



E-ISSN: 2320-7078

P-ISSN: 2349-6800

JEZS 2017; 5(6): 2569-2571

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Received: 24-09-2017

Accepted: 28-10-2017

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## Management of zinc responsive dermatitis in dogs

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### Abstract

This paper presents the zinc responsive dermatitis and its successful management in dogs. The study included 9 dogs of various breeds, presented to the hospital with the history of erythema lips, crust lesions, hypotrichosis on lips, chin, around the nose and in the interdigital area and 6 healthy animals as a control. The Hb, PCV, TEC, Albumin, glucose and plasma zinc were significantly ( $p < 0.05$ ) decreased whereas TLC; globulin and copper were significantly ( $p < 0.05$ ) increased. All the animals were treated with zinc sulphate @10mg/kg orally, daily for 14 days and the animals revealed a marked improvement in clinical signs and hemato-biochemical parameters.

**Keywords:** Hemato-biochemical, dermatitis, zinc responsive, zinc sulphate

### 1. Introduction

Zinc is one of the most essential element for many body functions, mainly in the regulation of keratogenesis and wound healing [1]. All animals require a continuous supply of zinc in their diet since readily available body stores are limited and the dietary requirements vary according to the species and physiological state of the animal. Thus, young growing animals and breeding females require higher levels of zinc than healthy, non-reproducing adults [2]. Moreover, zinc absorption and utilization may be influenced by the presence of other dietary ingredients, such as phytate, which is present in many types of vegetable protein [3]. Excess calcium may also inhibit the intestinal absorption of zinc, possibly through competition for absorption sites or by acting as intestinal ligands [3].

In dogs, zinc-responsive dermatosis is an uncommon disease that is classified into two distinct syndromes. Syndrome I is seen almost exclusively in northern breed dogs (Siberian huskies, Alaskan malamutes and bull terriers) and characterized as an inherited impairment in the absorption or metabolism of zinc [3]. Syndrome II is seen in rapidly growing large-breed puppies consuming a high phytate diet, zinc-deficient diet, or a diet supplemented with components that may inhibit zinc absorption [4]. Both of these syndromes are characterized clinically by erythema at mucocutaneous junction and pressure point, scaling, crusting, alopecia, and lichenification.

### 2. Materials and methods

Nine pups of various breed (German Shephard (n = 5), Labrador (n = 2), cross breed (n=1) and Great Dane (n = 1) were presented with the history of inappetance, lethargy and mental dullness, pruritus, erythematous-crust papules affecting nearly every region of haired. The puppies had the history of calcium supplementation for more than 8 weeks. The animals were diagnosed for zinc deficiency based on clinical symptoms, laboratory analysis and treatment response [4]. The pups were treated with Zinc Sulphate ( $ZnSO_4$ ) (Tab Zinfate, Yash Pharma) @ 10 mg/kg b.wt. od. Orally, daily for 14 days. The control dogs include dogs which came to the clinic for routine checkup, vaccination and for deworming.

#### 2.1 Blood sample collection.

Ten ml of blood sample was collected on day 0 and 14 from affected dogs for hemato-biochemical and trace minerals estimation and compared with control group. Two ml of blood was collected in EDTA for the hematology estimation and rest of 8 ml was collected in heparinized vials and was centrifuged at 3000 rpm for 10 min to harvest plasma for the estimation of biochemical parameters and trace minerals.

#### 2.2 Statistical Analysis

The data generated was analyzed by one way ANOVA and all data is presented as mean  $\pm$

standard deviation. A p-value less than 0.05 is considered significant in all statistical analyses

### 3. Results and discussion

The diagnosis of zinc-responsive dermatosis must be based on a thorough history, physical examination, fungal culture of skin scrapes and histopathological examination of skin biopsies. In the present study animals were fed on generic adult dog food and had received calcium as a supplement and clinical signs were consistent with the zinc responsive dermatitis. However, histopathological examination could not be performed because of owner's disinclination. The cases were diagnosed to be zinc responsive dermatosis on the basis of clinical symptoms, and the recovery of puppies following oral administration of zinc and dietary corrections

Clinical examination revealed intense erythema on both upper and lower lips, crust lesions on the chin and around the nose. Erythema, hypotrichosis and crusts in the interdigital areas were also observed.

The hemato-biochemical parameters before and after treatment in zinc responsive dermatitis are given (Table I). Hematological observation revealed a significant ( $p \leq 0.05$ ) decrease in blood Hb, PCV, TEC in zinc deficient dogs which showed a significant improvement upon the zinc supplementation. Reduction in the Hb content may be due to increased rate of disruption or reduction in the rate of formation of erythrocyte [5]. Recorded low TEC supports this hypothesis. The decrease in PCV was obviously due to the decreased cellular count in affected dogs. Hemoglobin, PCV and TEC of the deficient dogs improved significantly upon zinc supplementation and our result is consistent with other work [6] who reported increased hemoglobin and other hematological parameters upon zinc supplementation. Total Leucocytic count was significantly increased in zinc deficient

animals and this leucocytosis was accompanied with neutrophilia and lymphopenia; however these values showed a marked improvement upon zinc sulphate supplementation. Zinc is essential for integrity of the immune system, deficiency results in reduced immunocompetence and decreased resistance to infections [7] and supplementation boost the immune response.

