



CLINICO-HAEMATOLOGICAL, BIOCHEMICAL AND THERAPEUTIC STUDIES ON NUTRITIONAL ANAEMIA IN GOATS

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ABSTRACT

A significant decrease in haemoglobin, packed cell volume, total erythrocyte count, mean corpuscular volume, mean corpuscular haemoglobin and biochemical indices [total serum protein, albumin, globulin, albumin-globulin (A:G) ratio and blood glucose] and serum trace minerals (copper, cobalt and iron) were observed in eight goats showing the symptoms of anaemia and emaciation. Blood examination of anaemic goats revealed microcytic hypochromic anaemia. The anaemic goats were treated with an iron preparation injection Feritas (Intas Pharmaceuticals Ltd., India) @ 1 ml per animal intra-muscularly. Second and third injection was repeated 3 days each after first dosing. Along with parenteral therapy the anaemic goats were also given Ayumin V₅ mineral mixture (Dabur Ayurved Pvt. Ltd., India) @ 10 g daily to each goat for 30 days to supplement the micronutrients. The therapeutic response to iron preparation with oral haematinics resulted in significant improvement in haemogram of goats suffering from anaemia. Total serum protein and blood glucose also increased significantly after treatment. Significant improvement in serum copper, cobalt and iron level was observed after treatment. It can be concluded that the use of oral and parenteral haematinics is very effective in treating the nutritional anaemia in goats.

Keywords: Anaemia, blood profile, goats, therapeutic response

INTRODUCTION

Anaemia is the condition characterized by insufficient circulating haemoglobin and may be caused by several factors such as blood protozoan infection, ecto-endo-parasites, bacillary toxins, toxic feeds, and plants and chronic antigenic stimulation (Radostits *et al.*, 2000). Apart from these, nutritional deficiencies are also major factor responsible for causing anaemia in goats (Sarkar *et al.*, 1990). Goats reared only on grazing are prone to develop nutritional anaemia due to inadequacy of micro-minerals in tropical forages. Supplementation of micronutrients, required for erythrocyte formation along with parenteral therapy, plays an important role in faster recovery of anaemic state. Therefore, a study was conducted in clinical cases of caprine nutritional anaemia for therapeutic management with haematinics used by oral and parenteral route.

MATERIAL AND METHODS

A total of 59 goats, irrespective of age, sex and breed, were diagnosed for anaemia on the basis of clinical manifestations and laboratory examination. Routine faecal examination was carried for each

goat to rule out the possibility of endo-parasitic infestation. Diagnosis of anaemia was arrived on the basis of 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 dl^{-1}) below the mean of healthy goat (8.07 g dl^{-1}) were considered as anaemic (Welchman *et al.*, 1988). From selected anaemic goats, eight weak anaemic goats, negative for endo-parasitic infestation and having very low level of iron, were taken for the therapeutic trial. For comparison of haematological and biochemical status of anaemic goats with healthy goats, 8 apparently healthy goats maintained on a well balanced diet at Livestock Research Station, Beechwal, Rajasthan University of Veterinary and Animal Sciences, Bikaner were taken as control group.

The clinical parameters viz., body temperature, pulse and respiration rate were recorded in all the animals pre- and post-treatment. Blood samples collected pre- and post-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 method of Jain (1986). Biochemical analysis of serum samples was carried out pre- and post-treatment to estimate serum total protein, albumin, globulin, albumin-globulin (A:G) ratio and blood glucose by the methods of Tietz (1990), using standard kit. Serum copper, cobalt and iron levels were estimated by atomic absorption spectrophotometer as per the method of Pinta (1979).

