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Are Grains in the Diet Necessary for Heart Health?

No, they are not necessary. Veterinarians recently have been led to believe that grains are needed to prevent dilated cardiomyopathy (DCM) in dogs. There have been specific concerns about diets that use legumes (peas) instead of grains or animal products for the protein content of the food.

There are two extremely important facts about protein which affect heart health over the life of dogs.

One fact is that heart cells require COMPLETE protein which contains the 9 essential amino acids that must come from food because the body cannot create these amino acids. Only animal products (dairy products, eggs, meats, fish) and some plants (quinoa, amaranth, soy, buckwheat) contain COMPLETE protein. Other plants such as peas will not contain complete protein.

Any commercially cooked food will not provide complete protein. Most pet foods are cooked at high temperatures to kill bad germs, so the food does not spoil, and the pets do not get sick. Temperatures above 160 degrees Fahrenheit (71.1 degrees Celsius), however, damage proteins and binds them to certain carbohydrates in the food. [1] These combinations look strange to the body and the body does not have the ability to digest them. These undigested foreign molecules stay intact and cause inflammation and damage to the intestinal lining cells. This damage opens up the space between intestinal lining cells which then creates avenues that allow these foreign molecules to "leak" through into the bloodstream. These molecules then travel throughout the body, including to the heart. The body reacts with inflammation to try to break these foreign molecules down.

As you can see, it would not matter whether a commercially cooked pet food was grain-free or not, both can cause damage to the proteins of the food. Freeze-drying also damages proteins.

Certain breeds of dogs have a genetic predisposition to develop DCM including Dobermans, Irish Wolfhounds, Newfoundlands, Great Danes, Standard/Giant Schnauzers, and Portuguese Water Dogs.

Over the last 15 years, our office has been recommending grain-free diets. We have seen one case of DCM -- a Doberman who came to us already with DCM. Dr. Magnusson (Canobie Lake Veterinary Hospital in Windham, NH) has been recommending grain-free diets for 15 years as well to over 2000 clients. She has seen only 2 dogs so far diagnosed with DCM, "…both of these dogs were of breeds in which DCM had a genetic link and both dogs had parents who had DCM."

A study at the University of Missouri College of Veterinary Medicine looked at grain-free food sales compared to the incidence of DCM in across the country over a time span of 1-20 years. Nationally, grain-free pet food sales increased from 2011 to 2019, there was no significant change in the national percent of DCM cases.[2] Increased numbers of dogs eating grain-free foods did not result in an increased frequency of DCM.

Sources:

[1] Guide to Natural Health for Dogs and Cats, 1st , 2nd, 3rd editions, Richard and Susan Pitcairn

2 "Incidence of Canine Dilated Cardiomyopathy Diagnosed at Referral Institutes and Grain-Free Pet Food Store Sales: A Retrospective Study", Quest BW, et al., Front. Anima. Sci. 17 March 2022

Scientific Review Article

Grain-Free Pet Foods, Taurine, and Canine Heart Disease: Response to FDA

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Abbreviations

AAFCO Association of American Feed Control Officials
CHD Canine heart disease
DCM Dilated cardiomyopathy

Introduction

The FDA released a statement on July 12, 2018, that it is investigating a possible connection between grain-free diets and dilated cardiomyopathy (DCM) in dogs, which is also known as canine heart disease (CHD) (1).

There are various factors known to attribute to the development of DCM including genetics, diet, taurine requirements for dogs, the interaction between foods as they pass through the body, and the interaction between foods and the body itself (2). Researchers are only beginning to understand the importance of the last 2 factors listed above. Although nutritional knowledge has increased dramatically over the past century, this latest contention, that grain-free foods may be associated with some adverse effects on the heart, highlights how little we actually know and understand.

