

## Therapeutic Evaluation of Mineral Preparation for the Amelioration of Anaemia in Goats of Arid Zone of Rajasthan

Research Article

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### ABSTRACT

An experiment was conducted on eight weak and anaemic goats revealed pale conjunctivae, increased heart rate, rough hair coat, dullness and depression. The haematology showed significantly decreased haemoglobin ( $7.37 \pm 0.16$  g %), packed cell volume (PCV) ( $23.37 \pm 0.56\%$ ), total erythrocyte count (TEC) ( $8.12 \pm 0.18$  million/cumm), mean corpuscular haemoglobin (MCH) ( $9.10 \pm 0.30$  pg) and mean corpuscular volume (MCV) ( $28.82 \pm 0.80$  fl) in anaemic goats as compared to healthy goats. In anaemic goats, the serum level of total protein, albumin, albumin-globulin (A-G) ratio and blood glucose levels were significantly reduced. Biochemical analysis revealed decreased serum copper, cobalt and iron levels in anaemic goats. After haemato-biochemical analysis, anaemic goats were given a mineral preparation i.e., tablets COFECU plus at one tablet daily orally for 30 days. The anaemic goats gradually recovered by alleviating the anaemic syndrome in 30 days of treatment. The haemoglobin (Hb), packed cell volume (PCV), total erythrocyte count (TEC), mean corpuscular haemoglobin (MCH) and mean corpuscular volume (MCV) parameters showed improvement after treatment but are not comparable with the values recorded for healthy control goats indicating some more duration for better recovery. No significant variations in neutrophils, lymphocytes, monocytes, eosinophils and basophils values were observed in anaemic goats before and after treatment. The biochemical parameters revealed decrease in total serum protein, albumin, albumin-globulin (A-G) ratio and glucose values in goats suffering from anaemia, which recovered satisfactorily as a result of treatment regimens given for 30 days. A significant improvement in serum copper, cobalt and iron levels were observed after treatment of 30 days but could not reach to the level of control. It can be concluded that tablet COFECU plus is quite effective with slow recovery rate in treating the nutritional anaemia in goats and suggest an increase in treatment period.

**KEY WORDS** anaemia, arid zone, goats, nutritional, therapeutic.

### INTRODUCTION

Anaemia in goats may be caused by several factors such as bacterial, viral, haemoparasitic diseases viz., anaplasmosis, babesiosis and theilariasis, toxicity of chemicals, regional poisonous plants and venom, autoimmune hemolytic diseases, congenital defects, carcinoma, trauma and chronic

antigenic stimulation. Nutritional anaemia in goats occurs due to deficiency of iron, copper and cobalt (Chaudhary *et al.* 2008). Normally, these nutrients are in appropriate quantity in goat feed but sometimes under condition of starvation, famines etc., they may become deficient resulting in anaemia. The deficiency of micronutrients especially iron, copper and cobalt contribute to the condition by reduced

number of circulating erythrocytes and deficient haemoglobin synthesis (Fraser *et al.* 1991). The lower level of serum iron, copper and cobalt in goats might be due to poor contents of these minerals in grazing resources and non availability of green fodders in the tropics. Goat husbandry in the arid zone of Rajasthan is mostly dependent on grazing land especially in rural areas and under such feeding practices the mineral deficiency in animals is expected due to poor content of grazing resources. Further, most of the goats in urban areas are kept as stall fed animals which may also lead to nutritional problems and deficiency diseases. When versatility of safe micronutrient concentration range is exceeded either at upper level or at lower level the abnormality of function or deficiency syndrome develops. Once change occurs either in mineral input or its utilization, the whole mineral profile of animal gets distorted which can result in anaemia. Supplementation of nutritional factors, essential for erythrocyte production, plays a substantial role in the faster recovery of the anaemic patients. Therefore, the present study was undertaken to evaluate the efficacy of COFECU plus tablet (each tablet contain copper sulphate 200 mg, cobalt sulphate, 40 mg, ferrous sulphate 100 mg and manganese sulphate 400 mg), a mineral preparation for the treatment of anaemic syndrome in goats.

