



RECOGNIZE THE CHANGES

Greater awareness of cachexia will help provide practical approaches to managing body weight and lean body mass in dogs and cats, as well as more directed targets for treatment.



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NUTRITION

Catabolism in the Critical Patient

**MEET THE AUTHOR**

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Cachexia is a multifactorial syndrome characterized by progressive weight loss that is often accompanied by anorexia.¹ Unlike weight loss seen with starvation or anorexia, cachexia is distinguished by a loss of adipose tissue with accompanying loss of lean body mass, primarily muscle. Non-muscle protein, as found in the organs, is preserved in cachexia but not in starvation. Significant loss of mineral content in the bones also contributes to the overall weakness of many cachexia patients.¹ Veterinary nurses should understand how starvation differs from cachexia and the role nutrition plays in managing cachexia.

STARVATION VERSUS CACHEXIA

Disease-associated weight loss differs from loss seen with simple starvation. With cachexia, there is an equal loss of muscle and fat characterized by increased catabolism of skeletal muscle. During starvation, fat is mobilized first, sparing muscle proteins; resting energy expenditure is decreased; and glucose metabolism is reduced. In contrast, cachectic patients have normal or elevated resting energy expenditures and glucose turnover. Adequate nutrition halts and reverses the metabolic alterations that accompany simple starvation but cannot completely reverse the metabolic disturbances associated with cachexia.

The loss of lean body mass has a harmful effect on strength, immune function, and overall survival.² Weight loss provides an important prognostic indicator, with increased weight loss being inversely proportional



to overall survival time.^{1,3} Loss of muscle mass is first noticed over the epaxial, gluteal, scapular, and temporal muscles⁴ and is easily detected during a routine physical examination. There does not appear to be a cause-and-effect relationship between anorexia and cachexia, with weight loss exceeding that expected with simply a decrease in caloric intake.¹

Cachexia has been seen in animals with cancer, cardiac disease, renal disease, and other serious illnesses and injuries. Loss of 25% to 50% of the lean body mass compromises the immune system and affects muscle strength, with death resulting from infections, pulmonary failure, or both.⁵

PATHOPHYSIOLOGY OF CACHEXIA

Cancer-associated starvation is a consequence of a disparity between the nutritional needs of the patient, the demands of the tumor, and the availability of nutrients in the body.^{6,7} The competition for nutrients between the tumor and the host promotes a variety of metabolic disturbances, including alterations in carbohydrate, lipid, and protein metabolism. Cytokines are the main humoral and tumor-derived factors involved in cancer cachexia and may be responsible for most of the metabolic changes associated with cancer cachexia.

TABLE 1 summarizes the effects of cytokines on nutrient metabolism in patients with cancer cachexia.⁶

PHASES OF CACHEXIA

Three phases of cachexia are identified in people; the veterinary profession manages cachexia based on these patterns. During the first phase, the patient does not exhibit clinical signs; however, biochemical changes are taking place. These changes include elevations in lactate levels resulting from glycolysis; an increase in insulin levels, causing peripheral insulin resistance; and alterations in amino acid and lipid profiles.³

During the second phase of cachexia, clinical signs may manifest as anorexia, weight loss, and lethargy. Often, owners attribute these early signs to the pet's aging and may not recognize the clinical significance. The final phase is characterized by marked loss of body fat and protein stores, leading to severe debilitation, weakness, and biochemical evidence of negative nitrogen balance.³ If left untreated, cachexia can be the ultimate cause of death.

THERAPEUTIC STRATEGIES

The optimal therapy is to manage the underlying disease process. In veterinary medicine, therapeutic strategies generally include management of anorexia, nutritional support/supplementation, and omega-3 fatty acids.

Managing Anorexia/Hyporexia

Nutritional counseling should be a part of the entire treatment plan for all patients. Veterinary nurses should help owners understand the importance of measuring intake and should have a sequential plan for maintaining nutritional support throughout the treatment process. This may include simple strategies to increase consumption initially, progressing to assisted feeding if necessary. In a patient with a functional gastrointestinal tract, enteral feeding is preferred. Strategies for managing anorexia in dogs and cats have been thoroughly reviewed⁸ and are summarized in **TABLE 2**.

Key Nutritional Factors in the Management of Cachexia

While it is not possible to reverse the wasting process with nutritional supplements alone, manipulation of nutrients can benefit patients, as can be seen in some of the changes the body undergoes.¹ Proper nutrition can

TABLE 1 Effects of Cytokines on Nutrient Metabolism in Patients With Cancer Cachexia

NUTRIENT	CYTOKINE EFFECTS ON METABOLISM
Carbohydrate	<ul style="list-style-type: none"> ● Increased cellular resistance to insulin ● Increased glucose synthesis in the liver ● Increased Cori cycle activity (a vital mechanism of energy provision during starvation)
Protein	<ul style="list-style-type: none"> ● Increased protein breakdown (catabolism) ● Increased synthesis of acute-phase proteins by the liver ● Increased synthesis of tumor proteins
Lipid	<ul style="list-style-type: none"> ● Increased lipid mobilization ● Elevated serum levels of triglycerides

be key to managing cachexia through provision of calories, protein, and fat and modulation of cytokine production.² Specific dietary recommendations should consider the stage of disease as well as the patient’s energy needs, current and past nutritional status, and ability or willingness to eat.³

Caloric and Nutrient Distribution

The caloric distribution in the food should emphasize calories obtained from fats and proteins rather than carbohydrates, since glucose, not fatty and amino acids, is the preferred fuel for tumor cells in cancer cachexia patients. The goal is to feed the patient and starve the tumor cells.

