Practical Approaches to Feeding THE CANCER PATIENT

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The **American College of Veterinary Nutrition** (**acvn.org**) and ***Today's Veterinary Practice*** (**tvpjournal.com**) are delighted to bring you the **Nutrition Notes** column, which provides the highest quality, cutting-edge information on companion animal nutrition, provided by the ACVN's foremost nutrition specialists.

The primary objectives of the ACVN are to:

- Advance the specialty area of veterinary nutrition
- Increase the competence of those practicing in this field
- Establish requirements for certification in veterinary nutrition
- Encourage continuing education for both specialists and general practitioners
- Promote evidence-based research
- Enhance dissemination of the latest veterinary nutrition knowledge.

The ACVN achieves these objectives in many ways, including designating specialists in animal nutrition, providing continuing education through several media, supporting veterinary nutrition residency programs, and offering a wide array of resources related to veterinary nutrition, such as this column.

Nutritional Goals for Veterinary Cancer Patients

Nutritional support goals for veterinary cancer patients can range from simple to complex, but most important, they need to be defined and agreed upon by the pet caregiver and veterinarian at time of diagnosis. There is no published benefit to delaying nutrition assessment and support for the cancer patient.

Each nutrition support plan should be developed with defined goals in mind, and these goals should be individually defined for each pet. However, universal concerns for any pet with cancer include:

- Preserving lean muscle
- Minimizing metabolic and gastrointestinal (GI) intolerance to food
- Optimizing the pets' quality of life.

One of the most significant nutritional issues that can arise during cancer treatment in companion animals is malnutrition.[1]

Malnutrition is characterized by various clinical signs, including:

- Poor wound healing with altered immune response
- Fluid and electrolyte imbalances
- Body weight changes characteristically associated with a cachectic state.

In general, malnutrition of the cancer patient—both human and animal:

- Significantly decreases response to treatment protocols and time of remission
- Increases mortality and morbidity
- Has an overall detrimental effect on quality of life.

Pets with cancer—similar to human cancer patients—experience side effects when undergoing common oncologic therapies. The continuum of cancer survival, treatment, recovery, and living with advanced cancer requires an integrated approach to patient care. Appropriate and timely nutritional support is a key component in caring for these pets.

FACTORS THAT AFFECT NUTRITIONAL STATUS

Numerous factors impact—both directly and indirectly—the nutritional status of cancer patients, including:[2,3]

- Ongoing tumor–host competition for dietary energy substrates, which results in chronic malnourishment for the host (pet)
- The disease process itself (eg, neoplasms that cause vomiting)
- Use of antineoplastic therapies
- Pets' health status prior to initiation of treatment.

Cachexia is a complex syndrome characterized by severe, chronic, undesired, and progressive weight loss and muscle wasting, with or without loss of fat mass.[4] This

syndrome is:

- Associated with an underlying disease, anorexia, inflammation, insulin resistance, and increased lean muscle breakdown[5]
- Linked to tumor-disease driven changes in carbohydrate, lipid, and protein metabolism as a consequence of altered cytokine activity.[4]

Cancer cachexia is observed in approximately 50% of human cancer patients[4] and, although the incidence rate in pets is not reported, it is considered to be similar based on clinical observations.

TREATMENT IMPACT ON NUTRITION

Multimodal therapy for veterinary cancer patients is considered the current standard of care. Surgery, chemotherapy, and radiation therapy are commonly utilized, but can have deleterious direct and indirect effects on the nutritional status of the patient.[6-8] **Table 1** summarizes the major nutritional concerns associated with these therapies.

TUMOR IMPACT ON NUTRITION

Presence of a tumor results in alterations of a patient's nutrient metabolism. Research suggests that rapidly growing tumors:

- Preferentially utilize glucose from dietary carbohydrates (CHO) as their major fuel source
- Require protein to support metabolic pathways
- Are subsequently less efficient at utilizing dietary fats to support growth.

Alternatively, slow growing tumors:

- Preferentially utilize fat (lipids) as their major fuel source
- Upregulate lipoprotein lipase production, promoting entry of fatty acids into tumor cells for metabolism
- Have reported de novo synthesis (lipogenesis) of fatty acids.

The omega-3 fatty acids—eicosapentaenoic (EPA) and docosahexaenoic (DHA)—have reported antitumorigenic (models in humans, rodents, cats, and dogs) and anticachectic (models in humans and rodents) functions.[9-11]

Select amino acids are essential to support tumor cell functions, as is the case in non-neoplastic cells. **Table 2** summarizes the most important amino acids in tumor cell metabolism.[12] Further scientific investigation is needed to determine the precise balance of amino acid–protein intake for specific patients.

