

# NOURISHING THE SKIN

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The skin is the largest organ system of a dog's body. Healthy skin represents the dog's first line of defense against hazards in his environment. The importance of the skin barrier becomes obvious in patients with severe burns. The loss of skin barrier integrity leaves the pet constantly fighting battles against life-threatening bacterial infections.

Nutrition plays a critical role in maintaining the integrity of the skin. The most important nutrients for skin health are protein, essential fatty acids, zinc, vitamins A and E, and the B-complex vitamins, in particular biotin and pantothenic acid.

## PROTEIN

Skin cells on the surface of a dog's body are dead. Surface skin cells are constantly being sloughed off and the body is constantly producing new cells to replace them. Protein is required for skin cell synthesis as well as for hair growth. As much as 30% of a dog's daily protein intake is used to support these processes.

One of the most obvious symptoms of protein deficiency is a coarse, brittle coat, often with bald patches and skin lesions. This condition is commonly seen in malnourished dogs, and also sometimes in dogs with long term debilitating diseases such as kidney failure. Although healthy dogs fed a well balanced diet usually have healthy coats, brood bitches with large litters at peak lactation may show signs of protein deficiency even on a well balanced diet. If the protein demands of the litter exceed the bitch's protein intake, the bitch's hair growth will be temporarily suspended and her coat will suffer as a result.

## ESSENTIAL FATTY ACIDS

Essential fatty acids play an important role in skin health. The studies in the 1950s that originally defined "linoleic acid" as an essential nutrient for dogs described coarse, dry hair, excessive shedding, flaky skin and dandruff as symptoms of a deficiency of this fatty acid. In more severe cases, skin lesions

may develop and the dog will become more susceptible to secondary skin infections.

The National Research Council (NRC) and the Association of American Feed Control Officials (AAFCO) both define linoleic acid, an omega-6 fatty acid, as the only essential fatty acid for dogs. NRC and AAFCO do not consider omega-3 fatty acids, such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), essential for dogs. However several studies have shown improvements in the skin condition of dogs fed supplemental omega-3 fatty acids.

The body's metabolism of omega fatty acids leads to the production of molecules called eicosanoids. Omega 6 eicosanoids are pro-inflammatory, pro-aggregatory mediators which play a role in the normal immune response. When an animal's body is invaded by foreign bacteria, the pro inflammatory eicosanoids are responsible for attracting white blood cells to the infected site allowing them to fight the invaders, while the pro aggregatory eicosanoids help in blood clotting and wound repair.

In healthy dogs, eicosanoids are produced only as needed to face an immune challenge. In many dogs with skin disease however, excessive or prolonged production of these eicosanoids leads to chronic skin inflammation. Omega-3 fatty acids may help to control these conditions.

Omega-3 eicosanoids are much less inflammatory than those produced from omega-6 fatty acids. Since omega 3 and omega-6 fatty acids compete for the same metabolic enzymes, omega 3 supplementation not only enhances omega 3 eicosanoid production, it also inhibits the production of inflammatory omega 6 eicosanoids.

Most skin supplements for dogs contain a balance of both omega-6 and omega-3 fatty acids. Although a number of clinical studies have reported improvements in the skin of dogs fed these supplements, the individual

response is highly variable. Some dogs are remarkably responsive while others do not respond at all. As well, it is important to remember that improvements will not appear immediately since consumed fatty acids must first be incorporated into new skin cells inside the dog's body then moved out to replace lost surface cells. Visible signs of improvement may take 9 to 12 weeks of feeding.

## ZINC

Zinc plays an important role in skin health. Many cases of zinc deficiency result from an excessively high intake of dietary calcium. Zinc competes with calcium, iron and copper for uptake from the gut, so a high intake of any of these three minerals can result in a relative zinc deficiency, even if there are adequate levels of zinc in the diet.

Zinc deficiency generally leads to the development of skin lesions on the footpads and other pressure points such as the elbows and hocks. These lesions are red and inflamed, often with crusting and hair loss. As well, the coat becomes dull and harsh and patches may lose their pigment.

Certain breeds may be genetically predisposed to abnormal zinc metabolism. The Siberian Husky and Alaskan Malamute are two breeds in which a reduced ability to absorb dietary zinc has been reported. Zinc deficiency may be further exacerbated in these breeds by an increased requirement due to strenuous exercise. Racing sled dogs are often fed supplemental zinc to improve the toughness of their footpads.

Dogs affected by zinc deficiency respond quickly to zinc supplementation or to correction of the dietary imbalances which caused the zinc deficiency. Supplementing with zinc and linoleic acid together may provide additional benefits. It has been shown that these two nutrients work synergistically. When they are fed together the improvement in skin condition is considerably greater than the combined effect of each fed separately.

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## VITAMIN A

Vitamin A is required for the maintenance of healthy skin and symptoms of a vitamin A deficiency are very similar to that of a linoleic acid deficiency: hair loss, poor coat, scaly skin and an increased susceptibility to secondary bacterial skin infections.

Vitamin A deficiencies are extremely rare. However, certain breeds can suffer from "vitamin A responsive dermatoses". The underlying mechanism for the condition is not clear but there appears to be a genetic component to it. It is almost exclusively seen in Cocker Spaniels, but is occasionally found in Miniature Schnauzers and Labrador Retrievers.

Vitamin A dermatoses are not caused by a deficiency of vitamin A. Dogs with this condition are consuming adequate levels of this vitamin and have normal levels of vitamin A in their blood. Affected dogs do not respond to traditional therapies such as medicated shampoos and antibiotics, but do respond to vitamin A supplementation with the latter often leading to permanent alleviation of clinical symptoms. The vitamin dosage required to elicit a positive response is five to ten times higher than that required by healthy dogs.

## VITAMIN E

There are also skin conditions which are "vitamin E responsive dermatoses". Probably the most remarkable of these is a disease called "primary acanthosis nigricans" which is most commonly seen in Dachshunds. This disease causes hair loss, thickening and blackening of the skin and secondary skin infections. In more advanced cases, the skin becomes greasy and crusted and the dog's skin may give off a pronounced odor. Feeding vitamin E at levels five to ten times above maintenance requirements effectively alleviates symptoms and prevents their recurrence in affected dogs.

## B-COMPLEX VITAMINS

Several B-complex vitamins play a role in skin health, but two are particularly important: biotin and pantothenic acid (vitamin B5).

Biotin is a common constituent of many foods. This vitamin is also readily synthesized by bacteria in the dog's gut, so deficiencies are relatively rare. In fact, the only cases of biotin deficiency that have been reported in scientific literature involved dogs being fed raw egg whites. Raw egg whites contain a protein "avidin" which forms a very stable, non-digestible complex with biotin, preventing its absorption into the body. Symptoms of biotin deficiency include dry, scaly skin with dull, brittle hair, itchiness and eventually skin lesions.

Pantothenic acid deficiency is also extremely rare and symptoms of its deficiency do not generally include an abnormal skin or coat. However, pantothenic acid may be considered a "skin nutraceutical". It has been shown that supplementing with this vitamin at levels well above requirements may help to improve skin barrier integrity.

In most cases, skin and coat health is best maintained by feeding a high quality complete and balanced diet. In certain cases, additional supplementation with one or more of the nutrients discussed in this article may provide further benefits.