

**Taurine Deficient Dilated Cardiomyopathy in Dogs: What do we know?**



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**Dilated Cardiomyopathy (DCM)**




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**History**



UC Davis letter- Interest in Golden Retrievers with Dilated Cardiomyopathy on grain free foods: dogs were Taurine deficient

2017

2018

FDA-CVM (USA) Issued statement warning dog owners feeding foods with specific ingredients (legumes, potatoes) being associated with DCM

2018

Dr. Stern (UC Davis), 76 Golden Retrievers, 24 with DCM, all on BEG diets (grain free or high legume). None of the diets had a feeding trial

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## Agenda



WHAT IS DCM



AGE- BREEDS



SIGNS



DIAGNOSTICS



TREATMENT



POTENTIAL CAUSES-  
AMINO ACIDS



DIETS



RESOURCES

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## What is Dilated Cardiomyopathy?



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## What is DCM?



- Disease of the Heart muscle which results in weakened contractions and poor pumping ability
- Heart chambers **can become enlarged** and thinning of ventricle walls

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Age- Breed




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Age

- 4-10 years
- Currently cases of **younger dogs** being affected
- +- **Male** > Female




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**Breeds**

- Genetic
  - **Dobermans**
  - **Boxers**
- Prone to taurine deficiency
  - **Golden**
  - **Cocker Spaniel**
- Large breeds
  - Irish Wolfhound
  - Newfoundland
  - Saint Bernards
  - English setters
- Reported
  - German Shepard
  - Labradors
  - Dalmatians
  - Alaskan Malamute
  - Scottish terrier
  - Portuguese water dogs
  - Great Danes
  - Mixed breeds






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Signs



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Signs

- Early in the disease there may be **no signs**
- Possibly exercise intolerance
- Coughing
- Heart murmur
- Fluid accumulation (abdomen-chest)
- Arrhythmia on auscultation
- Weak arterial pulses
- Possible pale membrane color
- Blood pressure increases
- May lead to heart failure
- **Sudden death**



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Diagnostics



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## Diagnostics

- Exam
- X-ray
- EKG
- NT-ProBNP
- Echo
- Taurine
  - Normal whole blood >250nmol/ml
  - Plasma > 70nmol/ml




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## Taurine testing

- Whole blood or Plasma
- **Both** is best **or if only one** whole blood is best
  - Normal >250nmol/ml
  - Plasma >70nmol/ml
- Whole blood taurine can be affected by the platelet count, which can vary depending on the immune status and whole blood taurine
- Whole blood taurine may not reflect taurine in muscle, including cardiac muscle
- This may explain **why** some dogs diagnosed with DCM have normal whole blood taurine concentrations




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## Treatment




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### Treatment

- Medication
- Antioxidants
- Exercise limitation
- Fish oil
- Taurine
- L- carnitine



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### Treatment



### Dietary change

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### Potential Causes



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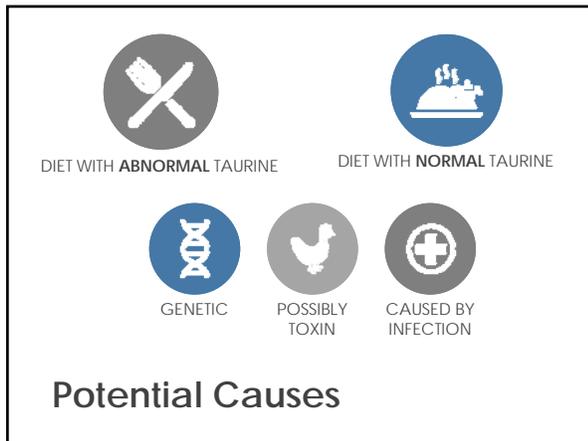
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### Potential nutritional causes with abnormal taurine

- Dietary **deficiency** of methionine and cystine resulting in reduced synthesis of taurine
- Lower bioavailability of taurine, methionine or cystine in the dog food
- Fiber content
- Higher urinary loss of taurine
- **Interactions** between certain dietary components
- Intestinal microbes cause altered metabolism of taurine in the intestines