The anaemic goats were treated with an injectable iron preparation Feritas (Intas Pharmaceuticals Ltd., India). Each ml Feritas contained iron sorbitol-citric acid complex 50 mg, folic acid 500 mcg, hydroxocobalamin acetate BP equivalent to hydroxocobalamin 50 mcg and water for injection q.s. @ 1 ml per animal intra-muscularly. Second and third injection was repeated 3 days each after first dosing. Along with parenteral therapy, the anaemic goats were also given Ayumin V₅ mineral mixture (Dabur Ayurvet Pvt. Ltd., India) @ 10 g daily to each goat for 30 days to supplement micronutrients. One kg of Ayumin V₅ mineral mixture contained vitamin A 700000 IU, vitamin D₃ 140000 IU, vitamin B₁₂ 3.0 mg, vitamin E 300 IU, nicotinamide 1000 mg, Saccharomyces 10^{10} cfu, L-lysine mono-hydrochloride 4.4 g, DL-methionine 1.92 g, calcium 250 g, phosphorus 125 g, magnesium 6.0 g, manganese 1.8 g, iron 1.5 g, iodine 325 mg, copper 1.2 g, zinc 9.6 g, cobalt 150 mg and selenium 10 mg. After 30 days of treatment trial, haemato-biochemical studies were conducted to assess the efficacy of treatment. The data were analyzed as per the methods of Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

All the goats suffering from anaemia were dull and depressed. The body coat was rough and conjunctival mucous membrane slightly pale. The other clinical signs included partial to complete anorexia, loss of body condition, weakness, tremor, tachycardia and dyspnoea. However, there was no abnormality in faeces or urine. Similar findings have been reported in anaemic goats such as anorexia, depression, pale mucous membrane of conjunctiva, dyspnoea, rise in temperature, debility, rough hair coat, emaciation, dehydration, tachycardia, etc. (Rajkhowa and Hazarika, 2002; Bhikane *et al.*, 2006). Pallor mucous membrane, anorexia and loss of weight have been reported in goats due to iron deficiency (Tufani and Haque, 2007).

The mean temperature in healthy and anaemic goats (pre-treatment) was 39.6 ± 0.2 and $39.9 \pm 0.3^{\circ}\text{C}$, respectively (Table 1). The temperature recorded in all the goats of different groups were within the normal range of 38.6 – 40.2°C (Kelly, 1986). The average pulse rates in healthy and anaemic goats were 83.12 ± 0.78 and $90.12 \pm 1.12 \text{ minute}^{-1}$, respectively. Significant increase in pulse rate was observed in all the anaemic groups which may be due to the effects of compensatory mechanism to decrease the circulation time of erythrocytes. The finding corroborates with those of Joshi *et al.* (1982) and Sarkar and Mishra (1991). The average value of respiration was $26.50 \pm 0.68 \text{ minute}^{-1}$ in healthy control goats and $30.50 \pm 0.75 \text{ minute}^{-1}$ in anaemic goats. Significant increase in respiratory rate was a

constant feature observed in almost all anaemic groups of goats. This probably reduced the oxygen carrying capacity of red blood cells and may be attributed to the consequence of certain physiological adjustment designed to enhance the deficiency of reduced circulating red cell mass (Jain, 1986).

The erythron values in healthy goats were haemoglobin (10.28 ± 0.39 g%), PCV ($32.37 \pm 1.29\%$), TEC ($9.97 \pm 0.31 \times 10^6 \text{ mm}^{-3}$), MCH (10.40 ± 0.55 pg) and MCV (32.63 ± 1.54 fl) [Table 1]. These values are in agreement with Jain (1986). In comparison the above erythron values in anaemic goats were low.

Table 1: Clinico-haematological observations pre and post treatment in anaemic goats

