

# The role of diet and supplementation in animal cancer care

By

Sue Armstrong, MA, VetMB, VetMFHom, CertIAVH, MRCVS, RsHom

January 31, 2013

1831

**Pets with cancer are very common in small animal practices. Learn more about how diet can be a tailored treatment plan for some patients.**

Cancer is one of the most common issues we deal with in small animal practice. Just as the causes are complex, so are the treatment options. More than any other disease, cancer has people going on the internet and adding every supplement they can find that's claimed to cure cancer. This is one area in which the integrative practitioner, even if untrained as a veterinary herbalist or nutritional expert, has a responsibility to help guide people so decisions such as diet choices can be tailored to each individual.

## **Why diet is key**

The importance of diet in treating and preventing cancer is long established. Some practitioners claim to treat [cancer](#) by dietary manipulation alone, focusing in particular on the elimination of cancer toxins and providing potentially deficient essential nutrients to support the immune system and liver.<sup>1</sup> Many of the diets advocated for the treatment of cancer in humans are vegetarian, but this may not be applicable to obligate carnivores such as the cat and carnivore-biased omnivores like the dog.

Growing evidence supports the basic principle in cancer nutrition of minimizing simple sugars and complex carbohydrates, and favoring protein and unsaturated fats as the main energy sources for humans, cats and dogs. This is based on studies of the metabolic requirements of cancer versus host cells. Cancer cells use protein for energy and will utilize certain amino acids, such as arginine, at the expense of the host.

Fats provide more calories per gram than protein and carbohydrates, an advantage to very sick animals able to ingest only small amounts of food. Most animals find fats more palatable. The biochemical response to food deprivation (even 24 hours of anorexia) leads to substantial dependence on fat derived fuels.

### *Glucose and tumor cell proliferation*

- 1) Most malignant cells have dysfunctional mitochondria and cannot sufficiently metabolize fatty acids or ketone bodies.
- 2) Ketone bodies, elevated when glucose is low, negatively affect tumor proliferation.
- 3) Most malignant cells depend on glucose availability.
- 4) Many human cancer patients exhibit altered glucose metabolism.
- 5) Cancer cells metabolize glucose for energy via a different pathway to healthy cells, and produce lactate as an end product, creating a local acid environment.
- 6) High insulin and insulin-like growth factor can directly promote tumor proliferation.



As cancer progresses, alterations in normal patient metabolism occur; often these changes are irreversible without treatment and adequate nutritional support. Diet in cancer patients can be extremely challenging when the animal is inappetent, able to swallow only small amounts of food, or is vomiting. Cachexic patients need high energy in the form of fat, and even carbohydrates may have to be reintroduced at this stage, even though they give the tumor an energy supply.

Ideally, I prefer animals to be taken off refined commercial diets and put on raw whole food diets. Guardians need good instructions on how to create a good diet for their animals. They must be willing to spend the time putting the diet together every day, using high quality human grade foods. Some excellent companies produce well-formulated raw food diets that are complete and take the hard work out of it for clients with limited time. Cheap fatty meats laden with carcinogens and old vegetables from the bottom of the fridge are as unhealthy to the animal as a refined diet. Dogs that have been used to commercial diets all their lives and are now very ill with cancer have

to be transitioned carefully (it may not even be possible or advisable to change some cases); I do not use diets high in bone for these animals. Those with cachexia may not be able to handle raw food diets. At this stage, cooking the food, feeding it warm and not cold, and using high energy convalescence products is required.

The home-formulated raw diet I use is essentially based on 2:1 meat/meaty bone to vegetable/fruit with an emphasis on human grade organic food. I also pay attention to the full spectrum of colors in fruit and vegetables to give the animal a good mineral/vitamin spread. If vitamin/mineral supplements are used, they must be bio-available and ideally sourced from whole plants. Additions to the basic diet include eggs, cottage cheese (especially if the liver is showing measurable signs of stress), spirulina, wheat grass, alfalfa juice and barley greens.

Reducing the acid load is helped by vegetables, fruits and the additions mentioned above combined with the elimination of refined carbohydrates, grains, sugars and dairy foods. Evidence indicates the cancer progresses more in an acid environment. There are also theories that take this understanding down to a basic imbalance between active ionized potassium providing positive electric potentials in health, versus negative potentials created by the ionization of sodium in disease. It is suggested that alongside detoxification, activated ionized minerals are essential for healing. The addition of digestive enzymes may be useful, especially in animals that have been fed refined diets for years.

