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Canine zinc-responsive dermatosis

Zinc plays important and diverse role in protecting against infections
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Zinc is essential for more than 300 enzymes, structural proteins and hormones in the mammalian body. It is needed for diverse physiological processes and metabolic functions including many aspects of the immune system, including iodine (thyroid) metabolism.

Lack of zinc is associated with atrophy of the thymus, a gland that has a role in the maturation of lymphocytes, and it seems the function of T lymphocytes is especially vulnerable to deficiency of this mineral.

With zinc deficiency, there is a reduction in delayed type hypersensitivity, and other immune responses mediated by T cells. Reduction in the production of antibodies and in the function of natural killer cells has also been reported in experimentally induced zinc deficiency in animals.

In addition, zinc is needed for cell replication and is thus essential for the regeneration of the intestinal mucosa, the healing of wounds and the turnover of epithelial cells necessary to maintain healthy skin, hair and nails.

It is also important in maintaining normal sexual function.

The combination of these essential functions explains why zinc plays such an important part in the protection against infections.

First reported case

The first reported case of zinc-related disease in the dog was reported in the journal, *Growth*, in an Alaskan Malamute with chondrodysplasia. It was found that these Malamutes absorbed only 25 percent of zinc in the small intestine compared to normal controls, and furthermore, the reduction in absorption was related to the inability to release protein-bound zinc to the non-protein-bound status at the gut level. This transfer occurs in normal dogs. This zinc-related disease (in this case, no skin problems were reported) in this breed has been later reported to cause skin lesions even with animals on a well-balanced commercial dog food.

True zinc deficiency is quite rare; it only has been reported in the Bull Terrier with lethal acrodermatitis.

This condition demonstrates a dysfunctional zinc metabolism and probable malabsorption in the small intestines. Stunted growth, diarrhea, numerous cutaneous or internal infections, and crusted and fissured paw pads are seen. The internal infection usually manifests as pneumonia and is directly related to diminished cellular immunity. Puppies usually die or are euthanized.

The affected dogs do not respond to oral or intravenous zinc supplementation.

Syndromes

There are basically three other syndromes of zinc-related dermatoses in the dog.

Most cases have been well-documented and seen in the past, but less so recently. This may be due to better breeding and improvements in the quality of canine commercial diets.

The first type occurs in Alaskan breeds including the Siberian Husky and Alaskan Malamute.

It has also been reported in Doberman Pinschers and Great Danes.

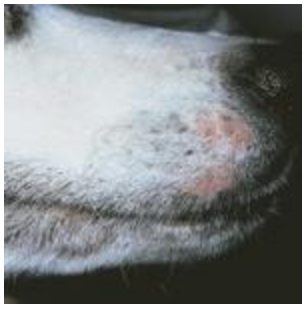
The affected dogs were all on a well-balanced commercial dog food that was sufficiently supplemented with zinc. It appears the skin disease is a result of several causes, primarily related to a genetic defect in intestinal absorption. This has been well documented in the Alaskan Malamute breed. The onset in the appearance of skin lesions has been also linked to estrus, severe stress, or severe diarrhea.

Note the crusts and alopecia periocularly.

Finally, diets that are supplemented with higher levels of calcium or phytates can reduce plasma levels of zinc by directly binding or interfering with zinc uptake and absorption. Phytate is a plant-based protein source. Lesions start relatively early in age and include thick crusts, erythema, scaling and occasional purulent exudation symmetrically around the eyes, mouth, pressure points, muco-cutaneous junctions (vulva, prepuce) and scrotum (Figure 1).

Also, the planum and the paw pad epithelium may also display similar changes as seen on the haired skin.

Some investigators have noted a very dull and dry haircoat with accompanying secondary seborrhea sicca. Secondary pyoderma is not uncommon, and can complicate the condition, thus interfering with response to treatment. Some dogs may also develop secondary Malassezia colonization on the surface of the crusts. Both of these secondary microbial infections can easily be diagnosed via surface cytology and microscopic evaluation. Variable pruritus can also be present.



