

NUTRITION

Nutritional Management of Patients with Neoplasia

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Cancer is considered the uncontrolled growth of cells in different tissues throughout the body, which cannot be regulated by normal physiologic functions. Integrating a comprehensive nutritional assessment into the diagnostic workup and therapeutic planning for patients with neoplastic conditions can potentially improve clinical outcomes. However, due to the diverse nature of neoplastic cells, creating the same therapeutic plan for every patient is difficult. The precise nutritional needs vary between individuals. Despite the existence of specific treatment protocols for management of neoplastic conditions, each patient must be evaluated and dietary therapy should be adjusted to meet their individual needs.

Dogs and cats with cancer often experience changes associated with decreased caloric intake and metabolic alterations (e.g., weight loss, decreased appetite, gastrointestinal [GI] changes, loss of lean body mass).^{1,2} Cancer cells often rely on glucose as their energy source, a phenomenon referred to as the Warburg effect. The Warburg effect occurs when neoplastic cells favor glycolysis over oxidative phosphorylation for energy production.² Because of these metabolic changes, researchers have explored whether feeding a diet lower in carbohydrates might benefit dogs and cats with cancer. However, dogs and cats have the ability to synthesize glucose through gluconeogenesis, which means that they can regulate their blood glucose levels irrespective of the carbohydrate content of their diet.

Abstract

Cancer is a complex condition that can affect metabolism, appetite, body weight, and lean body mass. Nutritional management strategies can help patients deal with those challenges, which affect each patient differently. Nutritional assessment and comprehensive dietary recommendations for clients may reduce the risk for malnutrition and weight loss. Dietary factors to consider for cancer patients include energy density; fatty acid, antioxidant, and protein content; digestibility; and palatability. One of the top priorities should be feeding a complete and balanced diet and limiting treats and toppers to 10% of total daily caloric intake. Not all patients with cancer benefit from a diet change; but for those who do, the transition should be gradual.



Take-Home Points

- Cancer is a highly diverse condition with varying characteristics across different tissues, which emphasizes the need for individualized nutritional approaches.
- Integrating a comprehensive nutritional assessment into case management and treatment planning can enhance clinical outcomes and patient wellbeing.
- Incorporating nutritional assessment and a diet plan can help identify and address patients at risk for malnutrition.
- Diet selection, tailored for each patient, should be based on energy density; fatty acid, antioxidant, and protein content; digestibility; and palatability.
- Key principles in nutrition include feeding a complete and balanced diet and ensuring that cancer patients receive adequate energy, with treats and toppers not exceeding 10% of total daily caloric intake.

DIETARY GOALS

Because of the complexity of the metabolic changes and the various types of cancer, understanding the fundamentals of nutrition for dogs and cats before considering specific nutritional management strategies for patients with cancer is essential. Two core principles are feeding a diet that is complete and balanced and ensuring that patients receive sufficient calories to meet their requirements.

Complete and Balanced Diet

A complete and balanced diet provides all the essential nutrients in the appropriate proportions to support physiologic functions, including growth, reproduction, and maintenance of body systems. A well-balanced diet supports the immune system, which is often compromised in cancer patients.^{3,4} To encourage food intake in ill pets, clients commonly incorporate treats and toppers into their pet's diet. Although short-term use of treats and toppers may help maintain caloric intake, continuing them for an extended period can lead to nutritional deficiencies. Deficiencies can be particularly detrimental for patients with cancer as many of the metabolic pathways are accelerated (e.g., by inflammation, tissue damage, tissue repair). Those metabolic changes result in increased energy expenditure, protein degradation, and altered lipid metabolism.¹

Cancer patients are at high risk for malnutrition, which may alter the immune system, compromise the ability to respond to treatment, and result in reduced quality of life.⁵ Research has demonstrated that outcomes for dogs with lymphoma are poorer among those that were

underweight than among those that were of normal weight or overweight at the time of diagnosis.⁶ Patients fed a diet that does not meet their essential nutrient requirements may experience the effects of malnutrition sooner than those whose diets do meet requirements. To avoid malnutrition, it is recommended to feed at least 90% of the total daily caloric intake from a complete and balanced diet that is formulated for the respective life stage of the dog or cat.