Parameters	Healthy goats	Anaemic goats	
		Before treatment	After treatment
Temperature ($^{\circ}\text{C}$) ^{NS}	39.60 ± 0.21	39.90 ± 0.29	40.00 ± 0.34
Pulse (rate minute ⁻¹)*	83.12 ± 0.78^a	90.12 ± 1.12^b	86.62 ± 1.37^a
Respiration (rate minute ⁻¹)*	26.50 ± 0.68^a	30.50 ± 0.75^b	28.12 ± 0.98^a
Haemoglobin (g%)*	10.28 ± 0.39^b	7.68 ± 0.07^a	9.20 ± 0.25^b
Packed cell volume (%)**	32.37 ± 1.29^b	23.87 ± 0.47^a	29.62 ± 0.82^b
TEC ($\times 10^6 \text{ mm}^{-3}$)*	9.97 ± 0.31^b	8.58 ± 0.13^a	9.68 ± 0.13^b
TLC ($\times 10^3 \text{ mm}^{-3}$) ^{NS}	9.10 ± 0.26	11.12 ± 0.54	10.48 ± 0.23
MCV (fl)**	32.63 ± 1.54^b	27.92 ± 0.96^a	30.61 ± 0.81^b
MCH (pg)**	10.40 ± 0.55^b	8.97 ± 0.16^a	9.50 ± 0.23^b
MCHC (g dl ⁻¹) ^{NS}	31.85 ± 0.66	32.27 ± 0.60	31.06 ± 0.29
Neutrophil (%) ^{NS}	37.75 ± 1.97	39.75 ± 1.88	40.25 ± 1.41
Lymphocyte (%)*	54.37 ± 1.82^b	52.75 ± 1.61^a	52.00 ± 0.96^a
Monocyte (%) ^{NS}	3.50 ± 0.42	3.25 ± 0.59	3.37 ± 0.53
Eosinophil (%) ^{NS}	4.00 ± 0.37	3.87 ± 0.22	4.12 ± 0.54
Basophil (%) ^{NS}	0.37 ± 0.18	0.37 ± 0.18	0.25 ± 0.16

NS- Non significant; *Significant at ($P < 0.05$); **Significant at ($P < 0.01$)

Mean superscripted with different letters within a row differ significantly from each other.

All the haematological parameters, except total leucocyte count, showed significant decrease in anaemic goats as compared to healthy ones. However, TLC was non-significantly higher in anaemic goats as compared to healthy goats. No significant changes were observed in differential leucocyte count, except lymphocyte which was significantly lower in anaemic goats as compared to healthy ones. Lower haemoglobin level of 7.68 ± 0.07 g% has been reported in anaemic goats by Sarkar *et al.* (1990). Decreased levels of PCV and TEC noticed during the present study simulate the findings of Rajguru *et al.* (2002) and Bhikane *et al.* (2006). Lower values of MCV and MCH indicating microcytic hypochromic anaemia might be due to iron or copper deficiency noticed in affected animals. In livestock such types of anaemia may occur due to blood sucking parasites or dietary deficiency of copper, cobalt and iron (Underwood and Shuttle, 1999; Radostits *et al.*, 2000). Since in the present study the goats having parasitic load were excluded, so anaemia may be of nutritional origin. DLC did not alter in anaemic goats are in agreement with Unny *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 or fodder.

The biochemical indices such as total serum protein, albumin, albumin-globulin (A:G) ratio and blood glucose were significantly low in anaemic goats but globulin values were within normal range (Table 2). Lower values of total serum protein, albumin, albumin-globulin (A:G) ratio and blood glucose are in tune with the findings of Sarkar *et al.* (1992). Globulin status of anaemic animals did not show much alteration (Siddiqua *et al.*, 1989; Sarkar *et al.*, 1995). Serum copper, cobalt and iron level were significantly low in anaemic goats in comparison to healthy ones. The observations corroborate with Sarkar *et al.* (1990), Rajguru *et al.* (2002) and Bhikane *et al.* (2006) who reported significant decrease in serum iron, copper and cobalt level in anaemic goats. Bhikane *et al.* (2006) reported significant decrease in serum iron level in anaemic goats ($118.60 \pm 3.35 \mu\text{g dl}^{-1}$) as compared to healthy

goats ($145 \pm 1.56 \mu\text{g dl}^{-1}$). Sarkar *et al.* (1995) reported lower serum iron in anaemic goats reared exclusively on grazing/ browsing in West Bengal as $153.77 \pm 2.33 \mu\text{g}\%$ as compared to $192.96 \pm 3.46 \mu\text{g}\%$ in healthy control goats. The present study revealed that the levels of serum iron, copper and cobalt in anaemic goats were deficient which suggested that anaemia possibly developed due to low or marginal trace minerals profiles as suggested by Radostits *et al.* (2000).

