# nutrition and the immune system

*by W. Jean Dodds, D.V.M.*

Wholesome nutrition is the key to maintaining a healthy immune system and resistance to disease. Commercial foods ingested by animals on a regular basis may not be balanced in terms of major nutrients, minerals and vitamins, and some continue to add chemicals to the final product to enhance its stability and shelf life. Nutritional deficiencies or imbalances as well as exposures to various chemicals, drugs and toxins present a continual immunological challenge, which can suppress immune function, especially in those animals genetically susceptible to immune dysfunction (immune deficiency, autoimmunity, allergies).

Genetic differences between individuals lead to quantitative variations in dietary requirements for energy and nutrient needs, and to maintain health. Also, genetic defects may result in inborn errors of metabolism that affect one or more pathways involving nutrients or their metabolites. While minimal and maximal nutrient requirements have been established for most vitamins and trace mineral elements, optimum amounts for every individual cannot be assumed. Examples of important vitamin and mineral requirements in this regard include vitamin C, vitamin E and selenium, vitamin A, copper and vitamin B12. Similarly, a wide variation occurs in the energy needs of dogs depending on their breed, age, sex and size.

Nutritional factors that play an important role in immune function include zinc, selenium and vitamin E, vitamin B6 (pyridoxine) and linoleic acid. Deficiency of these compounds impairs both humoral as well as cell-mediated immunity. The requirement for essential nutrients increases during periods of rapid growth or reproduction, and may also increase in geriatric individuals because immune function and the bioavailability of these nutrients generally wanes with aging. As with any nutrient, however, excessive supplementation can lead to significant clinical problems, many of which are similar to the respective deficiency states of these ingredients. Supplementation with vitamins and minerals should not be viewed as a substitute for feeding premium quality fresh and/or commercial pet foods.

Synthetic antioxidants like butylated hydroxyanisole (BHA) and butylated hydroxy-toluene (BHT) have been used as preservatives in human and animal foods for more than 30 years. More recently pet-food manufacturers preferred to use ethoxyquin because of its excellent antioxidant qualities, high stability and reputed safety. But, significant controversy arose about the safety of ethoxyquin when chronically fed for long periods of time at permitted amounts in dog foods. Toy-breed dogs were particularly at risk because they ingest proportionately more food and preservatives for their size in order to sustain their metabolic needs.

Naturally occurring antioxidants (vitamins E and C, and citric acid) are used almost exclusively today, in response to consumer and professional queries about the long-term effects of feeding synthetic chemical antioxidants to pets.

## nutrition and thyroid metabolism

Nutritional influences can have a profound effect on thyroid metabolism. The classical example is the iodine deficiency that occurs in individuals eating cereal grain crops grown in iodine-deficient soil. This will impair thyroid metabolism because iodine is essential for the formation of thyroid hormones. Iron and zinc also are important minerals in regulating thyroid metabolism. Another link has recently been shown between selenium deficiency and hypothyroidism. Cereal grain crops grown in selenium-deficient soil will contain relatively low levels of selenium. While commercial pet-food manufacturers compensate for variations in basal ingredients by adding vitamin and mineral supplements, it is difficult to determine optimum levels for so many different breeds of animals having varying genetic backgrounds and metabolic needs.

The selenium-thyroid connection has significant clinical relevance because blood, but not tissue, levels of thyroid hormones rise in selenium deficiency. Thus, selenium-deficient individuals showing clinical signs of hypothyroidism could be overlooked on the basis that blood levels of thyroid hormones appear nor-

mal. The selenium issue is further complicated because the synthetic antioxidants still used in some foods to protect fats from rancidity can impair the bioavailability of vitamin A, vitamin E and selenium, and alter cellular membrane function, metabolism and detoxification. Because animals with autoimmune thyroid disease have generalized metabolic imbalance and often have associated immunological dysfunction, it is advisable to minimize their exposures to unnecessary drugs, chemicals and toxins, and to optimize their nutritional status with healthy balanced diets. Families of dogs susceptible to thyroid and other autoimmune diseases show generalized improvement in health when fed premium cereal-based diets preserved naturally with vitamins E and C rather than with the synthetic chemical antioxidants mentioned above. Fresh vegetables cooked with Italian herbs and garlic, dairy products such as yogurt or low-fat cottage cheese, or a variety of meats and whitefish can be added.