We know that amino acids, like taurine, are found in foods in varying amounts depending on the animal or plant-based protein source. Taurine is an essential amino acid for cats because they need food-sourced taurine to prevent DCM. The Association of American Feed Control Officials (AAFCO) has a minimum requirement for taurine in cat foods. Taurine is not considered to be an essential amino acid for dogs because they synthesize sufficient quantities for their metabolic needs in the liver from cysteine and methionine. Although taurine is present in dog food, AAFCO does not require a minimum amount of taurine to be present in dog food or to be listed on dog food labels (3).

Researchers have not been able to conclude whether cooking adversely affects or significantly degrades amino acid levels in foods, so this issue is still under debate. The results of a study by Spitze, et al. indicated that "The amount of taurine that remained in a feed ingredient after cooking depended upon the method of food preparation. When an ingredient was constantly surrounded by water during the cooking process, such as in boiling or basting, more taurine was lost. Food preparation methods that minimized water loss, such as baking or frying, had higher rates of taurine retention" (4). A study by Weiss, et al. concluded that high temperatures do cause breakdown or changes to amino acids, including cysteine, which is 1 of the essential amino acids that dogs need to form taurine. "Eight (including cysteine) of the 20 standard amino acids decompose at well-defined, characteristic temperatures, in contrast to commonly accepted knowledge" (5).

Taurine deficiency can lead to heart disease in humans, cats, and dogs (1, 2, 6, 7). All breeds and sizes of dogs can develop CHD. However, DCM is more common in large and giant breeds such as the Great Dane, Boxer, Newfoundland, Irish Wolfhound, Saint Bernard, and Doberman Pinscher. American and English Cocker Spaniels also have a relatively high incidence of DCM. The FDA reported atypical cases of DCM in Golden and Labrador Retrievers, Whippets, a Shih Tzu, a Bulldog, Miniature Schnauzers, and mixed breeds.

The Potential Connection Between Diet and Canine Heart Disease

To date, no research has been conducted to determine if grain-free diets could cause heart disease in dogs, but

several studies that investigated potential dietary causes of canine heart disease are summarized below:

A group of 131 normal dogs that consumed commercially prepared dog food had blood drawn 3–5 hours post-meal to be analyzed for plasma amino acids and whole blood taurine. It was determined that age, sex, body weight, body size, and diet did not have an effect on plasma and whole blood taurine concentrations. Whole blood taurine concentrations were lower in dogs fed diets containing whole grain rice, rice bran, or barley. The lowest whole blood taurine concentrations were found in dogs fed lamb, or lamb meal and rice diets. Plasma methionine and cysteine concentrations were lower in dogs fed diets with animal meals or turkey, and whole grain rice, rice bran, or barley (7).

A study was performed to determine taurine status in a large group of Newfoundlands related by environment, diet, or breeding to a dog with DCM and taurine deficiency. A group of 19 privately owned Newfoundlands between 5 months and 11.5 years old that had been fed commercial dry diets meeting established nutrient recommendations were included in the study. Diet histories were obtained; blood, plasma, and urine were assessed for taurine concentrations; plasma methionine and cysteine concentrations were measured. In 8 dogs, taurine concentrations were measured before and after 30 days of supplementation with methionine. Ophthalmic examinations were performed in 16 dogs. Twelve dogs were considered to be taurine deficient. Echocardiography was performed in 6 dogs that were taurine deficient. There was a significant linear correlation between plasma and blood taurine concentrations for the dogs with low plasma concentrations of taurine. The blood taurine concentrations did not vary substantially for the dogs with greater taurine plasma concentrations. Taurine-deficient dogs had been fed lamb meal and rice diets. Retinal degeneration, dilated cardiomyopathy, and cystinuria were not found in any dog examined for these conditions. The taurine deficiency was reversed by a change in diet or methionine supplementation (8).

The results of this study indicate a high prevalence of taurine deficiency among an environmentally and genetically related cohort of Newfoundlands fed apparently complete and balanced diets. In Newfoundlands, blood taurine concentrations indicative of taurine deficiency may be substantially less than concentrations indicative of a deficiency in cats (8).

