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EFFECT OF INORGANIC AND ORGANIC COPPER AND ZINC SUPPLEMENTATION ON HEMATOLOGICAL AND BLOOD BIOCHEMICAL PROFILE OF MALE KIDS

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ABSTRACT

A feeding trial with fifteen non-descript male kids (*Capra hircus*) 4-6 months of age was conducted at Animal Nutrition Shed, Indian Veterinary Research Institute, Izatnagar for a period of 120 days to determine the effects on supplementation of inorganic (sulphate) and organic (methionine) copper and zinc on haematological and blood biochemical parameters. All the kids were randomly subjected to three dietary treatments viz. T_1 (Basal diet), T_2 (Basal diet plus 7 ppm copper and 40 ppm zinc as sulphate) and T_3 (Basal diet plus 7 ppm copper and 40 ppm zinc as methionine). The basal diet consisted of wheat straw and concentrates mixture (60:40) to meet the nutrients requirement of kids. Blood samples were collected at 0, 60 and 120 days of the experiment. Supplementation of 7 ppm copper and 40 ppm zinc from both sources over the basal diet had no effect on hematological (haemoglobin, packed cell volume) and blood biochemical profile (Glucose, total protein, albumin, globulin, albumin: globulin ratio, blood urea nitrogen, creatinine and cholesterol) of kids as the values were within the normal range in the study.

Key words: Copper; Zinc; Methionine; Hemoglobin; Glucose; Total protein; Kids.

Copper (Cu) and zinc (Zn) are the most limiting trace minerals under farm conditions[5]. Metabolism of Cu and Zn plays a significant role in the regulation of physiological functions. Any excess or deficiency of these minerals may cause disease conditions in animals. Generally, Cu and Zn are supplemented in the diets of animals as inorganic salts. Organic minerals have higher retention and bioavailability in animals[16]. Organic minerals are biotechnologically produced by the integration of inorganic minerals with an organic compound such as amino acids, proteins or polysaccharides. It has been observed that the performance of calves given organic Zn was better than calves given inorganic sources of Zn[9]. Organic trace minerals were effective at a much lower concentration than the recommended levels without any adverse effects on broiler hematological and biochemical parameters[12]. Not much work has been reported in goats on the effect of simultaneous supplementation of organic Cu and Zn on their performance. Therefore, attempt was made to assess the effect of Cu-methionine plus Zn-methionine supplementation on hematological and blood biochemical profile in male kids.

MATERIALS AND METHODS

Fifteen healthy male kids (9.66±0.05 kg average body weight, 4-6 months old) were housed in well-ventilated shed with facilities for individual feeding and watering during the experimental period of 120 days at Animal Nutrition Shed, Indian

Veterinary Research Institute, Izatnagar. The kids were randomly divided into three groups of five kids in each on the basis of body weight in a complete randomized design. The basal diet fed to all the kids in three groups consisted of concentrate mixture (45% wheat bran, 27% ground maize grain, 25% soyabean meal, 2% mineral mixture, and 1% common salt) and wheat straw in the ratio of 60: 40. In addition to the basal diet, kids in group T_2 were supplemented with 7 ppm copper and 40 ppm zinc through copper sulphate and zinc sulphate, respectively; while an equal amount of copper and zinc was supplemented as copper methionine and zinc methionine in the diet of kids of group T_3. Amount of feed, copper and zinc required for each kid was calculated at fortnightly interval based on their body weights. Proximate composition and fiber fractions of basal diet offered to kids were analyzed[2 & 18].

About 5 ml of blood was drawn from each of the kids on 0, 60 and 120 days of experimental feeding by puncture of jugular vein in a sterile vial for estimation of hematological and blood biochemical parameters. Serum was separated by centrifugation as per standard procedure. Blood haemoglobin was estimated by treating blood with Drabkin's solution and packed cell volume (PCV) by using Wintrobe tubes method. The processed serum was used for estimation of glucose, serum total protein, albumin, globulin, albumin-globulin ratio, urea, creatinnine, cholesterol, calcium, inorganic phosphorous and Span Diagnostics Ltd. Kits were used for the same purpose as per manufacturer's protocol. Data generated in the experiment were statistically analyzed using analysis of variance technique[15] and means were compared using Duncan's multiple-range test[17].