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### Potential nutritional causes with normal taurine

- Deficiencies of other nutrients
  - Choline
  - copper
  - **L-carnitine**
  - magnesium
  - thiamine
  - vitamin E
  - Selenium
- **Deficiency** of certain nutrients are altered because of nutrient- nutrient interactions

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**Antinutritional effects**

Inadvertent inclusion of **toxic ingredients**

Raw cereals and legumes contain antinutritional factors that can **decrease protein digestion**, nutrient absorption, and/or cause illness

**Trypsin inhibitor** can be destroyed during the extrusion process. For example when soybean was extruded at 100 to 150 C trypsin inhibitor levels were decreased

**Production- processing**  
Processing may alter nutrients

The **Maillard reaction** causes heat damaged protein  
Heat-damaged proteins (digestibility of Amino Acids) can greatly overestimate bioavailability

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**Amino Acids**




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**Amino acids of importance in DCM**

- Methionine
- Cystine
- Taurine
- L Carnitine

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Methionine  
and  
Cysteine

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Methionine  
and  
Cysteine

- Sulfur amino acids synthesize to make **taurine**
- If there is **enough** of these amino acids to produce taurine

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Methionine  
Functions

- Principle supplier of sulfur for skin, hair and nails
- Production of adenosylmethionine (SAME)
- Decreases urine pH
- Help liver process fat
- Antioxidant
- Helps support the absorption of trace minerals: selenium and zinc
- Serves as a neurotransmitter and neuromodulator in the central nervous system
- Creates amino acids Carnitine, **taurine**, with cysteine
- Precursor to **cysteine**

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## Cysteine

- Cystine bladder stones
- Can replace **half** of the **methionine requirement**
  - Cannot be **converted** to methionine
  - There **must** be methionine to convert to taurine
- Combines with other amino acids to synthesize to protein



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## Taurine



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Is a Sulfur containing amino acid

**Synthesized** from sulfur amino acids methionine and cysteine, mostly in the **liver** and central nervous system

## Taurine

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- Is unable to form peptide bonds, so does not synthesized into protein
- Found as a **free amino acid** in high concentrations
  - **Heart** (60% of total AA)
  - Retina
  - Brain
  - Myocardium
  - Skeletal muscle
  - Liver
  - Platelets- leukocytes

**Taurine**

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Taurine  
function

Normal retina

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Neurologic

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Reproductive

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Normal fetal- brain development

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Immune

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Platelet function

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Antioxidant, osmolyte, neuromodulator

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Body temperature regulation

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Assist in absorption of dietary fats

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Low taurine intake can deplete calcium pools in the cardiac cells and prevent contraction of cardiac muscle tissue

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**Normal heart function**

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- Animal sources
  - High levels in
    - Most tissues, especially skeletal muscle
    - Heart
    - Viscera
    - Brain
    - **By- products (liver- organs)**
    - Shellfish- Chicken- Turkey
  - Low levels in
    - **Lamb**
- Plant sources
  - Contains no measurable taurine

**Taurine  
sources**

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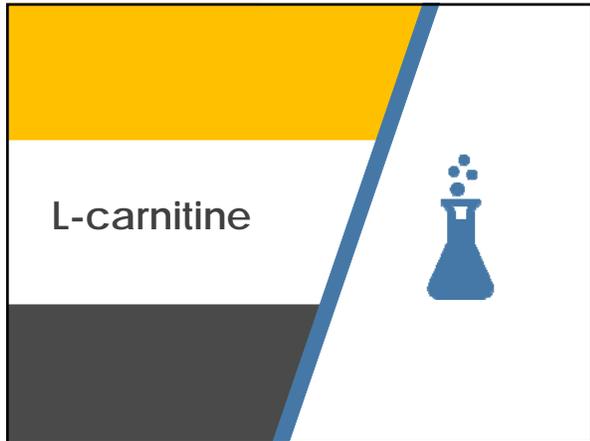
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L-carnitine

