Veterinarians are commonly faced with questions from pet owners about nutrition, but when an animal has cancer, such questions are even more likely. Most owners of dogs and cats with cancer want to know everything from whether diet contributed to the development of the cancer to whether they should change their pet’s diet to whether dietary supplements should be administered as part of their pet’s treatment. Advertisements for dietary supplements abound in magazines for pet owners and veterinarians alike, and it can be tempting for owners of pets with cancer to believe the claims of disease treatments or cures that are supposed to come from a few pills. If owners do not ask their veterinarians questions about these claims, they often use the Internet to try to get the answers for themselves. Therefore, it is important to be aware of both the potential benefits and risks of dietary supplements.

Abstract: Nutrition is an important component of the care of dogs and cats with cancer, and dietary supplement use is common in this patient population. Antioxidants are thought to be among the most commonly used supplements. While antioxidants have potential benefits for cancer patients, they also may have detrimental effects. Therefore, information regarding the overall diet, including dietary supplements, should be collected for every cancer patient and carefully assessed, with specific attention to antioxidants, to identify areas in which the patient’s medical care can be optimized.

QuickNotes

It is important to maintain optimal weight and prevent nutritional deficiencies in cancer patients to improve their outcome.

Antioxidants in Cancer Treatment: Helpful or Harmful?

Lisa M. Freeman, DVM, PhD, DACVN,
Tufts University

Nutrition in Pets With Cancer

Nutrition should be an integral part of the management of every cancer patient. Cancer patients may be predisposed to weight loss, malnutrition, and specific nutrient deficiencies during treatment. Therefore, it is important to maintain optimal weight and prevent nutritional deficiencies in these patients to improve their outcome. It is also important to avoid excesses of overall calories and individual nutrients. Obesity resulting from excessive caloric intake is a common problem in animals with cancer. Body weight, body condition score, and muscle condition (i.e., whether muscle loss is occurring) should be assessed at each visit. Obtaining a thorough diet history allows the veterinarian to determine whether the animal is eating an appropriate diet, whether deficiencies or excesses are likely to occur, and whether components of the diet are working with or against the selected therapeutic plan for the patient. This information can then be used to make necessary modifications to ensure optimal care.

The Importance of Diet History

Dietary supplementation is extremely common in today’s society. More than half of all Americans take dietary supplements on a regular basis. Fewer pets in the general population receive dietary supplements; in one study of pet owners, approximately only 10% of dogs and cats were receiving supplements, with multivitamins, chondroprotectives, and fatty acid supplements being the most common. However, in populations with disease conditions, dietary supplement use is higher. Dietary supplements are used in 31% of dogs and 13% of cats with cardiac disease, respectively, and in ≥50% of dogs and cats with cancer.

*Dr. Freeman discloses that she has received research funding from Nestlé Purina PetCare, Boehringer Ingelheim, and the Waltham Centre for Pet Nutrition and that she has served on a Nestlé Purina Scientific Advisory Council.
with chronic diseases use supplements even more commonly than the general population, and only a small proportion of these patients tell their health care providers about their supplement use. With the increase in supplement use in populations with diseases comes an increased risk for interaction between supplements or between supplements and medications. Because animals with cancer are one of the most likely populations to be receiving dietary supplements, an important part of a thorough diet history is to specifically ask owners if they are giving supplements to their pets.

A thorough diet history is one of the keys to providing optimal care for animals with cancer. Questions should include the specific food (brand and specific type), amounts and frequency of feeding, types and amounts of treats and table foods, whether the animal is eating an unconventional diet (e.g., homemade, raw meat), and whether dietary supplements are being used. Dietary supplements can be a particular issue because owners often do not consider them to be either drugs or part of the diet. Therefore, if owners are not specifically questioned about the use of dietary supplements, they usually do not mention them. Veterinarians should ask about the types, brands, and doses of supplements being administered. This information can help to determine whether supplements are being used and dosed appropriately and whether they might interact with any drugs or nutrients being used as therapy.

**Antioxidants**

Antioxidants are thought to be among the most commonly used dietary supplements in animals with cancer. They are typically administered with the goal of aiding in the treatment of cancer, enhancing immune function, or reducing treatment toxicity. Endogenous antioxidants include enzymes (e.g., glutathione peroxidase, superoxide dismutase), free radical scavengers (e.g., vitamins A, C, and E), and metal chelators (e.g., transferrin). Normally, these antioxidants compensate for the production of oxidants known as reactive oxygen species (e.g., hydrogen peroxide, superoxide anions, hydroxyl radicals), which are normal by-products of

**QuickNotes**

There is a great deal of controversy among human oncologists as to whether antioxidants are beneficial, innocuous, or detrimental.
Another potential benefit of antioxidants is pro-
ductive stress. However, there also are potential detrimen-
tal effects of antioxidants. Antioxidants have a number of potential
benefits, including the ability to protect against oxidative stress,
which is known to contribute to a variety of diseases, including heart
disease, cancer, and aging. However, the use of antioxidants
depends on the development of reactive oxygen species.