## Supplements for cancer

Many supplements, in addition to [Omega-3](#) fatty acids and L-arginine (see below), are commonly used alongside basic cancer nutritional therapy. Most are taken directly from human cancer care, so there is little evidence available about dose rates, toxicity reports and contraindications in cats and dogs. In addition, there is a huge tendency for clients to want to use everything possible with little understanding of the pharmacology of the substances used. This is of particular concern in animals undergoing chemotherapy and radiotherapy, as some supplements can radically alter the availability and toxicity of these potent treatments. Since some common supplements are immune modulators that may enhance the proliferation of tumor cell lines, they are not good for lympho-proliferative tumors.

## Amino acids & fatty acids

High quality protein and amino acids are required for dogs with cancer. Two amino acids in particular play a very important role.

**1** Arginine is critical in collagen and urea synthesis. It stimulates the release of certain hormones (insulin-like growth factor), modulates immune function (lymphocytes have a requirement for arginine), and promotes wound healing. Arginine supplementation should be considered in most cases and particularly in animals undergoing surgical intervention where primary wound healing is required.

**2** Glutamine is the most abundant free amino acid in plasma and intracellular fluids, and plays a central role in several metabolic pathways. Intracellular glutamine forms an essential store of carbon and nitrogen which is rapidly mobilized in times of need for protein synthesis. It also has a role in the maintenance of normal gut and immune function. Supplementation with glutamine may help slow the rate of muscle breakdown and protein catabolism, and can be indicated in cancers of the gastrointestinal system, including the oral cavity. It is an important energy substrate for these cells. Because it is also a substrate for any rapidly dividing cell populations, there is a question if cancer cells use this substrate. It is often preferentially metabolized by brain tumor cells, so its use should be limited to cachexic patients with non-CNS tumors.

The addition of n-3 fatty acid supplements (Omega 3 fish oils and flaxseed oil) and a restriction of n-6 fatty acids (evening primrose oil and borage oil) alters the ratio between n-3 to n-6 fatty acids and has marked effects on the inflammatory cascade by reducing the number of pro-inflammatory cytokines. A double-blind, randomized placebo-controlled study<sup>2</sup> to evaluate the effects of fish oil, arginine and doxorubicin chemotherapy on remission and survival time in dogs with lymphoma has shown that fatty acids of the n-3 series normalize elevated blood lactic acid in a dose-dependent manner, resulting in an increase in disease-free intervals and survival time for dogs with lymphoma.

The addition of n-3 fatty acids to the diet should be carefully evaluated in each cancer case. A reduction in platelet aggregation has been noted in cats, so they are potentially unsuitable for tumors with a haemorrhagic tendency. There are also some reports of depressed immune function which may be due to increased tissue lipid peroxidation. In these cases, vitamin E levels should be assessed and may need to be raised to protect against the increased oxidative damage.

Here are some common supplements that have a growing evidence base for efficacy and safety in animals, and that I consider for my cancer patients:

**Antioxidants**, including vitamins A, C, E, beta-carotene and lutein are now added in increased quantities to many commercial pet foods, with anti-cancer claims being made for some of these foods. Chronic oxidative stress with formation of reactive oxygen species, especially when antioxidant capacity is inadequate, has been hypothesized to contribute to DNA damage, malignant transformation, and eventual tumor development in numerous species.

Very little is known about the potential anti-neoplastic effect of antioxidant supplementation in dogs and cats. However, the beneficial effects of dietary antioxidant supplementation on the development of malignant lymphoma and other neoplastic lesions in mice have been demonstrated at the Department of radiation oncology, University of Pennsylvania School of Medicine.

The main message I would give about antioxidants is that they are of most use in prevention. They are often contraindicated in active cancer treatment, particularly cases undergoing treatments that rely on pro-oxidant cell death.