Another study compared 216 privately owned Newfoundland dogs to Beagles and expanded on the above 2003 prospective study. All the dogs were fed the same lamb meal and rice kibble. The top ingredients were lamb meal, brown rice, ground rice, rice bran, chicken fat (preserved with mixed tocopherols and ascorbic acid), flax seed, dehydrated alfalfa meal, dried egg product, avocado oil, lecithin, and brewers dried yeast. It is important to note that beet pulp was not listed as an ingredient (9).

As of 2006, the known possible causes of diet-induced taurine deficiency include 1) insufficient synthesis of taurine, 2) extraordinary loss of taurine or its precursors in urine, 3) accelerated gastrointestinal loss of taurine in bile acid conjugates, and 4) low dietary concentrations and poor bioavailability of sulfur amino acids (9).

After feeding a diet apparently adequate in sulfur amino acids for 3 weeks, the researchers compared 6 Newfoundland dogs to 6 Beagles. The plasma taurine concentration was low in 8% of the dogs. Dogs with low plasma taurine were older, less active, had more medical problems and treatments, and had lower plasma albumin, cyst(e)ine, tryptophan, and alpha-amino-n-butyric acid concentrations than the other dogs. Of the 9 taurine-deficient dogs, 3 had CHD that was reversed by taurine supplementation, and 1 had retinal degeneration (9).

The Newfoundlands had lower concentrations of plasma taurine and cyst(e)ine, lower blood glutathione, lower de novo taurine synthesis, and greater fecal excretion of bile acids. The difference in taurine status between Newfoundlands and Beagles may be explained by differences in de novo taurine synthesis. On the bases of metabolic body weight and liver weight, the Newfoundlands had less than half of the taurine synthesis rates of Beagles. Compared to Beagles, Newfoundlands consumed less food on a metabolic body weight basis to maintain their body weight. This difference coincides with previous findings on metabolic energy requirements in dogs. As a consequence, Newfoundlands had lower total intakes of methionine and cysteine, and lower concentrations of plasma cysteine and blood glutathione than the Beagles. These results are probably the result of the lower intake of methionine and cysteine by the Newfoundlands. Consequently, Newfoundlands appear to have a higher dietary requirement for sulfur amino acids than Beagles, who are the model breed used in nutrient requirement determinations (9).

These findings support the theory that taurine deficiency in dogs may be related to the consumption of certain dietary ingredients. Scientific and clinical evidence supports the hypothesis that DCM is associated with low blood taurine concentration in dogs. The authors noted that "Taurine deficiency in dogs is suggested to result from reduced sulfur amino acid bioavailability in dietary ingredients that are heat processed, such as rendered meat meals" (9).

In a study looking at the effect of beet pulp on taurine status, a group of 18 medium/large mixed-breed dogs were split into 3 groups. Each group was fed purified diets that contained either rice bran, beet pulp, or cellulose. Each of these diets included 12% protein with 0.23% methionine and 0.12% cysteine. This formulation prevented an excess of substrates for taurine synthesis that might overwhelm the effect of fiber on the taurine metabolism being studied. The protein content was higher than the National Research Council minimum protein requirement for maintenance of dogs, and the 0.35% sulfur amino acid concentration in the diets was within the 0.2–0.4 % range of total dietary sulfur amino acid requirements for maintenance of adult dogs (10).

Before feeding the 3 groups these diets, the researchers fed them all the same expanded diet containing 29.5% protein with 0.58% methionine and 0.46% cysteine (as-fed basis). This diet was prepared to maintain an excess production of taurine for the maintenance of taurine homeostasis as determined by short-term nitrogen balance experiments. After 12 weeks, compared to the cellulose and rice bran groups, the beet pulp group showed significantly lower plasma and whole blood taurine concentrations, lower apparent protein digestibility, and higher fecal bile acid excretions (10).

In summary, compared to rice bran, dietary beet pulp had a more significant effect on lowering plasma and whole blood taurine concentrations in dogs. The possible mechanisms responsible for this result include: 1) lower protein digestibility which limited the bioavailability of sulfur amino acids for taurine synthesis, 2) enhanced fecal excretion of bile acids and subsequent loss of taurine metabolites which would otherwise undergo entero-hepatic recycling and maintain taurine status, and 3) increased fermentability of beet pulp by gut microbes which is associated with enhanced degradation of taurine (10).