RESULTS AND DISCUSSION

Chemical composition of the basal diet :

The basal diet offered to kids had 91.2% organic matter, 13.1% crude protein, 2.6% ether extract, 63.8% neutral detergent fiber, 31.6% acid detergent fiber, 27.0% cellulose, 32.2% hemicelluloses, 1.0% calcium, 0.6% phosphorus, 12.8 ppm copper and 26.0 ppm zinc, which were sufficient to meet the nutrient requirement of these animals.

Hematological and blood biochemical parameters:

Values of hematological and serum biochemical parameters of kids in different groups are presented in Table 1: Results revealed no significant (P>0.05) difference in the hemoglobin and PCV values in the three groups. In agreement with the present findings, no difference was detected in the hemoglobin and PCV values of the calves supplemented with 40, 70 and 100 ppm Zn in the basal diet (35 ppm Zn)[3]. Similarly, no significant (P>0.05) effect was observed in Holstein Friesian calves on hemoglobin and PCV due to 10 or 20 ppm Cu and zinc supplementation over control diet[7]. Similarly supplementation of different level and sources of Zn in crossbred calves also did not show any variation in PCV value[8].

There was no significant (P>0.05) differences in the serum glucose, total protein, albumin, globulin, albumin to globulin ratio, blood urea nitrogen, creatinine, and cholesterol due to treatments and time intervals. Similar to the present findings, earlier workers also did not observe any change in serum total protein concentration following Zn supplementation[8]. There was no effect on blood glucose level in calves due to Zn (17 vs 40 mg/ kg feed) supplementation[4]. No significant increase in serum glucose and total protein concentration was observed in West African Dwarft goats raised on copper supplemented diet[19]. Serum albumin and albumin to globulin ratio in growing kids given 10 ppm copper to a basal diet containing 5.7 ppm copper in a 90 days study did not show any significant variation[10]. No significant effect of 10 ppm copper supplementation in the basal diet on buffalo calves on serum protein, urea and creatinine was reported[10]. Supplementation of 10 or 20 ppm Cu in control diet of Holstein Friesian calves for a period of 73 days, did not showed any effect on blood urea level[7]. Similarly, no significant effect on serum cholesterol level was observed by supplementation

of inorganic and organic copper and zinc to Malpura sheep[13]. The blood glucose and globulin level showed no change in guinea pigs fed organic and inorganic Zn[14]. No significant difference was observed in serum globulin and plasma urea-N concentration in crossbred calves due to organic or inorganic zinc supplementation[8]. Similarly, no effect on the concentration of serum albumin, globulin and A:G ratio was observed in kids supplemented inorganic and organic zinc for 120 days[6]. Similar results were reported by other authors[12].

In the study Cu and Zn as such have no influence on serum Ca and serum inorganic phosphorus level. In agreement with our finding no effect on serum Ca and serum inorganic phosphorus level was observed in Holstein frisian calves due to Cu and Zn supplementation[7]. Contrary to this, significant increase of serum calcium and phosphorus was reported[1]. It might be due to higher level of zinc in the basal diet.

CONCLUSION

The result of the present study implies that supplementation of either inorganic or organic Cu (7 ppm) + Zn (40 ppm) in the basal diet of kids had no effect on blood hematological and biochemical parameters.

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Table-1. Effect of inorganic and organic copper and zinc supplementation on hematological and serum biochemical profile of kids

