



Healthy Skin & Haircoat: The Importance of Nutrition

A pet's skin and haircoat are among the most visible signs of health and vitality. The skin and haircoat are of vital importance to the body's protective mechanisms against environmental insults of all kinds, from infectious agents to temperature gradients.¹ In addition, hair is of great aesthetic importance to owners and a source of great concern when it is not normal.²

Nutritional deficiencies of many types may be manifested by alterations in this highly visible organ system. Perhaps because of these issues, nutritional supplements and nutraceuticals are widely used in skin and hair care.

Good nutrition is essential to normal skin health. Normal keratinization requires an adequate supply of several nutrients, including protein, fatty acids, zinc, copper, vitamin A and B vitamins. Deficiencies in numerous essential amino acids, fatty acids, vitamins or minerals can cause various deviations in skin structure or function. Epidermal atrophy occurs with protein, calorie and vitamin deficiencies. Hyperkeratosis or acanthosis can occur with magnesium, zinc, pantothenic acid, pyridoxine, biotin, vitamin A or essential fatty acid deficiencies, while parakeratosis is symptomatic of zinc deficiency. Pigment changes may be seen with deficiencies of copper, cysteine or pantothenic acid. Alopecia or changes in the sebaceous glands may occur with zinc, biotin or riboflavin deficiencies. In addition to these direct effects, suboptimal nutrition may increase susceptibility to parasites, such as mange mites, fleas and lice, as well as enhance susceptibility to skin infections. ^{3,4,5}

Providing minimum nutrient requirements, by definition, should eliminate all dermatologic signs associated with dietary deficiencies. However, certain animals may have genetic or metabolic differences that may respond to intakes greater than are considered adequate to avoid recognized dietary deficiencies. In addition, most pet owners do not exclusively feed complete and balanced pet foods. ^{6,7} Excessive treats or nutritional imbalanced supplements can contribute to nutritional imbalances. Thus, an assessment of a pet's total diet may reveal areas that could benefit from nutritional modifications.

Protein

Skin contains a significant amount of protein and serves as a major source of protein reserves when intake is inadequate. ⁸ The hairshaft is composed primarily of alpha-keratin protein. Specific skin effects from gross protein deficiency include hyperkeratosis, epidermal hyperpigmentation, flaky skin, loss of hair pigmentation, and increased hair fragility. ^{4,9} This

may be seen as crusty skin lesions with patchy alopecia and dry, brittle haircoats. Microscopic changes include puffing and flaking of the keratin layer and foamy-looking collagen layers. 4 Hair root changes occur in protein malnutrition, with an increased number of follicles in telogen phase and a decreased number in anagen phase. 10 Subclinical protein deficiency may be less noticeable. Sub-optimal protein intake can decrease hair or wool production and decrease fiber diameter, length and breaking strength. 3,11,12 Increasing dietary protein or sulfur amino acid intake increased the rate of division of cells in the follicle bulb matrix, which increased keratin gene expression, protein deposition and follicle growth rate. 3,13 Optimum dietary protein or dogs, based on measures of protein turnover in muscle and liver, appears to be at least 20%o calories from high-quality protein. 8 Even greater quantities may be beneficial for enhanced haircoat quality.

Fat and Fatty Acids

Generalized flaky desquamation, coarse, lusterless haircoats or alopecia, and pruritus are among the changes seen with essential fatty acid deficiency. Essential fatty acids may be oxidized and denatured in poor quality foods, foods stored too long or at high temperatures, or those inadequately preserved with antioxidants. Animals fed these foods may show evidence of essential fatty acid deficiency. Such signs also may be observed in pets fed low-fat diets over extended periods, pets with fat malabsorption syndromes, or those with unusually high requirements for these nutrients. Numerous fatty acid supplements are available; however, response to fatty acid supplements in open clinical trials has been highly variable. 14 Pet health and overall diet quality should be addressed to identify underlying problems prior to administering supplements.

Vitamins

Riboflavin deficiency can cause a dry flaky dermatitis with reddening of the skin and hair loss. Biotin deficiency can cause the hair to become thin or lose pigment and the skin to become dry and flaky or greasy. 4 Pantothenic acid deficiency can lead to loss of hair pigment and hair loss. Such deficiencies of B-vitamins are rare among pets fed quality commercial pet foods. However, since table scraps, treats and other foods can make up a large portion of the diet for many pets, deficiencies should be considered if these signs are observed. Various forms of vitamin supplements are available. Most contain all the B-vitamins so it is not necessary to identify the specific deficiency.

Vitamin A deficiency can appear like an essential fatty acid deficiency and lead to dry, scaly skin. 4 Excessive vitamin A also causes skin lesions that appear similar to those of vitamin A deficiency, including dry skin, alopecia and pruritus. On the other hand, vitamin A or related compounds have been used topically to treat various skin problems in humans. Retinoic acid (a form of vitamin A) has been shown to be involved in regulation of epidermal keratinocytes by regulating gene transcription. 15 Dietary supplementation with vitamin A has been used to treat seborrhea

in American cocker spaniels while topical treatments have been used for a number of skin conditions in various breeds. 16 The vitamin A supplement, given at 10 to 25 times the requirement of 100 IU/kg body weight/day, appeared most useful in patients with marked follicular plugging and hyperkeratosis. 14

Active vitamin D (1,25-dihydroxychole- calciferol) has been investigated in human medicine as a treatment for psoriasis and ichthyosis, both hyperproliferative conditions. 17 Cells of the outer root sheath and epidermal cells have vitamin D receptors. In vitro data shows that active vitamin D inhibits the proliferation of keratinocytes and dermal fibroblasts. Vitamin D supplements (2 ug/day orally) were beneficial in human patients with psoriasis. Active vitamin D itself can be toxic, so safety as well as efficacy must be considered.

Minerals

Zinc is critical for normal skin development, and deficiency leads to parakeratosis and dermatitis. Zinc-responsive dermatitis generally is reported in puppies or zinc-sensitive breeds (primarily Siberian Huskies and Alaskan Malamutes), although it can occur in other breeds. A similar condition reported in dogs fed generic or low-cost commercial dog foods was presumed to be zinc deficiency secondary to poor zinc bioavailability. 18,20 Some older dogs with poor haircoats and scaly skin also may improve with zinc supplementation. 19 Zinc bioavailability can be influenced by the zinc source, as well as by dietary phytate, supplemental calcium and other variables. Affected dogs have scaling, crusting skin lesions, hyperkeratosis and secondary skin infections that respond to dietary change or zinc supplementation. Elemental zinc (initial dose 1mg/kg/day, divided and given with food) from either zinc sulfate or zinc gluconate has been recommended as an initial dose for dogs with suspected zinc-responsive dermatosis. 16 The dose may need to be increased for some dogs, and should be reduced following resolution of signs.

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Desc:

Good nutrition is essential to normal skin and haircoat health. See how vitamins, minerals, proteins, and fats affect your pet's fur and skin.