Ideally, the caloric composition of food for these patients should be 50% to 60% fat and 30% to 50% protein, with the remaining portion being carbohydrates (**FIGURE 1**).^{3,9} The protein provided should be highly digestible. For dogs, protein should account for about 30% to 45% of the food on a dry-matter basis; for cats, it should account for about 40% to 50%. To put it another way, the minimum recommended protein intake is 5.14 g/100 kcal, with 6 to 7 g/100 kcal preferred.^{2,10}

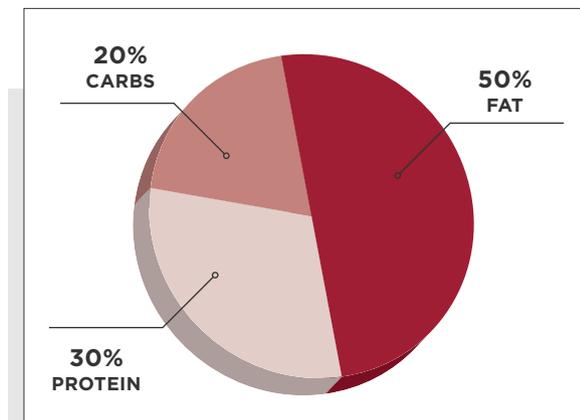


FIGURE 1. Ideal caloric composition of food for canine cancer cachexia patients.

Because tumor cells preferentially use glucose for energy, selecting a carbohydrate with a lower glycemic index is preferred for cancer cachexia patients. The lower the glycemic index, the slower the release of carbohydrate-generated glucose into the bloodstream. Rice has one of the highest glycemic indexes, with barley, sorghum, and corn having much lower indexes.³ Moderately fermentable fibers, such as beet pulp and pea fiber, count as carbohydrates but are not available for digestion by the tumor cells.

TABLE 2 Strategies for Managing Anorexia in Dogs and Cats

STRATEGY	NOTES
Improve ambiance for eating	Create a quiet, isolated, comfortable feeding area.
Increase palatability of food	
<i>Increase moisture</i>	Switch to canned food/add water to kibble. Caution: Some cats have texture preferences and prefer dry food.
<i>Increase fat</i>	Higher-fat diets are more energy dense, so less food may be required to meet needs.
<i>Increase protein</i>	Dogs may choose foods with higher protein levels.
<i>Add sweet and salty flavors</i>	Adding a sweet flavor (no artificial sweeteners) as top dressing may increase palatability for dogs. Adding salt (if appropriate) may increase palatability. These additions should be used for a limited time, not indefinitely.
Ensure food freshness, aroma, and temperature	Provide “fresh” canned/dry foods. Warming foods to no greater than body temperature may release appetizing aromas.
Consider “uncommon” food	Uncommon food may entice some dogs and cats to eat. Try to offer foods that are uncommon but not completely novel.
Provide limited variety of food at one time	A “buffet” approach is not recommended. This approach may lead to food aversions, resulting in the patient avoiding all options, including therapeutic options.
Avoid associating food with drug administration	Never top-dress food with medication or use the desired diet to administer medication. Avoid giving medications immediately before or after a meal if possible.
Eliminate physical barriers to eating	Be sure food bowls are accessible, and account for any limitations in movement (e.g., raise bowls, remove Elizabethan collars)
Avoid appetite-stimulating drugs	These drugs are not recommended for cachectic patients, as their effects are unpredictable, intermittent, and brief. If above approaches are ineffective, assisted feeding is recommended.



Omega-3 Fatty Acids

Omega-3 fatty acids, especially those found in certain types of fish and fish oil (eicosapentaenoic acid [EPA] and docosahexaenoic acid [DHA]), are probably the most important nutraceuticals to consider for animals with cancer.^{6,9,10} These fatty acids produce less potent inflammatory mediators (cytokines) than the omega-6 class of fatty acids, which are considered proinflammatory; in fact, the inflammatory response to cytokines produced from omega-3 fatty acids is decreased in proportion to the level of omega-3 fatty acids in the diet.

Studies using animal models have shown that supplementation with EPA and DHA can help prevent cachexia and metastatic disease processes. The recommended doses of each are 40 mg/kg of EPA and 25 mg/kg of DHA. Using the common formulation of most fish oil capsules, this concentration is achievable with about one 1-g capsule for 10 lb (4.5 kg) body weight.² Many recovery diets already contain this amount, and additional supplementation is not recommended. The veterinary team should check the product reference guide provided by the manufacturer with any questions.

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Feeding Methods

Oral feeding of a canned or dry pet food is always the first choice.^{3,9,10} When a patient is unwilling or unable to consume the desired amount of food by mouth, a feeding tube should be used. The specific tube selected depends on the patient, the desired duration of use, and the owner's willingness to feed at home. Diet selection is based on the route selected for feeding.

Preparation of home-cooked diets can be used short-term to tempt the patient to eat, but should only be

used long-term after consultation with a boarded veterinary nutritionist. A number of excellent commercially available therapeutic diets fit the recommended diet profile and can be fed both orally and via tube.

SUMMARY

Veterinary nurses must recognize and understand cachexia in patients. Healthcare team members must also learn to use nutritional strategies to help manage anorexia and the imbalance between the nutritional needs of the patient and the availability of nutrients in the body. Feeding strategies should be aimed at alleviating the competition for nutrients between the disease process and the host.

While cachexia is a fairly obvious sign of biochemical imbalances, these imbalances have been occurring for a while by the time physical change is evident. By recognizing the changes cachexic processes cause within the body, veterinary nurses can help make diet recommendations that benefit the patient throughout disease and cancer treatment, resulting in more positive outcomes and happier patients and clients. **TVN**

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