CVM CY15-17 Report on Heavy Metals in Animal Food

October 24, 2019

By Mikayla Deemy, ORISE Fellow and Linda Benjamin, PhD, Center for Veterinary Medicine

INTRODUCTION

As part of the Animal Feed Contaminants Program (AFCP) (7371.003), the Center for Veterinary Medicine (CVM) manages a Mineral (elements/heavy metals) Surveillance Program (PAC 71003B). Under this program, each year a broad range of domestic and imported animal food samples are collected and analyzed for heavy metals. This program allows CVM to protect human and animal health by monitoring for heavy metal levels in animal food and ingredients to be included in pet food and livestock feed.

Heavy metals - such as arsenic (As), lead (Pb), cadmium (Cd), mercury (Hg) and others - are found in certain animal foods. For these heavy metals, high levels can be toxic; however, eliminating them entirely from our animal food supply is not always possible because these metals are found in the air, water, and soil.

While the FDA CVM has not promulgated guidance, action levels, or tolerances for heavy metal levels in animal food, the FDA has—and uses—the authority to take action on a case-by-case basis where a particular animal food is found through routine or targeted testing to be adulterated. This is accomplished by taking into consideration information provided in the National Research Council of the National Academies *Mineral Tolerance of Animals* book (NRC) as well as information provided in the Association of American Feed Control Officials *Official Publication* (AAFCO OP).

BACKGROUND

From January 1, 2015 through December 31, 2017 a total of 318 samples (241 domestic and 77 import) were collected and analyzed for heavy metals. This included samples collected for the following commodities:

- 32 (10.1%) of the samples were vitamins, minerals, or supplements
- 12 (3.8%) of the samples were medicated animal feeds
- 122 (38.4%) of the samples were non-medicated animal feeds
- 102 (32.1%) of the samples were byproducts for animal feeds
- 50 (15.7%) of the samples were pet and laboratory animal foods

The current maximum tolerable/tolerance level for arsenic, cadmium, mercury and lead in (complete) feed according to the NRC and the AAFCO OP are provided below.

	Arsenic (ppm[1])	Cadmium (ppm)	Mercury (ppm)	Lead (ppm)
NRC[2] MTL[3] in complete feed	30	10	0.2	10
AAFCO[4] MTL in complete feed	50	0.5	2	30

RESULTS

Table 1. Range of Heavy Metal Levels Detected in Vitamins, Minerals, or Supplements

Commodity [Number of Samples (D/I)[5]]	Arsenic (ppm)	Cadmium (ppm)	Mercury (ppm)	Lead (ppm)
Vitamins [1/1]	0 - 1.81	0 - 0.19	0 - 0.02	0 - 2.85
Mineral supplements and mineralized salt [24/6]	0 - 8.54	0 - 4.34	0 - 0.84	0 – 57.0

Table 2. Range of Heavy Metal Levels Detected in Medicated Animal Feeds

Commodity [Number of Samples (D/I)]	Arsenic (ppm)	Cadmium (ppm)	Mercury (ppm)	Lead (ppm)
Finished Medicated Feed [10/2]	0.03 – 1.11	0.03 - 0.08	0 - 0.01	0.04 – 1.24

Table 3. Range of Heavy Metal Levels Detected in Non-Medicated Animal Feeds

Commodity [Number of Samples (D/I)]	Arsenic (ppm)	Cadmium (ppm)	Mercury (ppm)	Lead (ppm)
Livestock Feed [95/6]	0.002 - 2.68	0 - 1.40	0 - 0.13	0 – 12.2
Mixed Pellets [21/0]	0.01 – 1.65	0.01 - 0.17	0 - 0.003	0.01 - 1.43

[1] ppm = parts per million
[2] Values cited are those for the most sensitive animal species in NRC's 2005 edition of "Mineral Tolerance of Domestic Animals."
[3] MTL: "The maximum tolerable levels" in complete feed represent the dietary level that when fed for a defined period of time, will not impair the animal health and performance, should not produce unsafe residues in human food derived from that animal, and were obtained from the NRC (2005). MTL's are listed for the most-sensitive species, other than rodents.
[4] Values cited are those for the most sensitive animal species in NRC's 1980 edition of "Mineral Tolerance of Domestic Animals."
[5] D/I = Domestic/Imported samples