Biochemical parameters revealed significantly higher values of globulin and lower values of albumin and glucose in zinc deficient dogs (Table I). The higher globulin observed in the zinc deficient dogs could be due to increased production of gamma globulins in response to the infection as zinc deficient dogs had higher TLC values. Following treatment with zinc sulphate the altered biochemical parameters revealed a significant improvement. Zinc helps in protein synthesis and could possibly be the reason for the improvement in albumin concentration after treatment and the improvement in globulin could be because of enhancement of immune response after zinc supplementation. The increase of plasma following zinc supplementation may be attributed to the increase of ACTH and steroids hormones as a result of supplemental dietary Zinc [8].

The trace element status of the affected dogs revealed significantly lower values of zinc whereas copper was significantly raised (Table I). The decreased levels of zinc and occurrence of disease might have been precipitated by calcium supplementation as calcium is antagonistic to zinc absorption [9]. There is a strong inter-relationship between zinc and copper increased level of copper in the present study could be because of the removal of an antagonistic effect of zinc on copper absorption and utilization [10]. There was a significant improvement in zinc levels after zinc supplementation.

**Table I:** Hemato-biochemical and trace minerals in dogs before and after treatment with zinc sulphate

Parameters	Control (n=6)	Pre-treatment	Post-treatment
Hb (g/dl)	11.26 ± 0.50 <sup>a</sup>	9.90 ± 0.34 <sup>b</sup>	10.71 ± 0.15 <sup>c</sup>
PCV (%)	33.78 ± 1.51 <sup>a</sup>	29.60 ± 0.15 <sup>b</sup>	33.07 ± 0.97 <sup>a</sup>
TEC (x10 <sup>6</sup> /µl)	5.80 ± 0.28 <sup>a</sup>	4.90 ± 0.23 <sup>b</sup>	5.82 ± 0.38 <sup>a</sup>
TLC (x10 <sup>3</sup> /µl)	10.34 ± 0.70 <sup>a</sup>	13.51 ± 0.30 <sup>b</sup>	9.86 ± 0.31 <sup>a</sup>
Neutrophils	68.50 ± 2.04 <sup>a</sup>	77.08 ± 1.27 <sup>b</sup>	72.8 ± 0.65 <sup>c</sup>
Lymphocytes	25.83 ± 2.45 <sup>a</sup>	17.54 ± 0.81 <sup>b</sup>	21.36 ± 0.50 <sup>c</sup>
Monocytes	3.06 ± 0.25	2.4 ± 0.18	3.33 ± 0.33
Eosinophils	2.33 ± 0.55	2.73 ± 0.17	2.50 ± 0.42
Total protein (g/dl)	7.35 ± 0.10	7.47 ± 0.14	7.25 ± 0.16
Albumin (g/dl)	3.17 ± 0.18 <sup>a</sup>	2.68 ± 0.07 <sup>b</sup>	2.93 ± 0.18 <sup>a</sup>
Globulin (g/dl)	4.18 ± 0.09 <sup>a</sup>	4.79 ± 0.09 <sup>b</sup>	4.09 ± 0.17 <sup>a</sup>
Glucose (mg/dl)	90.62 ± 2.13 <sup>a</sup>	79.28 ± 2.86 <sup>b</sup>	84.25 ± 2.5 <sup>c</sup>
Zinc (µg/ml)	1.46 ± 0.16 <sup>a</sup>	0.52 ± 0.04 <sup>b</sup>	1.01 ± 0.02 <sup>c</sup>
Copper (µg/ml)	1.16 ± 0.07 <sup>a</sup>	1.40 ± 0.04 <sup>b</sup>	0.95 ± 0.03 <sup>c</sup>

The value with different subscript (a,b,c) in a row differ significantly at 5% ( $p < 0.05$ )

### 4. Conclusion

Zinc responsive dermatosis is associated with anemia, decreases plasma zinc and increased copper levels. Calcium supplementation in fast growing breed could precipitate zinc-responsive dermatosis (II type) and thus there is a need of feeding these animals with high quality food, as well as veterinary actions towards discouraging owners to use calcium supplements, without veterinary prescription.

### 5. Acknowledgements

The authors are thankful to the Dean of the Faculty of Veterinary Science and Animal Husbandry, SKAUST-Jammu, India, for providing the necessary facilities

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