



## **The Impact of Nutrition on Immune Function**

Healthy immune function in dogs, as in any species, is vital to survival. The immune system, after all, defends the body against foreign organisms, such as bacteria, viruses and parasites, and from malignant cells.

Nutrition is important in maintaining normal immune function. Healthy dogs fed good quality complete and balanced diets are unlikely to experience nutritional deficiencies, but in reality, few dogs receive only food from well-balanced diets.

“It is clear that in today’s world of well-nourished companion animals, the macronutrient composition of the diet can influence immune function,” says Thierry von der Weid, Ph.D., an immunologist at the Nestlé Research Center in Lausanne, Switzerland. For example, macro-supplementation of certain nutrients, such as vitamin E, has been shown to possibly enhance immunity, while excessive intakes of other nutrients, such as vitamin A, zinc and iron, may induce immunodeficiencies.<sup>1-4</sup>

Likewise, nutritional deficiencies can be associated with immuno-incompetence. For instance, zinc, selenium, iron, copper, vitamins A, C, E, B6, protein, energy, and folic acid deficiencies may adversely affect immune response.

### **Nutritional Influence of Diet**

While the majority of dogs in the United States may not be malnourished, their immune systems may not be operating optimally, especially if fed a diet that is not nutritionally complete and balanced or if overfed supplements, says von der Weid. The rapid turnover of lymphoid tissues (such as the lymph nodes) appears to make these tissues very susceptible to nutrient imbalances, which then may affect the metabolic pathways and functions involved in immune defense.<sup>5</sup> “As we work to further understand how nutrients interact with the immune system, it is helpful to discuss whether macronutrient composition of a diet can help to optimize immune function,” von der Weid says.

### **Importance of Protein**

Protein content of the diet is important. Marginal protein deficiency is difficult to monitor clinically. While blood protein concentration in humans is not considered a good indicator of a marginal protein deficiency, adaptation to marginal protein deficiency does not necessarily result

in body weight loss.<sup>6</sup> Yet, studies have shown that marginal protein deficiency may be associated with compromised immune response, reduced protein turnover (the building and breakdown of protein), and loss of lean body mass, even when the protein source has a high biological value.<sup>6-8</sup>

Dogs maintained with inadequate protein reserves may appear healthy, but may be more susceptible to stress from bacteria and viral infections and can have more difficulty recovering from physical trauma and injury. Besides having compromised immune function, a less severe protein deficiency may cause dogs to have rough, dull hair coats and reproducing bitches may produce less milk. Severe protein deficiency in dogs may result in poor food intake, retardation of normal growth or weight loss, subnormal concentrations of blood proteins, muscle wasting, emaciation and even death.

Since most immune responses, such as the manufacture of antibodies, require protein synthesis from essential amino acids, it is easy to understand why protein deficiency interferes with optimal immunity. Many studies have shown that depending on the severity of the protein deficiency, negative effects on the immune response can be attributed to specific functions.<sup>9, 10</sup>

An optimal quantity of quality dietary protein is necessary to maintain immune function. Dogs may appear to be well-nourished, yet have a marginal protein deficiency that may compromise the dog during periods of stress, such as infection, injury or elective surgery. The amount of dietary protein needed by an individual dog may be influenced by factors such as age, lifestyle, genetics and others, von der Weid says.

Optimal dietary protein is important for normal immune function — this level appears to be greater than minimum recommendations for adult maintenance, he says. It is recommended that adult dogs receive diets containing protein at least 20 to 25 percent of the metabolizable calories. Metabolizable calories are calories ultimately available to a dog after fecal and urine losses. The amount of protein needed to achieve these levels, as a percent of the diet, depends on the fat and energy content of the diet (see “Recommended Minimum Dietary Protein for Adult Dogs, Based on Fat and Energy Content of the Diet,” above).

### **Impact of Overfeeding**

Clearly, overfeeding leads to obesity, says von der Weid. Obesity may adversely affect immune response to infection, and infection is reported to occur more frequently in obese individuals.<sup>11</sup> Obese dogs also have been shown to have a decreased resistance to salmonella infection and canine distemper virus and a shortened average survival time following distemper virus infection.

Dietary fat provides more calories per gram than any macronutrient, von der Weid says. Obesity and consumption of high-fat diets are clearly linked to immuno-incompetence; however, a certain quantity of fat in the diet is essential.

## **Healthy Immune Function**

The effect of inadequate nutrition — or over nutrition — on a dog's immune system can be profound. The defense system that is so important in maintaining health and vitality can break down if the nutrients it needs to run efficiently are lacking, or in some cases, provided in excess. Feeding a complete and balanced dog food is the best way to help ensure healthy immune function.

This article contains information from "Immune Function: How Diet Helps Shape the Defenses," which appeared in Volume 6, Issue 2 of the Nestlé Purina Research Report.

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