Because treats and toppers play a role in the human–animal bond and may help improve caloric intake in inappetent patients, clients should be given guidance on ways to safely integrate those options into their pet's diet plan (**BOX 1**). To maintain nutritional balance and prevent potential deficiencies, treats and toppers should

BOX 1 Ideas for Encouraging Food Intake

- Feed in a quiet place
- Adjust the temperature of the food (e.g., warm, cold, frozen)
- Change the feeding location
- Change the dish or use a dinner plate (preferably nonmetal, as stainless steel can produce undesirable flavor for dogs receiving chemotherapy)
- Add palatability enhancers (e.g., honey, applesauce [dogs]; low-fat yogurt, nutritional yeast, probiotic supplements [dogs and cats])

not provide more than 10% of the patient's total daily caloric intake, thereby ensuring that the patient continues to receive the essential nutrients while still allowing families to provide special food items as a part of their pet's nutrition plan (**TABLE 1**).

Fatty Acids

Polyunsaturated fatty acids play a role in several metabolic pathways and help maintain cell wall function. They can also serve as an energy source and may help improve appetite and reduce cancer cachexia. Omega-3 polyunsaturated fatty acids promote formation of anti-inflammatory factors and decrease production of tumor necrosis factor and interleukin-1, which may help modulate inflammation associated with cancer.^{7,8}

Antioxidants

Patients with cancer often experience increased oxidative stress, an imbalance between production of free radicals and the body's ability to neutralize them, which can damage cellular structures (e.g., DNA, protein, lipids). In cancer patients, oxidative stress can be exacerbated by proliferation of cancer cells, inflammation, and the side effects of chemotherapy and radiation therapy. Antioxidants from the diet mitigate oxidative damage and decrease DNA damage, which improves immune function.⁷

Examples of antioxidants include vitamins C and E, selenium, zinc, glutathione, and various phytochemicals that can be found in fruits and vegetables. A concern associated with giving antioxidants is that they may protect the cancer cells against radiation and chemotherapy; therefore, it has been argued that

TABLE 1 Nutritionally Safe Treat or Topper Ideas for the Canine or Feline^a Cancer Patient

TREAT/TOPPER	QUANTITY	KILOCALORIES
FRUITS AND VEGETABLES		
Chopped carrots	1/4 cup	12
Diced watermelon	1/4 cup	12
Cauliflower ^b	1/2 cup	13
Air-popped popcorn (no butter, salt, or unsafe flavorings)	1/2 cup	14
Unsweetened applesauce	2 tablespoons	14
Green beans	1/2 cup	15
Broccoli ^b	1/2 cup	15
Cantaloupe	20 grams	7
Apple	1/4 cup	15
Kale	1/2 cup	16
Sliced banana	1/8 cup	16
Baked squash (spaghetti, acorn)	40 grams	16
Blueberries	1/4 cup	21
Canned pumpkin	1/4 cup	21
Baked sweet potato	30 grams	27
PROTEIN TREATS^c		
Plain low-fat yogurt	1 tablespoon	10
Cooked beef top round (fat removed)	1/4 ounce	13
Peanut butter (no xylitol)	1 teaspoon	16
Cooked tilapia	15 grams	19
Cooked ground lamb (85% lean)	1/4 ounce	20
Cooked chicken breast (boneless, skinless, roasted)	15 grams	25
Large egg, cooked	1/2 egg	39

^aDue to the absence of sweet taste receptors in cats, they may not show interest in food with sweeter flavors.

^bConsuming cruciferous vegetables has the potential to induce flatulence.

^cHigh-protein treats should be limited or avoided in dogs and cats with medical conditions that affect their ability to tolerate protein.



supplementing additional antioxidants should be avoided.⁹ When antioxidants are given, the antioxidant level should provide sufficient support but should not be excessive, which could potentially interfere with cancer treatments.⁹ The most effective types and optimal dosages remain an area of ongoing research.

Protein

Proteins, and more specifically amino acids, help maintain and repair body tissues, including muscle. Muscle loss and cancer cachexia can lead to weakness and compromised health, making protein a major factor to consider when creating a diet plan.⁹ In human medicine, meeting energy requirements along with amino acid supplementation has been shown to improve muscle mass and strength.¹⁰ However, be sure that clients do not give their pet amino acid/protein products marketed for humans, which would unbalance the diet. The goal is a complete and balanced diet that not only meets energy requirements of the patient but also provides adequate protein.

Energy Density

Some patients with cancer lose weight due to inadequate caloric intake, resulting in a negative energy balance. In a negative energy balance state, the body begins using muscle and adipose tissue, which is part of the body's adaptive response to an insufficient energy supply. That process is further exacerbated when inflammation accompanies the neoplasia.