Attributes	Treatment	Period (days)			Mean
		0	60	120	
Hemoglobin (g/dl)	T_1	9.5 ± 0.27	9.8 ± 0.33	9.8 ± 0.26	9.7 ± 0.27
	T_2	9.5 ± 0.19	9.9 ± 0.09	10.6 ± 0.21	10.0 ± 0.20
	T_3	9.5 ± 0.11	10.2 ± 0.25	11.8 ± 0.26	10.5 ± 0.33
PCV (%)	T_1	33.4 ± 0.75	34.2 ± 1.06	34.4 ± 1.27	34.0 ± 1.02
	T_2	31.2 ± 1.04	34.4 ± 0.84	35.2 ± 0.72	33.6 ± 0.85
	T_3	32.2 ± 0.88	34.4 ± 0.79	35.6 ± 0.82	34.1 ± 0.90
Glucose (mg/dl)	T_1	42.0 ± 0.69	45.2 ± 0.65	44.5 ± 0.53	43.9 ± 0.66
	T_2	42.3 ± 1.13	45.2 ± 0.76	44.4 ± 0.86	44.0 ± 0.89
	T_3	42.0 ± 1.22	44.9 ± 1.08	45.1 ± 0.75	44.0 ± 1.04
Total Protein (g/dl)	T_1	6.1 ± 0.16	6.1 ± 0.18	6.1 ± 0.20	6.1 ± 0.16
	T_2	5.6 ± 0.09	6.1 ± 0.12	6.4 ± 0.21	6.1 ± 0.17
	T_3	5.6 ± 0.11	6.1 ± 0.12	6.6 ± 0.18	6.1 ± 0.14
Albumin(g/dl)	T_1	2.9 ± 0.06	2.8 ± 0.05	2.9 ± 0.04	2.9 ± 0.05
	T_2	3.0 ± 0.07	2.9 ± 0.04	3.0 ± 0.06	3.0 ± 0.06
	T_3	2.9 ± 0.04	3.0 ± 0.06	3.0 ± 0.13	3.0 ± 0.08
Globulin(g/dl)	T_1	3.4 ± 0.05	3.5 ± 0.04	3.5 ± 0.04	3.5 ± 0.04
	T_2	3.4 ± 0.04	3.4 ± 0.04	3.5 ± 0.03	3.4 ± 0.03
	T_3	3.4 ± 0.09	3.5 ± 0.10	3.6 ± 0.12	3.5 ± 0.10
Albumin: Globulin	T_1	0.86 ± 0.02	0.81 ± 0.01	0.83 ± 0.01	0.83 ± 0.01
	T_2	0.88 ± 0.02	0.86 ± 0.01	0.85 ± 0.02	0.86 ± 0.02
	T_3	0.86 ± 0.02	0.86 ± 0.02	0.86 ± 0.02	0.86 ± 0.02
Urea (mg/dl)	T_1	12.0 ± 0.27	11.8 ± 0.16	12.0 ± 0.12	12.0 ± 0.21
	T_2	11.5 ± 0.30	12.8 ± 0.18	11.9 ± 0.25	12.1 ± 0.24
	T_3	12.3 ± 0.31	13.0 ± 0.04	12.1 ± 0.22	12.6 ± 0.20
Creatinine (mg/dl)	T_1	1.6 ± 0.12	1.6 ± 0.14	1.6 ± 0.13	1.6 ± 0.12
	T_2	1.6 ± 0.11	1.3 ± 0.08	1.4 ± 0.08	1.4 ± 0.09
	T_3	1.5 ± 0.16	1.3 ± 0.12	1.5 ± 0.10	1.4 ± 0.12
Cholesterol (mg/dl)	T_1	71.4 ± 3.52	70.5 ± 2.15	72.1 ± 2.58	71.3 ± 2.60
	T_2	70.8 ± 2.85	69.4 ± 3.04	68.0 ± 3.14	69.4 ± 2.89
	T_3	68.9 ± 4.36	68.9 ± 4.01	68.0 ± 3.67	68.6 ± 3.74
Calcium (mg/dl)	T_1	9.2 ± 0.2	9.2 ± 0.2	9.4 ± 0.2	9.2 ± 0.2
	T_2	9.2 ± 0.2	9.2 ± 0.2	9.4 ± 0.2	9.2 ± 0.2
	T_3	9.1 ± 0.2	9.3 ± 0.2	9.6 ± 0.3	9.3 ± 0.2
Phosphorous (mg/dl)	T_1	5.4 ± 0.2	5.6 ± 0.2	5.8 ± 0.3	5.6 ± 0.2
	T_2	5.4 ± 0.2	5.7 ± 0.3	5.9 ± 0.4	5.7 ± 0.3
	T_3	5.5 ± 0.2	5.9 ± 0.5	6.4 ± 0.5	5.9 ± 0.4

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