Taurine

What is Taurine and Why the Controversy in 'Grain-free' Dog Foods?

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What is Taurine?

Taurine is a dispensable β-aminosulphonic acid in dogs that has been linked to dilated cardiomyopathy (DCM). Taurine should not be confused with the essential and non-essential α-amino acids that form the structure of proteins and therefore taurine does NOT occur in proteins. As a consequence, taurine is not directly related to the protein content of foods in the diet.

How is taurine made in dogs and why is taurine not made in cats?

Taurine can be synthesised in dogs via two pathways. Firstly, in the pancreas from the amino acid, cysteine via a three-enzyme process including the key enzyme, cysteine sulfinic acid (CSA) decarboxylase. The second pathway which occurs mainly in liver synthesises taurine from the essential amino acid, methionine firstly via transmethylation pathway to cystathionine and then the transulphuration pathway again through the key enzyme CSA decarboxylase to taurine. The transmethylation pathway synthesises the quaternary ammonium compounds, choline and carnitine and methylates a series of compounds including DNA. So, these transmethylation reactions are in competition for carbon with the transulphuration pathway. Consequently, the synthesis of taurine will require adequate sulphur essential amino acids, cysteine and methionine, and since these amino acids are essential (and cannot be made in the body) they must be supplied in adequate amounts in the diet.

Cats lack the enzyme CSA decarboxylase and so they cannot make taurine. Taurine must be included in cat diets at the AAFCO recommended rate of 0.1% DM in dry cat food and 0.2% DM in wet cat food.

What does taurine do physiologically?

Taurine is essential for cardiovascular function, development and function of skeletal muscle, retinal function, and the central nervous system. In fact, taurine is the most abundant free amino acid in the heart, retina, skeletal muscle, brain, and leucocytes. Taurine conjugated bile salts are essential for the digestion and absorption of fats from the diet.

While taurine is required in several physiological processes, the exact mechanisms whereby taurine functions is not well understood.

What happens if there is not enough taurine in the diet?

Cats have distinct clinical signs of taurine deficiency. The most characteristic signs of taurine deficiency in cats is central retinal degeneration (CRD) which is a slow decline in retinal function

leading to irreversible blindness. In addition, cats with low plasma taurine concentrations can present with feline dilated cardiomyopathy which is reversible with taurine supplementation.

More recently, in 2018, dilated cardiomyopathy (DCM) has been reported by the Food and Drug Administration (FDA) in dogs in the USA being fed so-called grain-free diets often containing potatoes and pulses and legumes. The FDA has released an updated report on the 27th June 2019 summarising the current knowledge of DCM in dogs and its relationship to dietary constituents and plasma taurine as well listing a number of dog foods fed to dogs that presented with DCM https://www.fda.gov/animal-veterinary/news-events/fda-investigation-potential-link-between-certain-diets-and-canine-dilated-cardiomyopathy. The FDA noted the link to a range of dog foods labelled as "grain-free," that contained a high proportion of peas, lentils, other legume seeds (pulses), and/or potatoes in various forms (whole, flour, protein, etc.) as main ingredients (listed within the first 10 ingredients in the ingredient list, before vitamins and minerals). Many of these case reports included breeds of dogs not previously known to have a genetic predisposition to the disease. Based on the data collected and analysed thus far, the FDA stated that the potential association between diet and DCM in dogs is a complex scientific issue that may involve multiple factors. Nevertheless, 'grain free' diets have been included by the authors of an influential JAVMA article in so-called BEG (boutique, exotic-ingredient and grain-free) diets in the USA that seemed to be a frequent factor in these DCM cases associated with the efficacy of taurine supplementation (1). On the other hand, the authors of another recent article have questioned the 'rush to judgement' of these BEG diets by those authors of the JAVMA article and the inferences by the FDA (2). This disagreement between the two articles about the current understanding of the underlying aetiology and causes of DCM in dogs has led to a request for a retraction of the JAVMA article (https://www.veterinaryintegrity.org).

Where do dogs and cats obtain taurine in their diet?

Taurine occurs naturally in fish and meat. However, most land-based plants do not contain taurine. Moreover, legumes are often low in methionine and cysteine, the major precursors of taurine. An unusual exception is prickly pear fruit which does contain taurine, as do a number of microalgae. Vegans and vegetarians are low in taurine as noted in surveys of plasma levels.

The most reliable source of taurine for dogs and cats is scientifically formulated complete and balanced petfood from reputable petfood companies that either has a high proportion (i.e. more than 50% of protein from meat) of meat protein in the food and/or includes taurine supplementation in the ingredient listing. Where diets for dogs are promoted as 'grain-free' the meat content, the proportion of legumes and pulses (as shown by ranking in the ingredient listing) and the presence or absence of taurine supplementation should all be noted. At present there is no AAFCO recommendation for taurine inclusion in diets for dogs. All cat diets should be supplemented with taurine at least to the minimum concentrations recommended by AAFCO (2019) i.e. 0.1% DM for dry foods and 0.2% DM for wet foods.

1. Lisa M. Freeman, Joshua A. Stern, Ryan Fries, Darcy B. Adin, John E. Rush Diet-associated dilated cardiomyopathy in dogs: what do we know? JAVMA (2018) 253: 1390 – 1394.

2. Wilfredo D. Mansilla, Christopher P.F. Marinangeli, Kari J. Ekenstedt, Jennifer A. Larsen, Greg Aldrich, Daniel A. Columbus, Lynn Weber, Sarah K. Abood, and Anna K. Shoveller, Special topic: The association between pulse ingredients and canine dilated cardiomyopathy: addressing the knowledge gaps before establishing causation: J. Anim. Sci. 2019.97:983–997.