A diet's energy density is determined by the number of calories provided per unit of food. For cancer patients, maintaining or even increasing caloric intake may be necessary to support increased metabolic demands. Diets with increased energy density can provide more calories in smaller portions, which can be beneficial for patients with decreased appetite or those that are having difficulty eating larger meals. Because weight loss is a common concern with cancer patients, feeding a diet with more calories per cup (or per can) helps meet their caloric needs and avoid a negative energy balance, thereby minimizing weight loss and helping preserve muscle mass, which can improve the pet's overall quality of life. One way to achieve a diet with higher energy density is to increase the amount of fat in the diet. Fat provides more calories per gram than protein or carbohydrates. An additional benefit of a higher-fat diet is that many dogs and cats find fat to be highly palatable, which may improve diet acceptance.

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Digestibility

A higher proportion of dietary nutrients are absorbed from the GI tract when patients consume diets with high rather than low digestibility. Patients with cancer may experience GI signs (e.g., nausea, vomiting, diarrhea, decreased appetite) and consume less food. Being fed a highly digestible diet may alleviate some GI signs and improve the patient's willingness to eat, thereby helping to maintain adequate nutrition during cancer treatment.¹¹

COMMERCIALLY AVAILABLE DIETS

Because no single diet fits the needs of every cancer patient, it is fortunate that there are several commercial diets with nutrient profiles and ingredients appropriate for cancer patients as well as a new diet specifically for cancer patients, Hill's Prescription Diet ONC Care (hillspet.com). In a single-armed, nonrandomized study, the new diet was evaluated for acceptance by dogs with benign and malignant tumors.¹² It was well accepted, and the dogs demonstrated increased enthusiasm for eating. The diet may help improve or maintain weight in patients with cancer. However, because it contains moderate to high levels of fat, whether the patient has a history of fat intolerance should be considered before feeding Hill's Prescription Diet ONC Care.

CHANGING THE DIET

Not all dogs and cats with cancer require a diet change. However, some clients may want to change their pet's diet as a way to control a specific area of care, especially when other aspects of the illness are beyond their control. Other patients may have a medical condition that warrants a diet change. If a diet change is indicated, there are several factors to consider,

beginning with a comprehensive nutritional assessment that includes a thorough evaluation of the patient's diet history, medical background, and physical examination findings to ensure that the new diet will meet the individual needs of the patient. When reviewing the diet history, it is helpful to screen for indications of potential food sensitivities or intolerances that were present before the cancer was diagnosed (e.g., selective appetite, grass eating, increased flatulence, sensitivity to diet changes). Such information gives the veterinarian insight into how the patient has responded to food in the past and can be useful for selecting a new diet. For instance, if a dog has been fed a low-fat diet (20 grams fat/1000 kcals), the new diet should not be high in fat. Other dietary factors to consider are energy density; fatty acid, antioxidant, and protein content; digestibility; and palatability.

Food aversion can develop when a patient associates a new diet with a negative or unfamiliar experience (e.g., hospitalization). Changes in the environment, increased stress levels, and unfamiliar surroundings in a hospital setting can contribute to food aversion. When possible, avoid feeding the diet that is intended for at-home use while the patient is hospitalized, although doing so can pose a significant challenge, particularly for patients with medical conditions that require precise dietary management.

Camille Torres-Henderson

Dr. Torres attended Colorado State University (CSU) for her undergraduate and veterinary education. After she earned her DVM degree in 2001, she went into small animal private practice in Albuquerque, New Mexico. She joined community practice at CSU's James L. Voss Veterinary Teaching Hospital in 2008, and earned her feline and canine DABVP certification in 2011. As a general practitioner, she has observed the power of preventive medicine. Seeing how preventing disease can be so much easier for a pet than treatment led her to explore the effects of obesity on companion animals and nutrition's role in obesity management. Her enthusiasm for nutrition in multiple areas inspired her to seek additional training in the field of nutrition at CSU, and she completed a residency in nutrition and became a diplomate of the American College of Veterinary Internal Medicine (Nutrition) in 2021. Her furry family consists of 2 cats and a yorkiepoo. She enjoys spending time with her husband and their 2 boys, taking every opportunity to participate in the wonderful outdoor activities that Colorado has to offer.



SUMMARY

Diets for cancer patients should be tailored to their individual needs. The transition to a new diet should be gradual and slow, to allow the intestines to acclimate to the new diet and to decrease the risk for GI upset (i.e., diarrhea, vomiting, decreased appetite). In general, the ideal diet is complete and balanced with treats and toppers limited to no more than 10% of the daily caloric intake, contains sufficient energy, is highly digestible, and is highly palatable. Providing adequate nutrition for cancer patients can work in conjunction with medical/surgical therapy to lead to improved clinical outcomes and wellbeing. **TVP**

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