pet Food Committee Working Group
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1. Bacterial Endotoxins

While the rendering process kills bacteria, it does not eliminate the endotoxins or spores that some of those organisms produce. These contaminants can survive processing and cause sickness and disease.

Toxin-producing bacteria like *Salmonella, E. coli*, *Clostridia*, *Staph*, and other gram-negative bacteria are very common contaminants of all slaughterhouse products (including human-edible meat and poultry), but especially of the sorts of things that make up by-products, such as digestive organs. [Strombeck 2010, Cullor 2001]

When infected animals die, massive numbers of bacteria from the colon migrate out and contaminate the carcass. Rendering kills large numbers of coliform and other gram negative bacteria, which releases large amounts of endotoxin, which is not altered by processing. Even a small amount of endotoxin present in the finished product can make pets sick.

Despite rendering, live coliforms have been cultured from rendered meat meal. [Strombeck 2010] Additionally, bacterial spores from organisms like *Clostridia* and *Bacillus* are not destroyed by rendering. [Franke-Whittle 2013]

Even when high temperatures during rendering and extrusion kill all the bacteria, the final product loses its sterility during drying, spray-coating, and packaging processes. In one survey, live bacteria were cultured from the surface of every single one of 80 dry dog and cat foods tested. [Cullor 1999-2000]

The usual number of bacteria in most animal products used for food is 1,000 to 10,000 per gram. In one study, 40 mg of endotoxin was given orally to normal pigs and goats. They all showed signs of illness, some severe. [Cort 1990] The pig's digestive system is very similar to that of dogs and cats.

> "Small amounts of endotoxin cause shock that can lead to death… Endotoxin can initiate and perpetuate damage to the intestinal mucosal surface, and it can perpetuate inflammatory diseases of the digestive system, including allergies." [Strombeck 2010]

2. Antibiotic Resistant Organisms

Food animals can become hosts to antibiotic resistant bacteria through either contaminated feed or administration of subtherapeutic antibiotics to the animal. Carcass contamination during slaughter is a common route for human infection. While bacteria are killed during most pet food processing methods, fragments of bacteria or bacterial DNA can pass the resistant trait to resident organisms in a pet's digestive tract that can potentially be transmitted to humans and other animals through fecal contamination of the environment. [Davis 2003]

One study found multi-drug resistant *Enterococci* and methicillin-resistant *Staphylococcus aureus* from dog fecal samples collected from city streets and sidewalks. The presence of the resistant bacteria in an urban environment may represent a public health hazard which requires control measures by competent authorities. [Cinquepalmi 2013]

3. Fungal Toxins

Some types of mold produce toxins similar to bacterial endotoxins. Modern farming practices, adverse weather conditions, and improper drying and storage of crops can contribute to mold growth. Aflatoxin, ochratoxin, fumonisin, trichothecene, zearalenone and patulin are the most common mycotoxins in animal feed (and human food).

When mycotoxins are present in feed consumed by livestock, they can contaminate meat and milk from those animals. [Boudra 2007; Milićević 2010; Peska 1995] This is significant because even if a manufacturer tests grain products for aflatoxin, it may completely miss significant levels in animal-source ingredients.

Many mycotoxins are toxic; even low concentrations can cause autoimmune disease, including allergies. Others are teratogenic, carcinogenic, and mutagenic [Bennet 2003; CAST 2003]. Mycotoxins are relatively heat-stable; some can withstand temperatures up to 300^{o}F. Very little if any destruction occurs under normal food processing conditions and temperatures. [Milićević 2010]

Mycotoxins can have both acute and chronic effects on animals, especially monogastrics (including dogs, cats, and humans). [Hussein 2001; Milićević 2010; Zain 2011]. The effects of mycotoxins in food include loss of human and animal life, and increased health care and veterinary care costs. [Hussein 2001]

The pet food ingredients most likely to be contaminated with mycotoxins are grains such as wheat and corn; as well as fishmeal. However, virtually any food can be contaminated. There have been many large recalls of pet food in response to illness and death in pets due to one very powerful poison—aflatoxin—in dry food. Survivors may continue to experience problems, as aflatoxin is highly carcinogenic and can cause disease even at low levels of exposure; it is also genotoxic. [Buss 1990; Milićević 2010] Ochratoxin affects primarily the kidneys. Trichothecenes cause vomiting, diarrhea and bowel inflammation; they are also immunosuppressive. Fumonsins are "ubiquitous in corn" and particularly toxic to the nervous system. [Milićević 2010]

4. Pharmaceutical drugs

Because sick or dead animals are frequently processed for pet foods, the drugs that were used to treat or euthanize them may still be present in the end product. Penicillin and pentobarbital are just two examples of drugs that can pass through processing unchanged. [Markus 1989; FDA/CVM 2002] There are a few kidney-toxic antibiotics that are extremely restricted, with long "withdrawal" times before slaughter for human food; but if livestock die with high levels of drugs in their systems, they are condemned for human consumption but can still be rendered and used in pet food.

