

Cardiac Disease – Feline

Lisa M. Freeman, DVM, PhD, DACVN

Definition

Hypertrophic cardiomyopathy (HCM) is the most common cardiac disease in cats and occurs at a high frequency, especially in some regions of the country. Other cardiac diseases (e.g., *congenital cardiac diseases*) occur at much lower incidence. *Dilated cardiomyopathy* (DCM) is now an uncommon disease in cats unless the cat is eating a vegetarian or nutritionally unbalanced diet. HCM can result in *congestive heart failure* (CHF), *arterial thromboembolism* (ATE), *syncope*, or *sudden death*. There are a number of systems to classify the severity of cardiac disease. One is the International Small Animal Cardiac Health Council (ISACHC) classification of heart failure (see Table 1 on page 14).

Key Diagnostic Tools and Measures

Body weight (BW), body condition score (BCS; see Appendix I), muscle wasting, appetite/food intake (diet history; see Appendix II), clinical signs (e.g., difficulty breathing, weakness, syncope, vomiting, diarrhea), and laboratory values (e.g., BUN, creatinine, electrolytes, hematocrit) should be considered in the diagnosis of cardiac disease in cats. Other tests, if indicated, could include thoracic radiographs, blood pressure, electrocardiography, and echocardiography.

Pathophysiology

Alterations in cats with cardiac disease that impact nutritional management include the following.

Calories. When cats with cardiac disease are asymptomatic, appetite usually is unaltered. When CHF arises, however, most cats will have alterations in appetite and food intake. This may result in changes in food preferences (e.g., type of food, flavors) or in a reduction in the amount eaten. These alterations can be the result of increased production of inflammatory mediators (e.g., cytokines, oxidative stress), side effects of cardiac medications, or poor control of heart failure signs.

Protein/Amino Acids. Muscle loss (cachexia) can occur in cats with heart failure as a result of reduced appetite, increased energy requirements, and increased production of inflammatory cytokines. Taurine deficiency causes DCM in cats. While DCM is now an uncommon disease in cats, taurine deficiency should not be ruled out as a cause in cases of DCM, especially if the cats is eating a vegetarian or home-made diet.

Fat. The n-3 fatty acids, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), reduce inflammatory mediators and have anti-arrhythmic and anti-thrombotic effects, all of which may be beneficial in cats with heart failure.

Minerals. Sodium and water retention occur in heart failure due to activation of the renin-angiotensin-aldosterone system. Hypokalemia may occur in cats receiving loop (e.g., furosemide) diuretics. Hyperkalemia can occur in cats receiving angiotensin converting enzyme inhibitors. High doses of diuretics increase the risk for hypomagnesemia.

Vitamins. Increased urinary losses of B vitamins may occur in cats receiving diuretics. Studies have shown, however, that vitamins B6, B12, and folate were lower in cats with HCM compared with controls whether or not CHF was present.

Signalment

While certain breeds are at increased risk for HCM and genetic mutations have been identified (i.e., Maine Coon cats, Ragdolls), most cats with this disease are domestic short- or long-haired cats.

Key Nutrient Modifications

Calories. Ensuring an appropriate calorie intake to maintain optimal body weight is critical. Obesity can be present, particularly in cats with early (asymptomatic) cardiac disease. As CHF develops, weight (and muscle) loss becomes common so ensuring adequate calorie intake is critical at this stage.

Protein/Amino Acids. Normal to increased protein intake should be the goal to help counteract muscle loss. Protein restriction should be avoided unless severe concurrent renal disease is present. Although DCM is now uncommonly seen in cats, taurine deficiency and DCM can occur in cats fed vegetarian or nutritionally unbalanced home-made diets. If taurine deficiency is present, taurine supplementation can reverse the disease in many cases.

Fat. The anti-inflammatory and antiarrhythmic effects of n-3 fatty acids have many potential benefits in cats with cardiac disease. n-3 fatty acid supplementation can reduce muscle loss and improve appetite via its anti-inflammatory effects. n-3 fatty acids can be provided in diets that are highly enriched with this form of fat or as a dietary supplement.

Minerals. Severe sodium restriction is not recommended in early (asymptomatic) cardiac disease as sodium restriction activates the renin-angiotensin-aldosterone system. In early cardiac disease, the goal should be to avoid excessive sodium intake and to educate the owner about treats and table foods high in sodium. As the cardiac disease progresses and CHF develops, greater sodium restriction is indicated and this can help to reduce the diuretic doses required to control clinical signs. Controlling sodium intake from the cat food is important but it is also critical to ensure that other sources of sodium intake are addressed, such as treats, table foods, and foods used to administer medications.

