EFFECT OF DIETARY SUPPLEMENTATION OF ZINC ON GROWTH PERFORMANCE AND NUTRIENT UTILIZATION IN KIDS

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ABSTRACT

Present study was undertaken to evaluate the effect of zinc supplementation on growth performance and nutrient utilization in kids. Twenty four goat kids (4-6 month age) were randomly divided into 4 groups (T_1, T_2, T_3 and T_4) having 6 kids each. Kids in the group T_1 were fed basal diet which contained 29.02 mg Zn/kg DM from ingredients of ration without any additional Zn supplementation. Kids in the T_2, T_3 and T_4 groups were fed the same basal diet with additive 20, 50 and 100 ppm Zn (as ZnSO4) in their diets, respectively. The study was conducted for 90 days. Digestion trial of 7 days was conducted towards the end of experiment to assess the digestibility of the nutrients. Results indicated significantly higher average body weight gain, crude protein (CP) digestibility and better feed efficiency in kids fed diet supplemented with 50.0 mg Zn/kg DM. From the results it was concluded that the Zn supplementation @ 50.0 mg/kg DM in basal diet significantly improved body weight (BW) gain, CP digestibility and feed efficiency ratio (FER) of kids.

KEY WORDS: Digestibility, FER, Kids, Performance, Zinc

INTRODUCTION

Trace mineral research in small ruminants has received less attention in the past and the recommendation on trace mineral requirements are mainly based on earlier research (NRC, 1981). Since very little work has been done on trace minerals requirement of goats in Indian conditions and whatsoever literature available on the nutrient requirement of goats is now very old. Zinc (Zn) is known to affect growth, reproduction and immune system of the animals by affecting enzyme activity and gene expression (MacDonald, 2000). Forages are the main source of Zinc for the goats but its contents in forages is quite variable; and when the mineral supplementation is insufficient, animals may suffer from several deficiencies. Bioavailability of Zn in feed ingredients is influenced by interactions with other trace elements like Ca, Cd, Ni, and phytic acid which can induce its secondary deficiency (Haenlein and Anke, 2011). The optimal dietary level of Zn in goats has not been properly established and effect of dietary Zn concentration on nutrient metabolism is not well understood. Keeping in view this brief background present study was designed to investigate the potential effect of varying levels of zinc supplementation on growth performance and nutrient utilization in goats.

MATERIALS AND METHODS

The feeding experiment was conducted for 90 days on 24 goat kids who were allotted to 4 dietary treatment groups (T_1, T_2, T_3 and T_4) having six kids each, using completely randomized design. All the animals were dewormed and vaccinated before start of the experiment. Experimental kids were stall fed basal ration (total mixed ration, TMR) consisting of concentrate feed mixture and green berseem (50:50) to meet their nutrient requirements (NRC, 1981). Kids in the group T_1 were fed basal diet which contained 29.02 mg Zn /kg DM from ingredients of ration without any extra Zn

supplement in their minerals mixture. Groups T_2, T_3, and T_4 were fed same basal diet with addition of 20, 50 and 100 ppm Zn (as $ZnSO_4$) in their diets, respectively. Daily feed intake and the body weight of individual kids were recorded at fortnight interval and feed efficiency ratio (BW Gain/DM Intake) was calculated. Digestion trial of 7 days was conducted towards the end of experiment to assess the digestibility of the various nutrients (DM, CP, EE, CF and NFE). Feed and faecal samples were analyzed for proximate principle as per AOAC (2000). Data collected were statistically analyzed using completely randomized design as described by Snedecor and Cochran (2004).

Table- 1: Chemical composition (% DM basis) of feeds offered to experimental kids

Nutrients	Concentrate Mixture	Berseem	TMR
DM	87.90	15.95	51.93
CP	18.64	17.69	18.16
EE	4.63	3.52	4.08
CF	8.25	25.08	16.66
NFE	59.78	39.71	49.74
TA	8.70	14.0	11.35

RESULTS AND DISCUSSION

Observations regarding overall performance of kids in different treatment groups are presented in Table 2. Significantly highest ($P>0.05$) body weight gain was recorded in group supplemented with 50 mg Zn/kg DM (T_3). Body weight gain of kids from group supplemented with 20 mg Zn/kg DM was significantly ($P<0.05$) lower than T_3 but higher than control (T_1) group. Body weight gain was significantly reduced in T_4 group fed higher level of Zn i.e. 100 mg/kg DM when compared to T_3 group (50 mg Zn/kg DM). Kids fed control diet (T_1) containing 29.02 mg Zn/kg DM gained comparatively less body weight than the treatment groups, suggesting that this level of Zn was inadequate for normal growth of kids fed high grain diets. In accordance to our results, Spears and Kegley (2002) and Garg *et al*. (2008) reported an increased ADG in steers and lambs after Zn supplementation. Our findings also corroborates well with the results of Jia *et al*. (2008), who reported increased ADG in Liaoning Cashmere goats supplemented with 15-45 mg Zn/kg DM when compared to control group fed basal diet containing 22 mg Zn/kg DM. At the same time Wright and Spears (2004) reported similar growth performance in calves supplemented with 20 mg Zn either as Zn sulphate or Zn proteinate to a basal diet having 28 mg Zn/kg DM. Shinde *et al*. (2006) also did not observe any significant difference in the growth rate of guinea pigs supplemented with Zn either through organic or inorganic sources.