It has been known for many years that overuse of antibiotics in livestock are a factor in multi-drug resistance and human illness.

"Recycling animal waste into animal feed has been practiced for > 40 years as a means of cutting feed costs… [AAFCO] advises that processed animal waste should not contain pathogenic microorganisms, pesticide residues, or drug residues that could harm animals or eventually be detected in animal-based food products intended for human consumption. Nonetheless, these guidelines are not adequately enforced at the federal or state level." [Sapkota 2007] If antibiotic-treated animals are not segregated, then their drug-loaded wastes will likely be included in rendered products and pet food.

5. Chemical Contaminants and Residues

Pesticides and fertilizers may leave residue on plant products. [Grisamore 1991] Grains that are condemned for human consumption by the USDA due to excessive residues may legally be used in pet food. (FDA Compliance Policy CPG Sec. 675; USDA personal communication 2001)

Dioxins, PCBs, fire retardants, and other persistent organic pollutants may be present in animal tissues used in both human food and animal feed, including pet food. [Fernández-González 2015; Srogi 2007] Other chemicals found in food include insecticides, rodenticides, fluoroquinolone antibiotics, bovine somatatropin, radioactive waste, and many more. Endocrine disruptors such as bisphenol-A are present in foods as well as some types of packaging, including steel and aluminum cans. Chemicals, as opposed to microbes, are typically thermally stable and not affected by heat from processes like rendering and extrusion. [Mansour 2011]

6. Maillard Reaction Products

This group of chemicals includes the known carcinogen acrylamide, as well as other potentially toxic compounds. They form at cooking temperatures of about 250˚F in foods containing certain sugars and proteins, particularly the amino acid asparagine (found in large amounts in potatoes and cereal grains) due to a chemical process called the Maillard reaction. This reaction reduces protein bioavailability, so that no matter what the guaranteed analysis says about protein levels, the amount a pet can use is significantly less. Most dry pet foods contain cereal grains or starchy vegetables such as potatoes, as well as animal proteins, and they are processed at high temperatures (200–300°F) at high pressure during extrusion; baked foods are cooked at 500°F or more. These conditions are perfect for the Maillard reaction to occur. In fact, the Maillard reaction is considered desirable in pet food because it imparts a palatable taste, even though it reduces the bioavailability of taurine, lysine, and other amino acids. The amount and effects of acrylamide in pet foods are unknown; but research shows that other Maillard reaction products are present in pet foods in much higher amounts than in human food. [van Rooijen 2014]

7. GMOs

Genetically engineered or modified plant products are also of concern. Currently, 95% of U.S.-grown soybeans and corn are GMO. Soy and corn are very common pet food ingredients; and they are also fed to most U.S. livestock and poultry. This creates a sort of double whammy; since the products of genetically altered DNA may be present in the animal products used in pet food, as well as being fed directly to our pets. A 2009 study found significant damage to the liver and kidneys of rats fed genetically modified corn [de Vendômois 2009].

Even if GMOs themselves are ultimately found to be safe, their use has resulted in a huge increase in herbicide application to crops, since weeds have adapted themselves to thrive despite it. Herbicides can be very toxic. For example, the active ingredient in Monsanto's Roundup®, glyphosate, inhibits liver and endocrine functions, which in turn have widespread effects all over the body. [Claire 2012, Samsel 2013]. Because glyphosate is toxic to bacteria, it also has deleterious effects on mammals' all-important commensal gut bacteria. If a plant product contains excessive herbicide residue, it is rejected for human consumption and may be diverted to animal feed, including pet food.

8. Heavy Metals and other Toxins

A study was conducted to assess the content of 15 toxic elements in pet food; samples were taken of wet and dry dog and cat foods across a range of prices. All tested foods contained toxic heavy metals; but the highest levels were found in dry foods. Toxic elements included arsenic, beryllium, cadmium, cesium, chromium, antimony, lead, molybdenum, nickel, thorium, thallium, uranium, and vanadium. The researchers compared the amount of these toxins in the food to allowable limits in human food, and found that the dose that would be consumed by the average pet exceeded limits set by the U.S. Environmental Protection Agency (EPA) and the

World Health Organization (WHO) for most of the foods [Atkins 2011]. The FDA later disputed these findings [FDA 2011], but their arguments are based primarily on "maximum tolerable levels," which is not equivalent to "safe for long-term consumption by pets in every meal of every day"—a standard that pet guardians rightly expect. [Fries 2014]

FDA itself recently conducted tests to ascertain current levels of arsenic in poultry. They found that the levels were higher than expected, especially in chicken livers. [FDA 2015] While the last of the arsenic-containing drugs will supposedly be withdrawn by the end of this year, pet food being made now, pet foods containing poultry liver or by-products that are currently on the market may contain significant levels of arsenic. Such foods will continue to constitute a threat to pet health until 2017, based on an expected 12- to 18-month shelf life.

Dioxins, PBDEs, and PCBs may also be present in animal tissues; one study found levels of these toxins in the US that were 3-20 times higher than Asia or Europe. [Fernández-González 2015]

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