## MATERIALS AND METHODS

A total of 59 goats irrespective of age, sex and breed brought to the Medicine Clinic of Department of Clinical Veterinary Medicine, Ethics and Jurisprudence, College of Veterinary and Animal Science, Bikaner. Goats from Gadwala, Pemasar, Udasar, Udramsar, Shivbari and Sujandesar village of Bikaner as well as goats belonging to individual holdings of the owner in and around Bikaner district of Rajasthan were diagnosed for anaemia on the basis of clinical manifestations and laboratory examination. Routine faecal examination was carried out for each goat to rule out the possibility of parasitic load. Diagnosis of anaemia was arrived on the basis of the history, general examination, clinical manifestations and laboratory examination. The final diagnosis was established on the basis of haemato-biochemical parameters. The goats having haemoglobin values (g %) less than mean -2 standard deviation of healthy goat (8.07 g %) were considered as anaemic (Welchman *et al.* 1988). From selected anaemic goats, eight clinically weak and anaemic goats negative for parasitic load were taken for the therapeutic trial. A group of 8 healthy goats maintained on a well balanced diet at Livestock Research Station, Beechwal, Rajasthan University of Veterinary and Animal Sciences, Bikaner having haemoglobin levels more than 8 g % served as a control group. The clinical parameters viz., body temperature, pulse and respiration rate were noted in all animals before and after

treatment. Blood samples collected before and after completion of treatment were analyzed for haemoglobin (Hb), packed cell volume (PCV), total erythrocyte count (TEC), total leucocyte count (TLC), differential leucocyte count (DLC), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) as per the standard method described by Jain (1986). Biochemical analysis of serum samples was also carried out before and after treatment to estimate serum total protein, albumin, globulin, albumin-globulin (A-G) ratio and blood glucose by the methods of Tietz, (1990), using standard SPINREACT kit (SPINREACT, S.A.U. Ctra. Santa Coloma, 7 E-17176 SANT ESTEVE DE BAS (GI) SPAIN distributed by ARK Diagnostics Pvt. Ltd, Bangalore). Serum copper, cobalt and iron levels were estimated by atomic absorption spectrophotometer as per the method of Pinta (1979). The treatment of anaemic goats was done with a mineral preparation i.e., tablet COFECU plus containing copper sulphate 200 mg, cobalt sulphate, 40 mg, ferrous sulphate 100 mg and manganese sulphate 400 mg at one tablet daily orally for 30 days. After 30 days of treatment trial haemato-biochemical studies were conducted to note the efficacy of treatment. The obtained data were analyzed as per the methods of Snedecor and Cochran (1994).

## RESULTS AND DISCUSSION

The mean haemato-clinical observations before and after treatment are presented in Table 1. The mean rectal temperature, pulse and respiration rate in anaemic goats were  $104.02 \pm 0.24$  °F,  $89.00 \pm 0.84$  rate/min and  $27.37 \pm 0.94$  rate/min, respectively. The higher pulse rate might be due to compensation made by the animal in an attempt to supply oxygen (Katoch and Mandial, 2003). The animals exhibited pale conjunctivae, rough hair coat, dullness, depression, tachycardia and pulse with large amplitude. However, their appetite, defecation and urination were normal. The clinical sign of anaemia, as recorded in present study, corroborated with the findings of Sarkar and Mishra (1991), Smith and Sherman (1994), Rajkhowa and Hazarika (2002) and Bhikane *et al.* (2006) in goats.

The haematological analysis revealed significant lower values of haemoglobin ( $7.37 \pm 0.16$  g %), PCV ( $23.37 \pm 0.56\%$ ), TEC ( $8.12 \pm 0.18$  million/cumm), MCH ( $9.10 \pm 0.30$  pg) and MCV ( $28.82 \pm 0.80$  fl) in anaemic goats before treatment as compared to healthy goats. Extremely low levels of haemoglobin, PCV and TEC before treatment indicated severe anaemia (Benjamin, 1977). The reduction in mean MCV was due to microcytic RBC and the reduction in mean MCH could be due to direct reduction in the level of haemoglobin concentration and are collectively known as microcytic hypochromic anaemia.