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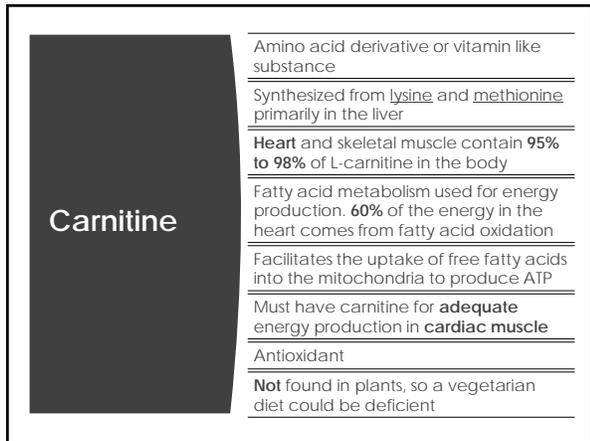
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**Carnitine**

- Amino acid derivative or vitamin like substance
- Synthesized from lysine and methionine primarily in the liver
- Heart** and skeletal muscle contain **95% to 98%** of L-carnitine in the body
- Fatty acid metabolism used for energy production. **60%** of the energy in the heart comes from fatty acid oxidation
- Facilitates the uptake of free fatty acids into the mitochondria to produce ATP
- Must have carnitine for **adequate** energy production in **cardiac muscle**
- Antioxidant
- Not** found in plants, so a vegetarian diet could be deficient

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Diets

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**B.E.G Diets**

Boutique 

Exotic 

Grain Free 

All formulated foods

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**B.E.G Diets**

- We do not know much about any of these ingredients
- Are they **decreased** in taurine or have reduce **availability** of taurine?
- Decrease bioavailability or Digestibility?
- Companies that do **not test**, so do not know if dogs are getting the nutrients that are on paper
- Grains have been **research** for years in the livestock and pet food industry

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**Exotic Ingredients**

- **Deficiencies** of nutrients
- Grain free and exotic ingredients
  - Kangaroo
  - Alligator
  - **Lamb** (low bioavailable **cysteine**)
  - Tapioca
  - quinoa
  - Legumes




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**Legumes**

- Soybeans, Fava beans

Pulses (Dried seed of legumes plants)

- Peas
- Lentils
- Chickpeas
- Dry beans

Low in fat

Used for their protein and fiber content

Typically high in lysine and **low in methionine**

Reported to be up to 40% of the diet

- Soybean at 15% DMB decreased protein **digestibility**

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**Complete and Balanced Diets**




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**Nutritional Adequacy Statement (AAFCO Statement)**

- The nutritional adequacy statement tells you a lot about **how the food was made**
- Marketing cannot change the statement it is a **verbatim statement**

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Animal feeding tests using AAFCO procedures substantiate that (legal brand name of food) provides complete and balanced nutrition for maintenance of adult dogs.



(Legal brand name) is formulated to meet the nutritional levels established by the AAFCO Dog Food Nutrient Profiles for all life stages.



Intended for intermittent or supplemental feeding only.

### Nutritional Adequacy (AAFCO) Statement

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### Feeding trials

- Includes lab work
- **Digestibility**
  - What goes in and out
- A feeding trial shows the formula is complete and balanced as the sole source of nutrition
- Companies have to **recertify** feeding trials every five years
  - Need to test nutrients from six lot codes
  - or
  - Redo the feeding trials



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- The pet food has to minimally meet AAFCO minimums and a few maximums to **sustain life**, not thrive
- A formulated food that meets the minimum may be deficient
  - Do not know **digestibility**
  - Do not know **bioavailability**
- Formulated foods do not have to have gone through **ANY TESTING**
- A company may not know nutrient analytical analysis

### Formulated Food requirements

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These diets are **NOT** complete and balanced

Should be no more than **10%** of the total calories

Intermittent/ supplemental

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### How pet food companies develop a formula

- **Ingredient nutrients** information
  - Company database
  - USDA Database
    - Human food-may not be the same ingredient used in pet food
- Need to account for **processing- cooking** affecting nutrients