Dietary CHO restriction results in glucose deprivation of tumor cells, which limits hydroperoxide detoxification in these cells, rendering them more susceptible to oxidant-induced cytotoxicity.[13]

Avoid dietary antioxidant (AOX) supplementation because it can "detoxify" damaging oxidant species in both normal and neoplastic cells, preventing tumor cell devitalization and destruction.

Turn to page 56 for this article's associated In-Clinic Form—**Step-by-Step: Feeding the Pet with Cancer.**

APPROACH TO NUTRITIONAL SUPPORT

The ACVN recommends *assessment of the patient, the food (diet), and the feeding method* as a stepwise, integrated, and individual approach to nutritional support.

Taken together, the patient's cancer diagnosis, treatment protocol, prognosis, and nutrition status category will aid in developing an optimal nutritional support plan. This approach is summarized in the table, **Feeding Guidelines Based on Nutritional Status for Dogs & Cats with Cancer**, available at **tvpjournal.com/resources.asp#resources**.

Patient Assessment

Assessment of the patient is based on physical examination, clinical history, dietary history, and diagnostics; these findings can be translated into one of 3 nutritional status categories:[3]

1. Well nourished
2. Borderline or at risk for becoming malnourished
3. Significantly malnourished.

TABLE 1. Anticancer Therapy Impact on Nutritional Status

TREATMENT MODALITY	IMPACT ON NUTRITIONAL STATUS
SURGERY	• Acute stress response (acute phase proteins, inflammatory mediators, hypermetabolism) • Anorexia-hyporexia, malabsorption • Electrolyte imbalances, development of hyperglycemia • GI alterations (diarrhea, nausea, bloat, regurgitation, vomiting)
CHEMOTHERAPY	
Cytotoxic and Immunotherapy	• Anorexia, food aversion • Diarrhea, nausea, and vomiting • Dysbiosis • Fatigue, immunosuppression
Hormonal	• Edema • Hypercalcemia, hyperglycemia • Nausea, vomiting
RADIATION	
Head–Thorax	• Anorexia, food aversion • Dysphagia, esophagitis • Fatigue, immunosuppression
Abdominal–Pelvic	• Abdominal pain, bloat, and flatulence • Diarrhea, nausea, and vomiting • Gastric ulceration, GI inflammation • Maldigestion, malabsorption
Extremities	• Protein loss, inflammation due to radiation-associated burns • Anorexia–hyporexia associated with limb pain/discomfort

TABLE 2. Tumor Utilization of Amino Acids

METABOLIC FUNCTION	AMINO ACID
Protein synthesis	All amino acids
ATP production	Glutamine
Glucose production	Alanine, threonine, serine, glycine
Nucleotide synthesis	Glutamine
Polyamine synthesis	Arginine, ornithine
Nitric oxide synthesis	Arginine
Methyl group transfer	Methionine
Serotonin synthesis	Tryptophan

TABLE 3. Examples of Pet Food Ingredients

INGREDIENT	EXAMPLES
Animal protein	Beef, chicken, turkey, duck, fish, lamb, venison
Vegetable protein	Corn gluten meal, soybean meal, soy isolate
Soluble CHOs	Ground grains, meals, flour, and starch
Complex CHOs	Whole grains and soluble fibers (guar gum, beet pulp, fructopolysaccharides, sweet potato, brown rice)

Diet Ingredients

When choosing or recommending a commercial food for a pet with cancer, reviewing the product ingredient list may be helpful. Examples of ingredients are listed in **Table 3**.

- Protein sources of animal origin provide more essential amino acids for dogs and cats compared with plant-derived protein sources.
- Soluble CHO sources are more readily available sources of glucose compared with complex CHO counterparts. Since glucose is thought to be a primary nutrient source for solid tumor types, reducing the overall soluble CHO content of the diet may be beneficial.
- Soluble fibers are another complex CHO source in pet foods; in excess, fiber may decrease overall diet digestibility, but soluble fibers promote GI health. Therefore, inclusion of soluble fiber sources is considered overall beneficial.
- Fat-enriched diets, such as recovery or growth life-stage diets, should be avoided in pets with concurrent medical issues (ie, pancreatitis, hyperlipidemia, cholangitis) that require dietary fat restriction.