**Mushrooms** are increasingly shown to contain different classes of biologically active compounds with strong immunomodulating and anticancer properties. One extensively used in both traditional herbalism and modern clinical practice is *Coriolus versicolor*, also known as yun-zhi. The chemical composition of the mushroom is very complex. Among various bioactive components derived from hot water and standardized ethanol-water extracts of *C. versicolor*, polysaccharopeptides (PSP) and protein-bound polysaccharides (PSK) have the strongest biological activity. The main effects on cancer are as follows:

- PSP and PSK can inhibit the proliferation of leukemia, lymphoma, hepatoma, breast, lung and prostate tumor cell lines. Their antimetastatic activity has also been demonstrated.
- PSP contributes to tumor eradication by stimulating both humoral and cell-mediated immune responses.
- PSP and PSK increase the synthesis of interferon (IFN)- $\gamma$  and interleukin (IL)-2.
- They enhance T-cell proliferation.
- They stimulate macrophage-derived nitric oxide production and counteraction of the immuno-suppression induced by cytotoxic drugs.

Other mushrooms are also of considerable interest and frequently used in mixed mushroom preparations with or without the use of Transfer Factor – *Cordyceps sinensis*, *Ganoderma lucidum*, *Grifola frondosa* are just a few. Each has a specific array of immunomodulatory effects and needs to be carefully selected and understood, especially when lympho-proliferative diseases are present or when chemotherapy is used.

**Curcumin** is an extract from turmeric (*Curcuma longa*). it can be an extremely useful supplement in many canine cancers. it has been shown to have the following effects in relation to cancer:

- Anti-proliferative effects in cancer cell lines
- Induces apoptosis
- Anti-angiogenic factors
- Impedes tumor growth and metastases
- Helps control matrix metalloproteinase activity
- Anti-inflammatory
- Pro-oxidant in high dose

It is generally well tolerated, although it has documented mild blood thinning properties so should not be given in cases of haemorrhagic tumors or immediately post surgery. it can be poorly absorbed so the quality of the product with regard to the percentage of curcuminoids present is essential. Curcumin can selectively enhance the cytotoxicity of chemotherapy agents, and in addition may reduce negative side effects. Due to these altered responses, any veterinary surgeon in control of chemotherapy must be aware if this supplement is being used.

**Artemisinin** is the active extract from the herb sweet wormwood (*Artemisia annua*). It has been shown to have the following properties in relation to cancer:

- Anti-angiogenic
- Increased apoptosis
- Selective cytotoxicity against cancer cells due to their higher iron content when compared to normal cells.

Artemisinin should not be used with high antioxidant supplements that act to buffer and protect against free radicals, because its cytotoxicity depends on the production of free radicals produced as a result of its interaction with iron in the cancer cell. It should not be given during or after radiotherapy for up to two months. radiotherapy causes the release of iron into local tissue, which could potentially lead to increased local cell damage.

## In conclusion

You need to assess each cancer case individually to determine the animal's nutritional requirements, as well as the frequency, consistency and method of delivering the food. With supplements, it is safer to give none than everything under the sun. if you do not know how they work, start with a corrected and appropriate diet and do nothing else. And caution your clients, as nothing provokes panicked self-treatment more than cancer.

## References

<sup>1</sup> Gerson M. *Gerson Therapy Handbook*, 5<sup>th</sup> Edition, Totality Books (1<sup>st</sup> Edition 2007).

<sup>2</sup> Ogilvie G, Vail DM. "Metabolic alterations and nutritional therapy for the veterinary cancer patient." Withrow SJ, MacEwan EG. *Clinical Veterinary Oncology*, Philadelphia, WB Saunders, 1996.

## Resources

Klemente R, Kammerer U. "Is There a Role for Carbohydrate Restriction in the Treatment and Prevention of Cancer?" *Nutr Metab*, 2011, 8 (75), Biomed Central Ltd

Mauldin G. "*Nutrition and the Small Animal Cancer Patient*", WSAVA, World Congress, Vancouver, 2001

Monro J. "Treatment of Cancer with Mushroom Products", *Archives of Environmental Health*, Aug 2003, Vol. 58, No. 8.

Clemmons RM. "Integrative Treatment of Cancer in Dogs", University of Florida, Department of Small Animal Clinical Sciences.

Schoen & Wynn. *Complementary and Alternative Veterinary Medicine*, Mosby, Inc., 1998.

White C. "Cancer Smart Bomb, Part 1: An Idea from Ancient Chinese Medicine", *New Horizons*, Brewer Science Library, Summer 2002.