Table- 2: Overall performance of kids fed on varying levels of zinc (Zn)

Groups	BW Gain (g/d)	DMI (g/d)	FER
T_1	25.11^{c}	289.61	0.086^{c}
T_2	30.22^{b}	294.55	0.102^{b}
T_3	41.67^{a}	307.96	0.135^{a}
T_4	28.22^{b}	295.11	0.095^{b}

Values bearing similar superscripts in the same column does not differ significantly ($P<0.05$)

The voluntary DM intake (g/day) of kids did not vary significantly among the different dietary treatment groups, which is in agreement with Salama *et al*. (2003), who did not observed any significant effect on DMI of ewes supplemented with 25 ppm Zn in their diet. Garg *et al*. (2008), Kumar *et al*. (2010) and Mann and Sihag (2014) also did not observe any significant change in DM intake of Zn supplemented kids.

Feed efficiency ratio (BW Gain/DM Intake) was significantly affected in kids after Zn supplementation and was better (0.135±0.01) in kids fed diet containing 50.0 mg Zn/kg DM than control (0.086±0.01) and other groups. In agreement to our result, Mann and Sihag (2014) reported that supplementation of Zn @ 45 mg/kg DM to a concentrate mixture containing 20.70 mg Zn/kg DM improved feed conversion efficiency of goats. Similarly, Garg *et al*. (2008) also reported improved feed efficiency of Zn supplemented kids.

Table- 3: Digestibility coefficient of various nutrients in kids fed on varying levels of zinc

Nutrients	T_1	T_2	T_3	T_4
DM	63.20	63.70	64.10	62.90
CP	65.10^{b}	65.20 ^{b}	67.70^{a}	64.80 ^{c}
EE	69.20	70.50	71.00	70.30
CF	51.40	50.60	51.10	51.70
NFE	70.10	70.80	71.20	70.90

Values bearing similar superscripts in the same column does not differ significantly (P<0.05)

Observations regarding digestibility coefficient of various nutrients are presented in Table 3. Inclusion of the Zn @ 20, 50, and 100 mg /kg DM did not significantly (P<0.05) influenced the digestibility of various nutrients except CP which was significantly (P< 0.05) higher in T_3 group supplemented with 50 mg Zn/kg DM than all other dietary treatment groups. CP digestibility was significantly (P<0.05) reduced when dietary Zn supplementation was increased to 100 mg/kg DM (T_4). Many studies in different species of ruminants have suggested that Zn supplementation (ranging from 20 to 135 ppm) had no effect on the digestibility of DM (Jadhav, 2005; Mandal *et al*., 2007). Our results corroborated well with the findings of Mann and Sihag (2014) who reported better digestibility of CP in Zn supplemented groups.

In support to our results, Salama *et al*. (2003) also recorded increased digestibility of CP in dairy goats supplemented with Zn-methionine in their diet. Garg *et al.* (2008) stated that the supplementation of 20 ppm Zn either from ZnSO4 or Zn-meth, did not have any effect on the digestibility of DM, OM, CP, EE, NDF and hemicellulose and their values were comparable (P>0.05) with other groups. A probable reason for no significant change in the digestibility of nutrients after Zn supplementation could be that the Zn requirement of rumen microbes was met from the basal diet itself containing no additive Zn.

On the basis of above results it can be concluded that Zn supplementation @ 50.0 mg/kg DM in basal diet significantly improved growth performance, CP digestibility and feed conversion efficiency in kids.

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REFERENCES :

AOAC (2000). Official Methods of Analysis, 17th ed. Association of Official Analytical Chemists, Washington, DC.

Garg, A.K., Vishal, M. and Dass, R.S. (2008). Anim Feed Sci Technol, 144:82-96.

Haenlein, G.F.W and Anke, M. (2011). Small Ruminant Res, 95:2–19.

Jadhav, S.E. (2005). Effect of different levels and sources of zinc supplementation on growth, nutrient utilization, rumen fermentation, blood biochemical and immune response in male buffalo calves. PhD Thesis. Indian Veterinary Research Institute, Izatnagar, India.

Jia, W. B., Jia, Z. H., Zhang, W., Wang, R.L., Zhang, S.W., and Zhu, X.P. (2008). Small Ruminant Res, 80:68-72.

Kumar, M., Kaur, H., Phondba, B.T., Mani, V., and Neelam, K., (2010). Indian J Anim Nutr, 27(4):353-357.

Maan, N.S., and Sihag, S. (2014). Indian J Anim Nutr, 31(3):227-231.

Mac Donald, R.S. (2000). J Nutr, 130:1500-1508.

Mandal, G.P., Dass, R.S., Isore, D.P., Garg, A.K. and Ram, G.C. (2007). Anim Feed Sci Technol, 138:1–12.

NRC (1981). National Academy Press, Washington, DC, p. 7.

Salama Ahmed, A.K., Cajat, G., Albanell, E., Snch, X. and Casals, R.(2003). J Dairy Res, 70:9–17.

Shinde, P., Dass, R.S., Garg, A.K., Chaturvedi,V.K. and Kumar, R. (2006). Biol Trace Elem Res, 112:247–262.

Snedecor, G. W. and Cochran, W. G. (2004). Statistical Methods. 9th ed. The Iowa State University Press, Ames, Iowa, USA.

Spears, J.W.and Kegley, E.B. (2002). J Anim Sci, 80:2747–2752.

Wright, C.L. and Spears, J.W. (2004). J Dairy Sci, 87:1085–1091.

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