**Table 1** Clinico-haematological observations before and after treatment in anaemic goats

Parameters	Healthy goats	Anaemic goats	
		Before treatment	After treatment
Temperature ( <sup>0</sup> F) <sup>ns</sup>	103.55±0.18	104.02±0.24	103.40±0.41
Pulse (rate/min)*	82.43±0.65 <sup>a</sup>	89.00±0.84 <sup>b</sup>	86.87±1.45 <sup>b</sup>
Respiration (rate/min)*	25.81±0.44 <sup>a</sup>	27.37±0.94 <sup>b</sup>	25.62±1.32 <sup>a</sup>
Haemoglobin (g %)**	10.33±0.25 <sup>b</sup>	7.37±0.16 <sup>a</sup>	9.55±0.29 <sup>b</sup>
Packed cell volume (%)**	32.50±0.75 <sup>b</sup>	23.37±0.56 <sup>a</sup>	30.12±1.04 <sup>b</sup>
TEC (million/cumm)**	10.03±0.21 <sup>b</sup>	8.12±0.18 <sup>a</sup>	9.53±0.23 <sup>b</sup>
TLC (thousand/cumm) <sup>ns</sup>	9.08±0.16	10.89±0.52	10.09±0.11
MCV (fl)**	32.62±1.05 <sup>b</sup>	28.82±0.80 <sup>a</sup>	31.55±0.54 <sup>b</sup>
MCH (pg)**	10.38±0.38 <sup>b</sup>	9.10±0.30 <sup>a</sup>	10.00±0.13 <sup>b</sup>
MCHC (g/dL) <sup>ns</sup>	31.82±0.43	31.62±0.73	31.74±0.37
Neutrophil (%) <sup>ns</sup>	38.31±1.28	41.50±1.96	41.12±0.76
Lymphocyte (%)*	53.87±1.06 <sup>b</sup>	49.37±1.83 <sup>a</sup>	50.75±0.55 <sup>a</sup>
Monocyte (%) <sup>ns</sup>	3.37±0.27	4.12±0.63	3.87±0.44
Eosinophil (%) <sup>ns</sup>	4.00±0.28	4.50±0.42	3.87±0.44
Basophil (%) <sup>ns</sup>	0.43±0.12	0.50±0.19	0.37±0.18

Note: mean superscripted with any one different letters within a row in a particular data differs significantly from each other. NS: non significant; \* Significant at P<0.05; \*\* Significant at P<0.01.

Schalm *et al.* (1975) reported that microcytic hypochromic anaemia in livestock may occur due to blood sucking parasites, gastro intestinal lesions or dietary deficiency of copper, cobalt and iron. Since all the studied goats in the present investigation, were free from blood sucking parasites and gastro intestinal worms, deficiency of copper, cobalt and iron in diet could be the cause of anaemia which was also evident from significantly (P<0.01) decreased serum copper, cobalt and iron levels in anaemic goats. Total leucocyte and differential leucocyte count were comparable in healthy and anaemic goats and agrees with the observations of Samanta *et al.* (1995) and Wadhwa *et al.* (2001). Non-significant changes in neutrophils, monocytes, eosinophils and basophils values indicated that the development of caprine anaemia might be due to nutritional deficiency either in feed, fodder or soil.

Lymphocytes were found to be significantly (P<0.01) lower in anaemic goats as compared to healthy control goats. Similar findings were also recorded by Sarkar and Mishra (1991) in nutritionally anaemic goats. In the present study the values of total serum protein, albumin, albumin-globulin (A-G) ratio and blood glucose in goats suffered from anaemia were significantly (P<0.01) lower as compared to healthy control goats (Table 2). However, a non-significant difference was observed in globulin values in both the groups. These findings corroborate with those of Sarkar *et al.* (1992), who attributed it to low intake of protein and micro-mineral deficiencies.

The anaemic goat group showed a significantly decreased (P<0.01) serum copper, cobalt and iron levels in comparison to healthy goats. Decreased level of iron, copper and cobalt noticed in the affected goats might be due to their deficiency in the feed and fodder (Katoch and Mandail, 2003).

A significant decrease in the iron levels in anaemic goats was also observed by Rajguru *et al.* (2002) who recorded lower values of serum iron (118.68±9.32 µg/dL) in anaemic goats as compared to healthy goats (189.83±9.32 µg/dL). A significant decrease in copper levels in the anaemic goats in the present study is in agreement with the results of Sarkar *et al.* (1990) reported serum copper level in the anaemic goat as 92.55±5.23 and 113.08±5.17 µg %, respectively, in comparison with healthy control (143.00±4.05 µg %). Sarkar *et al.* (1990) also reported lower serum cobalt level in anaemic goats as 5.99±1.54 and 10.31±2.22 µg % in comparison with healthy controls (32.58±2.10 µg %).