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### Feeding enough

- Daily energy requirements (DER)
  - Is the dog eating their DER for the day
    - If not may have **potential deficiencies** in taurine and other nutrients causing potential malnutrition
- If eating the full DER, is the food complete and balanced?
- **Owners need to read** the AAFCO statement

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## Complete and Balanced Diet

60 lbs. dog =  $835 \times 1.6 = 1336$  kcals/ 10% treats = 133 kcals/ 90% 1203 kcals



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Feeding a  
Intermittent/  
Supplemental  
Diet with a  
Complete and  
Balanced Diet

401 kcals- Complete and  
balanced

1049 Kcals intermittent/  
Supplemental

Total 1450 kcals  
(DER 1336 kcals)



72% NOT complete and  
balanced

28% complete and balanced

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Resources



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## Resources



- Petfology- Tufts Veterinary School – Dr. Lisa Freeman
  - <http://vetnutrition.tufts.edu/petfodology/>
- FDA
  - <https://www.fda.gov/AnimalVeterinary/NewsEvents/CVMUpdates/ucm613305.htm>
- UC Davis- Dr. Josh Stern
  - <https://www.vetmed.ucdavis.edu/news/uc-davis-investigates-link-between-dog-diets-and-deadly-heart-disease>




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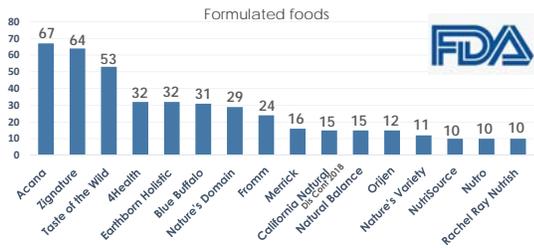
## FDA-Released June 27, 2019

Dog food brands named most frequently in DCM cases reported to the FDA

Reported diets from Jan 1, 2014 to April 30, 2019

560 reports-16 brands with 10 cases or more

91% grain free- 93% contained peas and/or lentils



[https://www.fda.gov/animal-veterinary/news-events/fda-investigation-potential-link-between-certain-diets-and-canine-dilated-cardiomyopathy?cid=tw482x184hmkw77x1z1010m16277xv8Zvz6n63k0k\\_ND0eym1M](https://www.fda.gov/animal-veterinary/news-events/fda-investigation-potential-link-between-certain-diets-and-canine-dilated-cardiomyopathy?cid=tw482x184hmkw77x1z1010m16277xv8Zvz6n63k0k_ND0eym1M)

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## Resources- Facebook Closed Groups

- Taurine-Deficient (Nutritional) Dilated Cardiomyopathy



- Taurine Deficiency Veterinary Professionals




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What to ask a pet food company?




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How to select a pet food

AAHA Guidelines  
2010  
[https://www.aaha.org/public\\_documents/professional\\_guidelines/nutritionalassessmentguidelines.pdf](https://www.aaha.org/public_documents/professional_guidelines/nutritionalassessmentguidelines.pdf)

AAHA Nutritional Assessment Guidelines for Dogs and Cats

WSAVA Guidelines  
2011  
<https://www.wsava.org/WSAVA/media/Documents/Guidelines/WSAVA-Nutrition-Assessment-Guidelines-2011-JSAP.pdf>




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What to ask a Pet Food Company?

- 1) Do you have a **veterinary nutritionist** or some equivalent on staff in your company? Are they **available** for consultation or questions?
- 2) **Who formulates** your diets, and what are their credentials?
- 3) Which of your diet(s) **are tested** using AAFCO feeding trials, and which by nutrient analysis?
- 4) What specific **quality control** measures do you use to assure the consistency and quality of your product line?

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## What to ask a Pet Food Company?

5) Where are your **diets produced** and manufactured? Can this plant be visited?

6) Will you provide a **complete product** nutrient analysis of your best-selling dog and cat food, including **digestibility** values?

7) What is the **caloric value** per can or cup of your diets?

8) What kinds of **research** on your products has been conducted, and are the **results published** in peer reviewed studies?

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## Dilated Cardiomyopathy (DCM)



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## Questions?



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