Recommended dietary potassium modifications will depend upon medications being administered and serum potassium concentrations. Feline diets have a wide range of potassium content so using one appropriate for the individual patient is important (e.g., avoiding high-potassium diets would be recommended for cats with hyperkalemia). Consequently, serum potassium should be monitored, especially as more medications are administered to a patient.

Serum magnesium should be monitored, especially in cats receiving high doses of diuretics. Magnesium should be supplemented in cats with hypomagnesemia.

Vitamins. If high doses of diuretics are being administered, B vitamin supplementation may be indicated.

Recommended Ranges of Key Nutrients

Nutrient	mg/100 kcal	mg/100 kcal
	Recommended dietary level	Minimum dietary requirement*
Protein (g)	7–9.5	6.5
Taurine (g)	0.025–0.050	0.025–0.050
Sodium (mg)	35–100 (depends on stage of disease)	50

Modified intake of certain nutrients may help address alterations induced by cardiac disease or medications used to manage the disease. The recommended dietary composition is shown as g or mg per 100 kcal metabolizable energy. All other essential nutrients should meet normal requirements adjusted for life stage, lifestyle, and energy intake except for those otherwise noted in the text. Correction of negative energy balance, if present, is critical.

*Nutrient requirement for adult animals as determined by the Association of American Feed Control Officials

Therapeutic Feeding Principles

Avoid making big dietary changes when a cat is hospitalized for an acute episode of CHF. Continue feeding the cat's usual diet (unless very high in sodium), but have the owner discontinue any high-sodium treats or table foods. When the cat returns in 7 to 10 days for re-evaluation, a gradual change to a more appropriate diet can be instituted. This helps to avoid food aversions that can develop when a new diet is imposed on a cat that is acutely sick.

Calories should be adjusted to maintain optimal body condition (e.g., reducing calorie intake in obese animals; increasing calorie intake in animals that are below optimal body condition).

Protein/Amino Acids. The diet should contain at least 6.5 g protein/100 kcal, unless severe concurrent renal disease is present. In cats with DCM and taurine deficiency (or while waiting for taurine results), taurine should be supplemented (125–250 mg q 12 hours).

Fat. The optimal dose of n-3 fatty acids has not been determined; however, the author currently recommends a dosage of fish oil to provide 40 mg/kg EPA and 25 mg/kg DHA for cats with anorexia or cachexia. Most cat foods do not achieve this dose so supplementation will be necessary. Fish oil supplements vary in their concentration of EPA and DHA so the author recommends a 1-gram capsule that contains 180 mg EPA and 120 mg DHA. At this concentration, fish oil can be administered at a dose of 1 capsule per 10 pounds of body weight. The capsule can be administered whole (although they are very large) or the oil can be expressed from the capsule and given as a treat or in the food. Alternatively, a liquid form of n-3 fatty acids (e.g., Cardiguard, Boehringer Ingelheim, which contains 420 mg EPA and 280 mg DHA per gram) can be used. It should be noted that if the owner cannot administer the capsule intact, the cat will be exposed to the very strong flavor of the fish oil. While some cats appear to enjoy the taste, others do not. In cats that dislike the flavor, administration of n-3 fatty acids will likely not be possible due to adverse effects on food intake. Fish oil supplements should contain vitamin E as an antioxidant, but other nutrients should not be included to avoid toxicities. Cod liver oil and flax oil should not be used to provide n-3 fatty acids (cod liver oil is high in vitamins A and D, which can cause toxicity, while cats are unable to convert the n-3 fatty acids in flax oil to EPA and DHA).

Minerals. With regard to sodium:

- ISACHC Stage 1: Counsel the owner to avoid diets high in sodium (>100 mg/100 kcal) and to avoid high sodium treats and table food.
- ISACHC Stage 2: The goal should be for <80 mg/100 kcal in the cat food. Sodium intake from other foods (e.g., treats, table food, foods used for medication administration) also will be important.
- ISACHC Stage 3: The cat food should be <50 mg/100 kcal although anorexia may require a slightly higher sodium content in the diet (<80 mg/100 kcal) in order to provide greater choice. Controlling sodium intake from other foods (e.g., treats, table food, foods used for medication administration) remains important.

Recommended dietary potassium modifications will depend upon medications being administered and serum potassium concentrations. Diets high in magnesium or an oral magnesium supplement should be used in cats with hypomagnesemia.

Vitamins. If high doses of diuretics are being administered, B vitamin supplementation may be indicated.

■ **Treats** – Fewer cats with cardiac disease receive treats on a regular basis compared with dogs (33% of cats vs. 92% of dogs); however, it is important to make specific recommendations to owners regarding treats that are

appropriate (and those that should not be fed) if owners wish to provide treats. Foods to be avoided include most commercial cat treats (unless specifically determined to be low in sodium), baby food, lunch meats and cold cuts, canned fish, and most cheeses. Acceptable treats include cat treats that are determined to be low in sodium (<5 mg/treat). Note that even low-sodium treats and foods can provide large doses of sodium if they are fed in large quantities to cats.