Treatment of anaemic goats was undertaken with COFECU plus at one tablet daily for 30 days. The anaemic goats gradually recovered by alleviating the anaemic syndrome with marked improvement in haemato-biochemical parameters. The anaemic goats showed significant improvement in Hb, PCV, TEC, MCH and MCV values after treatment. The significant (P<0.01) improvement in haematological parameters reflects the quantitative regeneration of the erythropoiesis which in turn could be due to copper, cobalt and iron supplementations from the therapy. This is in close agreement with Sarkar *et al.* (1995) reported an increase in Hb, PCV and TEC values after haematinics therapy used in goats suffering from nutritional anaemia.

There were no significant variations in the neutrophils, lymphocytes, monocytes, eosinophils and basophils at pre-treatment and post-treatment stages (P<0.05). The total serum protein and blood glucose levels of anaemic goats increased significantly (P<0.01) after treatment. Serum albumin, globulin and A-G ratio in anaemic goats showed no significant changes after 30 days of treatment (P<0.05). Decreased food intake as a result of illness, malnutrition could have contributed to hypoglycemia.

**Table 2** Biochemical observations before and after treatment in anaemic goats

Parameters	Healthy goats	Anaemic goats	
		Before treatment	After treatment
Total serum protein (g/dL)**	7.22±0.05 <sup>b</sup>	5.42±0.19 <sup>a</sup>	6.34±0.14 <sup>b</sup>
Albumin (g/dL)**	4.11±0.11 <sup>b</sup>	2.28±0.02 <sup>a</sup>	2.98±0.08 <sup>b</sup>
Globulin (g/dL) <sup>ns</sup>	3.10±0.13	3.14±0.19	3.35±0.20
A-G ratio**	1.38±0.09 <sup>c</sup>	0.74±0.04 <sup>a</sup>	0.92±0.08 <sup>b</sup>
Blood glucose (mg/dL)**	63.96±1.20 <sup>c</sup>	47.56±1.99 <sup>a</sup>	54.86±1.85 <sup>b</sup>
Serum copper (µg/dL)**	94.05±2.95 <sup>c</sup>	61.06±3.27 <sup>a</sup>	76.59±2.36 <sup>b</sup>
Serum cobalt (µg/dL)**	27.58±0.57 <sup>b</sup>	14.51±0.51 <sup>a</sup>	25.83±0.81 <sup>b</sup>
Serum iron (µg/dL)**	168.70±3.95 <sup>c</sup>	113.31±5.55 <sup>a</sup>	132.35±4.89 <sup>b</sup>

Note: mean superscripted with any one different letters within a row in a particular data differs significantly from each other. NS: non significant; \*\* Significant at P<0.01; A-G: albumin-globulin.

The control of causative agent by specific mineral therapy i.e., tablets COFECU plus should have affected the restoration of serum total protein and blood glucose levels. Though, the increase in total serum protein, serum albumin, globulin and A-G ratio and blood glucose was observed due to effect of treatment but could not reach the level of control healthy goats in 30 days.

Therefore, it is suggested that an increase in treatment period could restore these values to normal levels. The serum iron, cobalt and copper concentrations in anaemic goats increased after treatment with oral haematinics. Treatment led to improvement in the biochemical parameters but the values of copper and iron did not attain the normal status of healthy control animals.

These findings suggested that the treatment duration should be further increased until serum cobalt, copper and iron levels reach normal levels. The present observation is in agreement with the findings of Sarkar *et al.* (1996) who tried COFECU plus against the anaemic cattle and found the treatment was very effective in alleviating the syndromes of anaemia as the levels of Hb, PCV and TEC values were increased significantly to almost the same levels of the healthy control animals.

Tufani and Haque (2007) also reported that Fe, Cu, Mn and Zn levels increased significantly and reached almost normal levels at the 5<sup>th</sup> week of treatment with COFECU plus at one tablet daily in micro-nutrient deficient and anaemic crossbred calves.

The findings of Dhaliwal (1996) and Kumar (2007) also supported the results of present investigation observed improvement in biochemical parameters after treatment with COFECU plus tablet in anaemic cattle and camel, respectively.

It is inferred that nutritional deficiency anaemia in goats of the arid zone of Rajasthan might be due to exclusive grazing practices without supplementation of either mineral mixture or good quality concentrates and the oral mineral preparation, i.e., COFECU plus would be effective with a slow recovery rate in treating the nutritional anaemia in goats.

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