## nutritional management
### (commercial, homemade and raw-food diets)

Many veterinarians treating animals suffering from immunological diseases appreciate that alternative nutritional management is an important step in minimizing their patient's environmental challenges. The results of this approach have been remarkable. The replacement food must be of good quality and preferably of relatively low protein content (20 to 22 per cent). Increasing carbohydrate and reducing protein content, while maintaining high-quality protein, has been shown to be beneficial for many affected animals and is also believed to have a positive effect on behaviour. Diet and behaviour appear to be linked because certain highly nutritious foods may aggravate the condition of dogs with behavioural problems (dominant aggression, hyperactivity and fear).

For allergic animals, elimination diets with restricted or novel antigen source are given for six to 12 weeks to evaluate their benefit to the patient. Homemade diets can also be used provided that the formula is properly balanced. All other food supplements, including treats, are withdrawn. Example ingredients that have been used successfully include whitefish, rabbit, venison, duck, ostrich, emu, buffalo and turkey mixed with potato, sweet potato and other vegetables (except onions and cruciferous vegetables). Grains are often avoided, at least initially, although novel grains like quinoa, sorghum, barley or flax usually have been well tolerated.

For animals with liver disease, the author's liver "cleansing diet" includes: white potato/sweet potato (50/50) and white fish – 2/3 potato mix and 1/3 fish. Season with garlic, mixed Italian herbs or parsley, salt and pepper. Later, you can add chopped carrots, zucchini, yellow squash, green beans, spinach, and scrambled eggs, if these are tolerated. An infant liquid multivitamin or product like Missing Link should be added, if feeding the diet for long term.

Raw-food diets have been gaining in popularity as well. A key feature of these diets is the variety they provide. One of the prototype diets – Dr. Ian Billinghurst's BARF (bones and raw food) diet – recommends feeding a dog 60 per cent raw meaty bones (chicken backs, wings and necks), with the rest of the diet composed of ground vegetables mixed with ground meat, and supplements such as kelp, vitamin E and vitamin C. Nutritional analyses on some commercially available raw diets suggest that the raw meaty bones commonly used provide 40 to 70 per cent protein, and the meat/vegetable mixtures range from 20 to 50 per cent protein. The question has arisen about the potential for such high-protein diets to affect renal function when fed continuously, as high-protein diets are reported to induce renal hypertrophy, and increase renal blood flow and glomerular filtration rate. While this concern may not pertain to healthy dogs, it could play a role in dogs with previously compromised renal function.

Maintaining the appropriate ratio of trace minerals, vitamins, fatty acids and other nutritive elements is especially important for patients with acute and chronic diseases, as their metabolic demands have increased to sustain cell turnover and tissue repair. Typical supplements include: vitamin-mineral mix, antioxidants (vitamins A, C, D, and E and selenium), digestive enzymes, brewer's yeast, kelp, honey, coat additives, apple cider vinegar, hydrochloric acid (used sparingly), yogourt, Willard Water, liver, eggs, garlic and plenty of fresh water.

Vitamin A and E have been shown to enhance immune function in small animals, as the former can beneficially influence T-helper responses, and the latter is known to improve both cellular and humoral immunity. Dietary carotenoids, especially lutein and beta carotene, have been reported to modulate both cell-mediated and humoral immunity in dogs.

## study of raw-food diets

In collaboration with Drs. Susan Wynn and Joe Bartges, we investigated the basic clinical laboratory parameters of 256 healthy adult dogs of varying ages and breed types being fed raw-food diets for at least nine months. The same laboratory (Antech Diagnostics) analyzed the samples from 227 of the dogs. From this group, there were 87 dogs fed the classical Billinghurst BARF diet, 46 dogs were fed the Volhard diet of Wendy Volhard, and the remaining 94 dogs were fed other types of custom raw diets.

