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Zinc supplementation as a therapeutic managemental tool in diarrhoeal dogs

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Abstract

The present study was aimed to ascertain the plasma zinc profile of dogs suffering from diarrhoea and to evaluate the potential benefits of zinc administration in diarrhoeic dogs in order to strengthen the managemental strategies in control of the diarrhoeal episodes in dogs. The study was carried out on dogs presented at Teaching Veterinary Clinical Complex of the Faculty of Veterinary Sciences and Animal Husbandry, Sher-e-Kashmir University of Agricultural Sciences and Technology – Jammu presented with history of diarrhoea in 2014. Zinc supplementation was done in six dogs suffering from diarrhoea. Plasma zinc levels were found to be significantly lower in the diarrhoeic dogs ($8.09 \pm 0.87 \mu\text{mol/L}$) as compared to healthy control ($13.85 \pm 1.01 \mu\text{mol/L}$). Improvement in the plasma zinc levels of the diarrhoeic dogs was found after they were supplemented with zinc ($12.16 \pm 1.20 \mu\text{mol/L}$). Zinc supplementation in diarrhoeic cases was found to be effective in therapeutic management of diarrhoea.

Keywords: Diarrhoea, dogs, zinc supplementation

1. Introduction

Gastro-intestinal disorders are one of the common concerns in small animal veterinary practice and represent an average of 4% of all canine cases that are presented to the veterinary hospital on any given day^[1]. Diarrhoea can occur as a consequence of small or large intestinal disease but is not uncommon for both to be present. A number of causes of diarrhoea in dogs are recognized including infectious, nutrition and allergic conditions. Outbreaks of diarrhoea in dogs have implications in terms of welfare as well as economics^[2]. Therefore devising effective managemental and control strategies for combating diarrhoea is a primary requirement.

Zinc is an essential micronutrient for growth, development, and maintenance of the immune system^[3]. Zinc is also a pro-antioxidant and an anti-inflammatory agent^[4]. In the gastrointestinal system, zinc restores mucosal barrier integrity and enterocyte brush border enzyme activity, promotes the production of antibodies and circulating lymphocytes against intestinal pathogens, and exhibits a direct effect on the ion channels, acting as a potassium channel blocker of adenosine 3',5'-cyclic monophosphate-mediated chlorine secretion^[5]. The high concentrations of dietary Zn decreases intestinal permeability preventing translocation of pathogenic bacteria through the intestinal barrier^[6]. Also zinc reduces intestinal motility by activating β -adrenergic receptors and L-type Ca (2+) channels^[7]. In addition, studies on animal models have pointed out that chronic zinc deficiency alters the composition and function of gut microbiota^[8]. Thus, considering the multiple biological functions of zinc in the gastrointestinal tract, zinc administration in diarrheal episodes holds relevance.

The benefits of zinc supplementation during diarrheal episodes have been well assessed in children showing an association between therapeutic zinc supplementation and a reduction in the stool frequency, incidence and duration of diarrhea of diarrhea^[9, 10]. Also, zinc has been shown to reduce the incidence of subsequent diarrhoea^[11]. Since 2004, WHO and The United Nations Children's Fund have recommended giving oral zinc supplement for 2 weeks to children below 5 years with diarrhoea^[12]. Keeping this in view, the benefits of zinc administration in canine diarrhoea need to be investigated to strengthen the disease management strategy of diarrheal episodes in dogs. As such, the present study was designed to study the zinc profile of dogs suffering from diarrhea and to evaluate the potential of zinc supplementation in the management of canine diarrhoea.

2. Material and methods

The present study was conducted on dogs presented at Teaching Veterinary Clinical Complex of the Faculty of Veterinary Science and Animal Husbandry, Sher-e-Kashmir University of Agricultural Sciences and Technology – Jammu in 2014 presented with history of diarrhoea. Six cases exhibiting non-haemorrhagic diarrhoea were included in this study while six apparently healthy dogs with no clinical condition brought to the clinics for routine clinical examination irrespective of age, sex and breed were chosen randomly to act as control for the present study.

Blood samples were collected after proper restraining of the animals in sterile EDTA tubes through the cephalic or recurrent tarsal vein puncture and were centrifuged at 3000 r.p.m. for 10 minutes for separation of plasma. The plasma was immediately stored in acid washed vials. Three ml of each plasma sample was analysed for mineral analysis by digesting in 15ml distilled concentrated nitric acid (Merck.) followed by one cycle of hydrogen peroxide AR (2.0ml of 30

percent). Digestates (approximately 1 - 2ml) were diluted to 15 ml with double distilled water. The concentration of the microelement zinc was measured by Zeeman Atomic Absorption Spectrophotometer (Z - 300, Hitachi)^[13].

Zinc supplementation using zinc syrup (Syrup Zincoa, 1 t.s.f b.i.d for 15 days.) was given in the six diarrhoeal dogs and its effect on plasma zinc levels was studied thereof.

The data was statistically analysed using SPSS (Statistical Package for Social Sciences Software version 16.0-SPSS Inc.)

3. Results and Discussion

The comparative zinc profile of control, diarrhoeic and zinc supplemented dogs is presented in Table 1. The mean plasma zinc levels were significantly lower in the diarrhoeic dogs ($8.09 \pm 0.87 \mu\text{mol/L}$) as compared to the control group ($13.85 \pm 1.01 \mu\text{mol/L}$). The diarrhoeic dogs supplemented with zinc revealed an increase in plasma zinc levels after supplementation ($12.16 \pm 1.20 \mu\text{mol/L}$).

Table 1: Comparative zinc profile of control, diarrhoeic and zinc supplemented dogs

S. No.	Group (n=6)	Mean plasma zinc levels ($\mu\text{mol/L}$)
1	Control	13.85 ± 1.01^a
2	Dogs supplemented	0 day
		After 15 days

Values with same superscript indicate significance

In the present study, decreased level of plasma zinc was found in dogs suffering from diarrhea. Our findings are in agreement with previous studies^[14] who have reported decreased blood zinc levels in diarrhoeic dogs. Also, improvement in the serum zinc levels was observed post-treatment as compared to pre-treatment level. Literature scanned for zinc supplementation in dogs is scanty but in human medicine many studies have been reported especially in children. Zinc supplementation has been significantly seen to decrease the duration of diarrhoea in children^[15]. Zinc supplementation during diarrhoea has shown enhanced serum zinc concentrations when used as a treatment for diarrhoea in children helping in maintaining a more adequate zinc status during the convalescent period^[16]. Zinc is an important micronutrient and is crucial for many cell functions, such as protein synthesis and cell growth and differentiation^[17]. Zinc's mechanism of action for the treatment of diarrhea caused by different pathogens is not fully understood, but studies conducted in this field reveal that zinc plays different roles in the intestine, such as regulation of intestinal fluid transport and mucosal integrity and modulation of expression of genes encoding important zinc-dependent enzymes like cytokines, which play important roles in the immune system^[18]. Recent studies using rat model have attributed the contribution of zinc for reduction in the intestinal motility during diarrhea to the activation of β -adrenergic receptors and L-type Ca (2+) channels^[19].

4. Conclusion

Zinc supplementation was observed to be useful in therapeutic management of diarrhea as improvement in the plasma zinc levels of the diarrhoeic dogs ($8.09 \pm 0.87 \mu\text{mol/L}$) was found after they were supplemented with zinc ($12.16 \pm 1.20 \mu\text{mol/L}$). Based on the findings of the present study, the potential role of zinc administration in canine diarrhoeal episodes holds relevance. Further, it is suggested that larger trials be conducted in this regard and in reference to different types and severity of diarrhoea.

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