Table 4. Range of Heavy Metal Levels Detected in Byproducts for Animal Feeds

Commodity [Number of Samples (D/I)]	Arsenic (ppm)	Cadmium (ppm)	Mercury (ppm)	Lead (ppm)
Animal Protein Products [7/9]	0 - 8.34	0 - 1.63	0 - 0.17	0 - 1.88
Plant Protein Products [11/14]	0 - 0.09	0 - 0.20	0 - 0.33	0 - 0.20
Roughage Products [4/2]	0.01 - 0.77	0.04 - 0.47	0 - 0.002	0.01 - 1.18
Grain Products [30/6]	0 - 0.75	0 - 0.16	0 - 0.01	0 - 0.13
Processed Grain By-Products [7/7]	0 - 0.18	0 - 0.02	0 - 0.01	0 - 0.06
Miscellaneous [3/2]	0.01 - 4.04	0.002 - 0.31	0 - 0.003	0.01 – 6.24

Table 5. Range of Heavy Metal Levels Detected in Pet and Laboratory Animal Foods

Commodity [Number of Samples (D/I)]	Arsenic (ppm)	Cadmium (ppm)	Mercury (ppm)	Lead (ppm)
Pet Food [28/22]	0 - 2.58	0 - 0.22	0 - 0.13	0 - 0.90

Arsenic

None of the 318 samples were above the MTL for arsenic given by either the NRC (30 ppm) or the AAFCO OP (50 ppm). The three samples with the highest levels of arsenic were a domestic mineral supplement for goats (8.54 ppm), an imported fish meal from France (8.34 ppm), and a domestic cattle premix (6.40 ppm). The median arsenic value for all samples is 0.083 ppm.

Cadmium

None of the 318 samples were above the MTL for cadmium given by the NRC (10 ppm). Some samples were above the MTL for cadmium given in the AAFCO OP (0.5 ppm) including the three highest: a domestic mineral supplement (4.34 ppm), a domestic poultry mineral mix (3.14 ppm), and an imported supplement from China (3.14 ppm). The median cadmium value for all of samples is 0.047 ppm.

Mercury

None of the 318 samples were above the MTL for mercury given in the AAFCO OP (2 ppm). Some samples were above the MTL for inorganic mercury (0.2 ppm), but not for organic mercury (1 ppm), given by the NRC. The three highest concentrations included a domestic poultry mineral mix (0.842 ppm), an imported soybean meal from India (0.329 ppm), and a domestic herring meal (0.167 ppm). The median mercury value for all samples is 0.001 ppm.

Lead

Three of the 318 samples were above the MTL for lead given by the NRC (10 ppm) and two of those samples were above the MTL for lead in the AAFCO OP (30 ppm). These samples included an imported color additive from Germany (57 ppm), a domestic poultry mineral mix

(30.28 ppm), and a domestic vitamin balancer for cattle (12.2 ppm). The median lead value for all samples is 0.079 ppm.

CONCLUSION/RECOMMENDATION:

The review of heavy metal data reported between January 1, 2015 through December 31, 2017 showed that the animal food samples collected and analyzed were mostly below the maximum tolerable levels for arsenic, cadmium, mercury, and lead given in the NRC *Mineral Tolerance of Animals* book as well as those given in the AAFCO *Official Publication*. Although some animal food ingredients and/or mineral premix samples were over MTL levels, based on typical inclusion rates of these ingredients, the expectation is that the heavy metal levels in the final feed would be within an acceptable range and not cause a safety issue for the specified animal or for the human food derived from that animal.

In past sampling years, FDA CVM broadly monitored livestock feed, pet food, and byproducts/ingredients for heavy metals as well as other chemical, biological, and physical contaminants. Considering that animals may be exposed to heavy metals from different sources and that these various low levels could potentially add up to a level of concern, in the future, the Feed Contaminants Program will direct the collection and analysis of specific samples to aid in performing targeted metrics.

REFERENCES

Association of American Feed Control Officials. (2019). *2019 AAFCO Official Publication.* Champaign, IL: FASS Inc. Retrieved from http://www.aafco.org/Publications

National Research Council of the National Academies. (2005). *Mineral Tolerance of Animals* (Second Revised ed.). Washington, D.C.: The National Academies Press.