There were 69 dog breeds represented, including 233 purebreds, 16 crossbreds, one mixed breed and six of unknown breed type. Most of the dogs were neutered males (73) or spayed females (85), whereas there were 31 intact males and 32 intact females. Another six dogs were of unknown sex. The mean age of the group was 5.67 (± 3.52) years; and the mean length of time fed a raw food diet was 2.84 (± 2.54) years. The data from this group of dogs was compared to the same laboratory parameters measured at Antech Diagnostics from 75 healthy adult dogs fed a commercial cereal-based kibbled diet. Preliminary statistical comparisons of results for the raw and cereal-based diets found them to be essentially the same with the following notable exceptions:

- Higher packed cell volume (hematocrit) in all groups fed a raw diet (range of 51.0 to 53.5%) versus cereal-based kibble (47.6%).
- Higher blood urea nitrogen (BUN) in all groups fed a raw diet (range of 18.8 to 22.0 mg/dL) versus cereal-based kibble (15.5 mg/dL).
- Higher serum creatinine in the Volhard raw-diet group only (1.20 mg/dL) versus cereal-based kibble (1.07 mg/dL).

Results from this initial analysis indicated that dogs fed raw meats (natural carnivores) have higher red blood cell and blood urea nitrogen levels than dogs fed cereal-based food (obligate omnivores). A recently completed detailed analysis of the other parameters showed that statistically different parameters also included higher hemoglobin, MCH, MCV, MCHC, total protein, albumin, BUN/creatinine ratio, sodium, osmolality, and magnesium. Statistically lower values were seen for total leukocyte, neutrophil and lymphocyte counts, phosphorus and glucose. Thus, the normal reference values for dogs fed raw food diets should be revised.

The intake of proportionately large amounts of raw meat protein and the significantly higher BUN and other concentrations found here raise the possibility of spillover into the urine of measurable amounts of urea nitrogen and/or albumin. If so, are there potential short- and long-term clinical consequences ?

Accordingly, the presence of microlbuminuria [an indicator of early renal disease] was assessed in dogs fed exclusively on raw foods for at least 12 months in dogs using the Heska ERD – HealthScreen® test kit. The urine of 37 dogs was evaluated and results indicated that feeding a diet of raw ingredients does not appear to cause leakage of albumin into the urine in most of the dogs tested. In five dogs, there was a low-grade positive reaction in the test, but two of them were found to have urinary tract infections. The other three dogs were lost to follow up.

## ATTENDEES' NOTEBOOK

JANICE PREISS & LIN HAWKYARD

- ✓ There is still too much iodine in commercial dog food. Puppies receiving too much iodine will have their thyroid production suppressed, which could eventually cause them to be hypothyroid.
- ✓ Do not add kelp to a commercial diet more than once or twice per week.
- ✓ Ethoxyquin is finding its way back into SOME prescription dog foods. Vets typically don't read the contents on the packaging of foods they sell and some companies have changed hands or merged, so it is important to check if you get a prescription diet from your vet.
- ✓ Contrary to popular belief, a kibble and raw diet can be combined, just feed the two elements separately. No exact time frame is necessary.
- ✓ When feeding raw, a combination of 70% meat and 30% veggies is fine. Veggies can also come from tripe, which contains cellulose. Green leafy and orange veggies fed at least three times a week (parsley, kale, spinach, chard, carrots, sweet potatoes) may reduce the risk of cancer in genetically predisposed animals by 90%.
- ✓ Beef has been found to cause allergic reactions in dogs.
- ✓ Raw is not safe in dogs with a GI tract that is chronically affected (i.e., liver/kidney disease) since these dogs can end up with end-stage chronic cirrhosis.
- ✓ Animals fed a raw diet do not have the same "normal" values in lab tests as do kibble-fed animals. They typically have higher white blood counts, and higher titres and creatinine levels – all of which can be quite normal but may cause raised eyebrows at the vet clinic. There needs to be new standards developed for dogs fed a raw diet. One should do a complete blood panel yearly to establish a norm for your pet. You can then quickly spot any changes from the norm if you have regular testing done. Blood work is especially important for geriatric dogs.
- ✓ When giving thyroid medication, it's best to try to give twice per day to keep the levels constant and give by mouth rather than in the food. Thyroid hormones bind to calcium and soy, which decreases absorption so best to give one hour before or three hours after food.