Crusts also affect the perioral region in this Siberian Husky.

Large and giant breeds

The second type of zinc-related dermatosis in the dog is seen in large to giant breeds that are fast growing during the juvenile period.

It has been reported in the Great Dane, German Shepherd, Labradors, Standard Poodles and Dobermans. It is directly related to alterations in the diet or to supplements that may interfere with zinc absorption.

Diets that are high in phytate or calcium (both of which can bind to zinc in the small intestine) have been shown to induce this syndrome.

In addition, over-supplementation with vitamins and minerals has been linked to reduced zinc uptake in the gastrointestinal tract.

Dogs can present with similar lesions as seen in the Alaskan breeds, but may also have very thickly crusted paw pad and planum nasale epithelium with fissures. Severely affected dogs may also have generalized lymphadenomegaly, anorexia and depression.

"Generic dog food disease"

The third type of zinc-related dermatosis has been classically described as generic dog food disease.

In early reports, some dogs (particularly puppies) developed scaling and crusting as early as two to four weeks after being fed a commercial generic dog food!

The foods did not meet the National Research Council requirements and contained a sub-optimal level of poorly available zinc. Lesions can be well-demarcated on the muco-cutaneous junctions, pressure points and distal limbs with variable degrees of alopecia. The puppies also had fever,

Suggested Reading

depression, enlarged peripheral lymph nodes and pitting edema.

Diagnosis is made with history, clinical examination, measurement of zinc serum or hair levels and results of skin histopathology.

Measurement difficult

Measurement of serum zinc levels can be difficult due to a number of issues.

Samples may become contaminated with zinc in the tubes that hold the samples as glass and rubber are the primary culprits. Also, anti-coagulants may also interfere with the results and should not be present in the sampling tubes.

The samples are taken from peripheral veins, placed in a non-rubber stopper tube and the plasma or serum (preferably "royal blue tops") is then placed into a plastic vial. Also, it is possible for certain concurrent metabolic conditions and other diseases (i.e. hypothyroidism) interfering or falsely lowering zinc levels.

The results of skin histopathology is similar in all forms of zinc-related dermatosis and demonstrate the classic hyperkeratosis that is predominantly parakeratotic (the corneocytes have retained their nucleus) in nature.

This parakeratosis is evident on the epidermal surface and can become confluent to involve the follicular epithelium as well. This corresponds to the crusts and scales that are visualized upon physical examination. Sometimes dyskeratosis is also reported, especially in the generic dog food cases.

In addition, there is a superficial perivascular pattern of inflammation that can be mixed, but eosinophils can predominate.

Evidence of secondary pyoderma (folliculitis) can also be seen.

Treatment includes oral and intravenous (IV) zinc supplementation and alterations/improving the diet.

Zinc is available in many forms for oral supplementation and include zinc sulfate (oral and IV), zinc methionine, and zinc gluconate. Dosages are listed below:

> **Zinc sulfate oral:** 10 mg/kg once daily IV: 10-15 mg/kg weekly for four treatments.
> **Zinc methionine:** 1.7 mg /kg/day
> **Zinc gluconate:** 1.5 mg/kg/day of elemental zinc.

I recommend crushing the tablets and mixing it with food to enhance absorption and minimize vomiting.

There is a palatable dog biscuit manufactured by Zinpro (by Lincoln Biotech) with zinc methionine in a biscuit or a chewable tablet. Each tablet or biscuit contains 13 mg of elemental zinc. As of May 2004, they are sold directly from Lincoln Biotech and cost $64 for four, 180-count bottles.

Dr. Vitale received his veterinary degree from Mississippi State University, College of Veterinary Medicine. He completed a residency in veterinary dermatology at the University of California, Davis (UC-Davis) and is a diplomate of the American College of Veterinary Dermatology. Dr. Vitale is a clinical instructor/lecturer at UC-Davis. He is also a staff dermatologist at Encina Veterinary Hospital,Walnut Creek, Calif. and San Francisco Veterinary Specialists.

Disclosure: None

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