The pet's current clinical picture helps determine which CHO/fiber sources are most beneficial. For example:

- With concurrent diseases such as renal or hepatic disease: Soluble fiber sources
- Canine diabetes mellitus: Complex CHO sources (whole grains and soluble fibers)
- Shortened bowel: Soluble fiber sources.

Table 4 (page 54) outlines appropriate nutrient levels for both healthy pets and those with cancer; **Table 5** (page 54) provides a list of commercial diets that are appropriate for use in veterinary cancer patients.

Unconventional Diets

Some pet caregivers request alternatives to commercial therapeutic (prescription or OTC) foods. For pets with cancer, home-prepared meals are often recommended, but raw diets are contraindicated, especially in patients undergoing chemotherapy or radiation therapy.

Raw food can significantly increase the risk of infection and/or sepsis in an immunocompromised patient; pets treated with chemotherapy and radiation become severely neutropenic and immunocompromised.

Homemade diets can be specifically formulated to address the nutrient needs associated with single or multiple comorbidities when an appropriate commercial diet is not available for pets with cancer. Pet caregivers often perceive the diet preparation process as a way to bond with their pets, especially when pets are experiencing undesired clinical signs associated with their anticancer treatments.

If a pet caregiver does not feed a commercially prepared diet, emphasize the importance of ensuring the diet fed is nutritionally complete and balanced, which may require the assistance of a board-certified veterinary nutritionist.

Feeding Frequency

Providing the daily food allotment in smaller, frequent meals can be beneficial by:

- Enhancing overall nutrient uptake via the GI tract
- Minimizing intolerance due to meal volume
- Providing a sustained energy source throughout the day
- Decreasing stress associated with large meal feeding.

Assisted Feeding

As cancer progresses, patients may require assisted feeding to ensure receipt of adequate nutrition. When the pet is not consistently consuming at least 66% of resting energy requirement (RER) calories,[14] assisted feeding is indicated. Hand or enteric tube feedings are viable options for general practice and at-home settings. In some cases, constant delivery of nutritional support via an enteric feeding tube is best tolerated, although this method usually requires hospitalization and close monitoring.

What About GMO & Processed Foods?

Many clients that have pets with cancer ask about the role of genetically modified organisms (GMO) and/or processed foods in cancer and their pets' diets. Unfortunately, the jury is still out on the relationship between GMO/processed foods and cancer in humans because adequate data is not yet available.

TABLE 4. Recommended Nutrient Levels for Diets (% Dry Matter Basis)[a]

NUTRIENT RANGE	FAT	CHO	PROTEIN	N-3 FA[b]
Healthy Dogs				
Low	< 5	< 25	< 18	NR[c]
Moderate	10–15	25–54	18–22	NR
High	> 15	> 55	> 22	NR
Healthy Cats				
Low	< 9	< 24	<26	NR
Moderate	11–20	≈ 30	27–30	NR
High	> 20	> 40	> 30	NR
Canine Cancer Patients[d]				
% Dry matter basis	25–40	< 25	30–45	> 5
% Metabolizable energy	40–65	< 20	30-40	
Feline Cancer Patients[e]				
% Dry matter basis	25–40	< 24	40–50	> 2
% Metabolizable energy	40–65	< 20	30–45	

a. Based on AAFCO minimum nutrient allowances for adult and growth life stages
b. N-3 FA = omega-3 fatty acids, including DHA and EPA
c. NR = Values not reported in AAFCO; suggested N-6:N-3 ratio of 1:1–2.5:1
d. Canine values derived from reference 3
e. Feline values extrapolated from canine values; lower dietary fat based on concurrent disease states, such as pancreatitis, hyperlipidemia, and cholangitis.

TABLE 5. Commercial Diet Types Appropriate for Veterinary Cancer Patients[a]

CATEGORY OF DIET	CANINE APPROPRIATE	FELINE APPROPRIATE
Fish as primary protein source (OTC[b])	Yes	Yes
Grain-free (not calorie-reduced)	Yes	Yes
Kitten	No	Yes
Performance	Yes	No
Puppy	Yes	No
Recovery/critical care	Yes	Yes
Hypoallergenic, diabetic (selected diets)	Yes[c]	Yes[d]

a. These categories of commercial diets fall within the nutrient profiles recommended for veterinary cancer patients.
b. OTC = over the counter
c. Royal Canin Diabetic (canned)
d. Hill's Prescription Diet d/d (canned) and m/d, IAMS Skin & Coat Response LB, Purina DM, Royal Canin Hypoallergenic (canned) and Diabetic (canned)

Supplements: Appropriate for Veterinary Cancer Patients?