Since cellulose was the control fiber, and the rice bran group results were similar to those of the cellulose group, the study authors concluded that rice bran is unlikely to cause taurine deficiency in dogs fed lamb and rice diets (10).

FDA Statement

This section of the FDA statement is worth repeating:

"Diets in cases reported to the FDA frequently list potatoes or multiple legumes such as peas, lentils, other "pulses" (seeds of legumes), and their protein, starch, and fiber derivatives early in the ingredient list, indicating that they are main ingredients. Early reports from the veterinary cardiology community indicate that the dogs consistently ate these foods as their primary source of nutrition for time periods ranging from months to years. High levels of legumes or potatoes appear to be more common in diets labeled as "grain-free," but it is not yet known how these ingredients are linked to cases of DCM. Changes in diet, especially for dogs with DCM, should be made in consultation with a licensed veterinarian" (1).

The FDA is not questioning the validity of the existing research. As the FDA puts it, "The underlying cause of DCM is not truly known, but is thought to have a genetic component." The FDA is also not saying we should stop feeding pets grain-free foods. The FDA is merely stating a trend, which means that more research is clearly needed (1).

Discussion

Should we stop feeding grain-free pet foods?

If pet owners have already stopped feeding grains to their canine companions, was it intended to prevent leaky gut syndrome, help curb food sensitivities or intolerances to a particular grain or food ingredient, or to maintain optimal weight?

For clients that are concerned about the possible connection between feeding their dogs grain-free pet foods and the development of heart disease, veterinary clinics can send whole blood and /or plasma samples to a diagnostic laboratory with experience in measuring circulating taurine, methionine, and cysteine levels (a). Special sample preparation, storage, and shipping are required when using sodium or lithium heparin anticoagulated tubes for amino acid testing. If plasma taurine level is equivocal, then whole

Table 1. Normal plasma and whole blood taurine range for cats and dogs.				
	Plasma (nmol/ml)		Whole Blood (nmol/ml)	
	Normal Range	No Known Risk for Taurine Deficiency	Normal Range	No Known Risk for Taurine Deficiency
Cats	80–120	>40	300–600	>200
Dogs	60–120	>40	200–350	>150

blood taurine is measured to substantiate the diagnosis of taurine deficiency.

Published normal plasma and whole blood taurine ranges for cats and dogs are shown in Table 1.

Veterinarians can add to the FDA database by sending the results, regardless of whether they are normal or abnormal, along with information about the dog, including age, weight, breed, the type of food being fed, and health status related to heart disease and retinal degradation.

The grain-free pet food trend was started primarily by the small pet food manufacturers that make up the boutique and raw food segments of the pet food industry. Many of these manufacturers are transparent in identifying the origin of the ingredients in their foods. These manufacturers must meet the AAFCO standards, and if they do not, the labels clearly state that. Additionally, many do not include beet pulp in their formulations. A veterinary nutritionist made some nuanced statements in the FDA article that presumably were referring to small pet food manufacturers (11). These comments could be ignored or dismissed because a direct correlation was not stated. Major pet food manufacturers are now producing and selling grain-free foods, some of which contain beet pulp. Beet pulp may be implicated as a cause of DCM, but at present, we do not have the requisite information to confirm that hypothesis.

Researchers have documented the degradation of amino acids during the cooking process. As Bermingham and her team found in comparing raw to kibble diets, "Fecal weight and volatile fatty acids levels were lower, and the apparent digestibility of protein and energy were higher in dogs on the raw diet" (12).

Hopefully, as more research is completed, AAFCO will have the data needed to update and optimize the minimum nutrient requirements published in their guidelines so pet foods can be formulated appropriately by breed, size, and age.

Endnote

a. Amino Acid Laboratory, University of California, Davis, Davis, CA 95616

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