Table 2: Biochemical observations pre- and post-treatment in anaemic goats

Parameters	Healthy goats	Anaemic goats	
		Before treatment	After treatment
Total serum protein (g dl^{-1})**	7.15 ± 0.07^b	5.58 ± 0.18^a	6.47 ± 0.21^b
Albumin (g dl^{-1})**	4.09 ± 0.12^b	2.37 ± 0.07^a	3.01 ± 0.09^{ab}
Globulin (g dl^{-1}) ^{NS}	3.05 ± 0.15	3.21 ± 0.17	3.46 ± 0.21
A:G ratio**	1.37 ± 0.11^b	0.75 ± 0.03^a	0.90 ± 0.07^b
Blood glucose (mg dl^{-1})**	62.97 ± 2.11^c	50.57 ± 1.93^a	55.93 ± 1.62^b
Serum copper ($\mu\text{g dl}^{-1}$)**	93.27 ± 3.89^b	69.43 ± 2.49^a	88.95 ± 2.40^b
Serum cobalt ($\mu\text{g dl}^{-1}$)**	27.15 ± 0.79^c	16.65 ± 1.06^a	23.46 ± 0.60^b
Serum iron ($\mu\text{g dl}^{-1}$)**	168.06 ± 5.77^c	85.85 ± 6.00^a	125.47 ± 6.11^b

Mean superscripted with different letters within a row differ significantly from each other.

NS- Non significant; **Significant at ($P < 0.01$)

Following treatment, most of the haematological and biochemical parameters showed recovery towards normal. The animals showed slow recovery with body pulse and respiration progressing towards normal in 30 days of treatment. The colour of conjunctival mucous membrane started changing towards normal. The haematological parameters such as Hb, PCV, TEC, MCH and MCV values increased significantly after treatment and were nearer to that of healthy ones. The significant improvement in haematological parameters reflects the quantitative regeneration of erythropoiesis, which, in turn, could be due to iron supplementation. There were no significant variations in neutrophils, lymphocytes, monocytes, eosinophils and basophils at pre- and post-treatment stages. The total serum protein and blood glucose level in anaemic goats increased significantly whereas, serum albumin, globulin and A:G ratio increased non-significantly after 30 days of treatment.

Comparative studies of biochemical parameters of pre- and post-treatment groups revealed significant differences in serum copper, cobalt and iron values. Serum iron, copper and cobalt exhibited significant increase. The increase in iron, copper and cobalt was probably the outcome of supplementation of these elements through Ayumin V₅ mineral mixture. The marked increase in iron observed in present study is supported by Kumar *et al.* (2003) who reported improvement in iron concentration from 1.59 ± 0.13 to $2.39 \pm 0.33 \mu\text{g ml}^{-1}$ in kids after supplementing mineral mixture. Dey *et al.* (2004) also observed improvement in plasma iron in anaemic goats after treatment. Many workers have documented parenteral administration of iron in iron deficient animals (Deshmukh *et al.*, 2007; Choudhary *et al.*, 2008). These workers opined that the use of parenteral iron therapy in iron deficiency anaemia was effective in alleviating the syndrome.

The study revealed that treatment of anemic goats with oral and parenteral haematinics could lead to the improvement in biochemical parameters; however copper, cobalt and iron do not attain the normal status of healthy control animals. The treatment is effective but requires continuity of treatment for beyond one month. It is, therefore, concluded that in tropical countries where goat rearing mainly depends on grazing and browsing, supplementation of mineral mixture is essentially required in micro-mineral deficient areas to overcome the problems of nutritional anemia.

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