Caregivers are often keen to provide immune-enhancing, health-boosting supplements to their pets diagnosed with cancer. Limited evidence-based studies are available to substantiate dosage, duration, timing, or risk versus benefit; therefore, it is best to proceed with caution.

Some supplements have been documented through clinical studies in the cancer patient:

Omega-3 fatty acids, which include EPA and DHA, are recommended in various formats:

- Omega-3 fatty acids = > 5% dry matter[3]
- Ratio of omega-6 to omega-3 (EPA/DHA) = 1:1 to 2.5:1[3]
- EPA/DHA = 450 mg/100 kcal of daily energy requirement (DER); calculated based on Hill's Prescription Diet n/d nutrient profile

Antioxidants are contraindicated during ongoing chemotherapy or radiation therapy.

- Although oxidant-induced cellular damage is significant following completion of treatment protocol, human studies have reported conflicting results regarding AOX supplementation.[16]
- To date, no companion animal studies evaluating AOX supplementation have been reported.

Glutamine (GLN) is a primary fuel for enterocytes that can become depleted during prolonged anorexic–hyporexic states, especially with associated GI stress. Many tumors exhibit high rates of GLN consumption.

- GLN has been shown to improve:[17]
  - » Protein balance in tumor-bearing animals
  - » Natural killer cell function.
- Recommended supplementation following GI surgery = 500 mg GLN/100 kcal DER[14]
- No consensus on usefulness of GLN supplementation in nonsurgical cancer patients

For further information on the use of nutritional supplements in veterinary medicine, read **Surveying Supplements: Current Trends, Research, & Recommendations**—in the May/June 2014 issue of *Today's Veterinary Practice*—at **tvpjournal.com**.

ADDITIONAL CONSIDERATIONS

Appetite

The waxing/waning appetites of patients undergoing therapies for cancer can significantly impact the onset of malnutrition.

Therapeutic appetite stimulants are available for pets, including mirtazapine and diazepam.

Specific oral probiotics have been noted to enhance food intake in chronically ill cats and dogs; however, these effects are undocumented in veterinary literature. One such product, canine or feline FortiFlora (purinaveterinarydiets .com), is a powdered probiotic suggested for use to protect microbiota prior to, or replenish microbiota following, chemotherapy and/or radiation therapy.

Acupuncture, acupressure, and directed massage are nontraditional approaches to appetite stimulation. The appetite pressure point is located at the juncture of the nasal tissue and hairline on the dorsal aspect of the nose. Gentle, directed pressure for 5 to 10 minutes prior to feeding has been noted to stimulate appetite once food is offered.

Dietary fat, protein, and sodium are known palatability enhancers for pet food. In patients with hyporexia, higher fat and protein diets that are not sodium restricted may be more enticing. In cases involving concurrent pancreatitis, cholangitis, or hyperlipidemia, restricted dietary fat is recommended.

Taste & Food Aversions

In humans, altered taste is a common side effect of chemotherapy that may be present, but challenging to ascertain, in pets. However, food aversions have been observed in pets undergoing chemotherapy and/or radiation therapy. To help overcome these aversions:

- Use glass or porcelain feed and water dishes in place of metal dishes, which reduces the metallic taste associated with platinum-based chemotherapies; this taste is often reported by human cancer patients.[15]
- Alternate the main protein source in the diet, which influences smell and taste and helps overcome aversions.

SUMMARY

When nutritional support is overlooked in pets with cancer, malnutrition can develop and jeopardize patient health. While the catabolic–cachectic state in chronic cancer patients is not reversible, progression can be slowed through appropriate nutritional support.

- Begin nutritional support at diagnosis, and continue past remission for at least 6 to 9 months, or longer; residual alterations in nutrient metabolism associated with presence of neoplastic cells persist for varying time periods past intervention.
- Work closely with the caregiver to develop realistic nutritional support goals.
- Assess the pet as often as needed to ensure its needs are being met.
- As the pet's clinical picture changes, revise the nutritional support plan accordingly. ■

AAFCO = American Association of Feed Control Officials; AOX = antioxidants; CHO = carbohydrate; DER = daily energy requirement; DHA = docosahexaenoic acid; EPA = eicosapentaenoic acid; GI = gastrointestinal; GLN= glutamine; GMO = genetically modified organisms; OTC = over the counter; RER = resting energy requirement

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