Antioxidants have a number of potential benefits in cancer patients.
Oxidative stress has been associated with increased morbidity
and mortality for a number of human cancers, and recent studies have demonstrated oxidative
stress in dogs with mammary tumors and lymphoma.12–14
Reactive oxygen species can contribute to malignant transformation and neoplastic cell proliferation and so could contrib-
tu to disease progression. Therefore, boosting antioxidant reserves and reducing oxidative stress might reduce tumor growth or metastasis. Another potential benefit of antioxidants is prote-
tion against radiation- and chemotherapy-induced adverse effects (e.g., gastrointestinal, renal, and cardiac toxicities), some, but not all, studies in rodent models and people have shown modest benefits. These potential ben-
etits are the rationale behind the high use of various antioxidants during cancer treatment. However, there also are potential detrimental effects of antioxidants in patients undergoing treatment for cancer. The efficacy of radiation therapy and of many chemotherapeutic agents depends on the development of reactive oxygen species. Therefore, reduced treatment efficacy is possible if antioxidants are used concurrently with these therapies. Because of these competing effects, there is a great deal of controversy among human oncologists as to whether antioxidants are beneficial, innocuous, or detrimental.15–17

Antioxidants do not all behave similarly, and some have significantly different effects depending on their dose and form and what other medications and supple-

Recommended Web Sites

- **www.acvn.org**
  The American College of Veterinary Nutrition
  Offers a “Nutrition Resources” page that includes contact information for ACVN diplomats who do nutrition consultations or formulate homemade diets.

- **www.consumerlab.com**
  Consumerlab.com
  This group performs independent testing of dietary supplements for purity, potency, and bioavailability.

- **vm.cfsan.fda.gov/~dms/supplmnt.html**
  The US Food and Drug Administration Center for Food Safety and Applied Nutrition
  Resource for regulatory and safety issues, adverse event reporting, meetings, and industry information.

- **www.mayoclinic.com/health/druginformation/DrugHerbIndex**
  The Mayo Clinic
  Lists information and grades recommendations for the use of some drugs and supplements.

- **nccam.nih.gov**
  National Institutes of Health National Center for Complementary and Alternative Medicine
  Provides information on research into complementary and alternative healing practices.

- **dietary-supplements.info.nih.gov**
  National Institutes of Health Office of Dietary Supplements
  Includes fact sheets, safety notices, and the International Bibliographic Information on Dietary Supplements database.

- **www.quackwatch.org**
  Quackwatch
  This site calls itself a “guide to health fraud, quackery, and intelligent decisions.”

- **www.nal.usda.gov/fnic/etext/000015.html**
  The US Food and Drug Administration Food and Nutrition Information Center
  Includes general supplement and nutrition information and links to a variety of dietary supplement Web sites.

- **www.usp.org/USPVerified**
  US Pharmacopeia Dietary Supplement Verification Program (voluntary)
  This group performs independent testing of “dietary supplement finished products” for purity, potency, and quality and awards its Verified Dietary Supplement Mark to products that meet its criteria.
ments are being concurrently administered. Therefore, evaluating whether one has benefits (or adverse effects) can be a complicated endeavor.

In addition to the specific pros and cons of antioxidants are the general issues that are of concern with all human and veterinary dietary supplements: safety, efficacy, dose, bioavailability, dissolvability, and quality control. Until additional data are available, I recommend against the use of antioxidants during radiation therapy or chemotherapy in dogs and cats with cancer.

Conclusion

Once veterinarians determine what foods and supplements owners are giving their pets, they may need to gather additional information about their safety, efficacy, and potential for interaction with each other and other therapies. Some of the Web sites listed in BOX 1 can be useful for this purpose. Because there is little governmental regulation of dietary supplements, pet owners should consider selecting dietary supplements that bear the logo of the Dietary Supplement Verification Program, which tests human dietary supplements for ingredients, concentrations, dissolvability, and contaminants. Another good resource is ConsumerLab.com, which performs independent testing of health and nutrition products (primarily human supplements, but also some pet products).

As of 2008 (2009 or 2010 for smaller companies), the US Food and Drug Administration is instituting regulations that require supplements to be made using Good Manufacturing Practices and to meet quality standards.18

References