It also is important to provide the owner with appropriate methods for administering medications as cats are difficult to pill and many common foods used to administer medications are high in sodium. Fewer cats than dogs with cardiac disease receive medications in foods (34% of cats vs. 57% of dogs) so owners should be taught to administer the pill without using foods (either by hand or using a device designed for this purpose). Alternatively, foods such as low-sodium canned cat food or home-cooked meat (cooked without salt; not lunch meats) can be used. A compounded liquid medication can be considered although the pharmacokinetics of compounded medications may be significantly altered.

■ **Tips for Increasing Palatability** – Cats with CHF often have variable appetites (i.e., they may eat a food well for a week but then stop eating it). While reductions in appetite in a cat that was previously eating well can indicate the need for reassessment and medication adjustment, sometimes providing a different food will increase appetite again. Communicating with the owner about these issues can help to reduce anxiety and to provide the owner with specific strategies to address the problem (and when to bring the cat in for reassessment).

Home-made, low-sodium broth (e.g., chicken, beef, fish) can enhance palatability. Most store-bought broths are high in sodium, even if they say "low sodium." Cooked chicken, beef, or fish can be added to the food. n-3 fatty acids will often improve appetite in cats with CHF; however, it will take 2 to 4 weeks to see an effect. Appetite stimulants can be considered (e.g., cyproheptadine, mirtazepine). Cats with CHF often prefer warmed foods but encourage the owner to experiment to determine which food temperature works best for their cat. Sometimes feeding the cat from a dinner plate (rather than the pet bowl) and in a place different from their usual site can improve appetite.

Client Education Points

- Make specific diet and treat recommendations (both types and amounts).
- Warn the owner about common alterations in appetite in cats with heart failure.
- Give the owner appropriate methods for medication administration.
- Ask at each visit if the owner is administering dietary supplements. If so, ensure that the supplements are safe, are not interacting with the diet or medications, and are being administered at an appropriate dose. Fewer cats than dogs with cardiac disease receive dietary supplements (13% of cats vs. 31% of dogs) but addressing this issue with the owner is important as "Internet surfing" for alternative treatments of cardiac disease is common.
- In addition to safety and efficacy issues, there are significant concerns about the quality control of dietary supplements (e.g., quality control, bioavailability). Therefore, veterinarians should consider recommending specific brands of dietary supplements that bear the logo of the United States Pharmacopeia Dietary Supplement Verification Program (DSVP), which tests human dietary supplements for ingredients, concentrations, dissolvability, and contaminants. Another good resource is Consumerlab.com, which performs independent testing of dietary supplements (primarily human supplements but also some pet products).

Common Comorbidities

In one study, 56% of cats with cardiac disease had at least one concurrent disease. Therefore, the nutritional goals may need to be modified for a cat with heart disease that has a concurrent, nutrient-sensitive disease (e.g., a cat with CHF and urolithiasis or chronic renal failure).

Interacting Medical Management Strategies

Drug–nutrient interactions are common in CHF. Loop (e.g., furosemide) diuretics can increase the risk for hypokalemia and hypomagnesemia, while ACE inhibitors can increase the risk for hyperkalemia. Azotemia can result from overzealous use of diuretics. Anorexia can be a side effect of many cardiac medications (e.g., diuretics, digoxin, ACE inhibitors).

Monitoring

Reductions in food intake may indicate the need for dietary modifications but also may be an early sign of decompensation of the cardiac disease or the need for medication adjustment. Body weight should be monitored in

obese cats in order to achieve optimal weight. In cats with cachexia that are losing weight, dietary modifications are needed to minimize weight loss.

Body condition score (BCS) is helpful for monitoring cats with asymptomatic disease and those that are overweight or obese. Note that BCS systems assess fat stores but not muscle, so a cat can be overweight or obese but still have muscle wasting. Therefore, monitoring BW, BCS, *and* the degree of muscle wasting is important. Muscle loss is typically first noted in the temporal, epaxial, and gluteal muscles. A muscle condition score is being developed that subjectively categorizes muscle mass into four categories: No muscle wasting, mild muscle wasting, moderate muscle wasting, and marked muscle wasting. Intervening at an early stage (i.e., mild or moderate muscle wasting) provides improved opportunity for reversing or minimizing the degree of muscle wasting.

Clinical signs (e.g., difficulty breathing, weakness, syncope, vomiting, diarrhea), laboratory values (BUN, creatinine, electrolytes, hematocrit), and other measures, if indicated (e.g., thoracic radiographs, blood pressure, electrocardiography, echocardiography) should also be monitored.

Algorithm – Evaluation of Nutritional Issues in Feline Cardiac Disease

