

Anaplasmosis concurrent with copper deficiency in a Salem Black kid

Sathishkumar. G., Vijayakumar. H*, Gowri. B., Senthil. N. Ra., Raja. Pb and Giridharan. S.

Department of Veterinary Clinical Medicine, Madras Veterinary College,
Tamil Nadu Veterinary and Animal Sciences University, Chennai – 600 007.

Abstract

Four months old Salem black kid was brought to the with the history of alopecia around the face and ear. Clinical examination revealed severe alopecia on ears, face, trunk and easy epilation of hairs along with depigmentation, mild scaling in ear margins, steely appearance, pale mucosa and loss of body condition. Detailed dermatological analysis like skin scrapings and trichogram revealed negative for ectoparasites and hair growth abnormalities. Blood smear examination revealed *Anaplasma ovis* organisms, with blood picture of normochromic microcytic anemia. Amplified Polymerase chain reaction product found to be positive for *Anaplasma ovis*. Serum biochemistry revealed low level of copper (0.0598 mg/L), elevated total bilirubin (3.6 mg/dl), direct bilirubin (2.83 mg/dl), creatinine kinase (73 mg/dl) and LDH (348 U/L). Based on above findings and treatment response, the case was diagnosed as anaplasmosis in a kid with concurrent copper deficiency.

Keywords: Alopecia, Anaplasmosis, Copper deficiency and Salem black kid

Anaplasmosis is a tick-borne disease caused by *Anaplasma ovis*, *A. marginale*, and *A. capra*. In goats, it is frequently a subclinical illness (Smith *et al.*, 2022) and causes mild clinical symptoms but sometimes its adverse effect is aggravated in infected sheep and goats, when the animals are stressed by other factors such as co-infection, poor health conditions, hot weather, vaccination, deworming or heavy tick infestation (Aravind *et al.*, 2020). Chronically infected animals may look clinically normal; have recurrence of infection following stress, or exhibit clinical symptoms of ill-thrift such as poor body condition and poor fleece quality (Pugh and Baird 2011). Copper deficiency in ruminants is a worldwide problem that can occur as a primary deficiency when Cu intake is insufficient, or as a secondary deficiency when other factors in the diet, such as molybdenum (MO) and sulphur (S), interfere with Cu absorption or metabolism (Constable *et al.*, 2016). Ceruloplasmin a copper containing protein is necessary to mobilize stored iron for the production of haemoglobin and myoglobin, which causes anaemia. Hair discoloration, occurs because the melanin formation requires a copper-containing enzyme. Furthermore, copper is essential for the immune system to operate properly (Smith *et al.*, 2022).

Four months old Salem black kid was brought to the Large Animal Medicine unit of Madras Veterinary College Teaching Hospital with the history of hair fall around the face and ear. Clinical examination revealed severe alopecia on ears, face, trunks and effortless epilation of hairs along with depigmentation, mild scaling in ear margins, steely appearance, pale mucosa and loss of body condition (Figure- A). Clinical examination revealed normal rectal temperature (101.4°F), pale conjunctival mucous membrane and elevated heart rate (100 bpm). The lymph node and respiratory rate were normal. Rumen fluid examination revealed normal protozoa numbers (+++) and motility (++)

Blood smear examination revealed positive for *Anaplasma ovis* (Figure-B), confirmed by PCR (Figure C). Reduced haemoglobin, normochromic and microcytic anaemia were noticed along with elevated serum total bilirubin, direct bilirubin, creatine kinase (CK) and lactate dehydrogenase (LDH) (Table-1). Skin scrapings and trichogram revealed negative for ectoparasites and hair growth abnormalities. The faecal sample examination revealed negative for endoparasites infection.

*Corresponding author : vijayvet1985@gmail.com



Figure A - Severe alopecia on both ears, face, trunks along with hair depigmentation, mild scaling in ear margins, steely appearance and emaciation

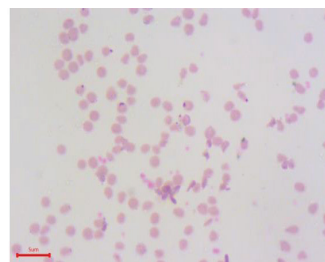


Figure B. *Anaplasma ovis*

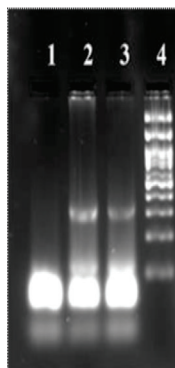


Figure. C PCR for *Anaplasma ovis*

Lane 1: Negative control

Lane 2 : Positive control

Lane 3 : Test sample positive for *Anaplasma ovis* (347 bp)

Lane 4 : 100 bp ladder

Table 1-Haemato-biochemical values

Parameters	Before treatment (Day-1)	After treatment (Day-5)	Reference value*
Hb (g/dl)	7.4	8.6	8.0-12.0
PCV (%)	23	24.7	22-38
RBC (m/cmm)	14.97	16.08	8.0-18.0
WBC (/cmm)	10,000	12,700	4.0-13.0
Platelets (/cmm)	2,00,000	3,00,000	3.0-6.0
Neutrophils (%)	49	43	30-48
Lymphocytes (%)	47	53	50-70
Monocytes (%)	4	4	1-4
Blood parasite	<i>Anaplasma ovis</i>	Negative	-
Blood picture	Anisocytosis & Polychromasia	NAD	-
Glucose (mg/dl)	78	86	50-75
Total proteins (g/dl)	7	8	6.1-7.5
Albumin (mg/dl)	2.5	3.7	2.3-3.6
BUN (mg/dl)	11.4	19.89	13-26
Creatinine (mg/dl)	0.45	0.75	0.7-1.5
Calcium (mg/dl)	9.68	12.13	9.0 -11.6
Phosphorus (mg/dl)	6.09	6.83	3.7-9.7
ALP (IU/L)	78	111	61-283
T. Bilirubin (mg/dl)	3.6	0.45	0.1-0.2
D. Bilirubin (mg/dl)	2.83	0.39	0.1-0.2
CK (IU/L)	73	60	16-48
LDH (IU/L)	348	250	79-265

*The Merck Veterinary Manual (2015).

Blood sample was collected and serum was separated and subjected to copper concentration estimation by Atomic Absorption Spectrophotometer. The result revealed low level of copper in blood (Table-2).

Table 2 : Copper Concentration Estimation

Parameter	Before treatment (Week – 1)	After treatment		Reference value
		(Week – 4th)	(Week –6th)	
Serum Copper (mg/ L) Or (ppm)	0.0598 mg/L Or 0.05 ppm	0.3540 mg/L Or 0.35 ppm	0.6272 mg/L Or 0.62 ppm	0.6-1.5 mg/dl (Fontes <i>et al.</i> , 2020) Or >0.80 ppm

The animal was treated with injection Oxytetracycline @ 10 mg/kg diluted with normal saline IV. Injection Vitamin B1, B6, B12 with total dose of 0.5ml IV, and the treatment was followed for 5 days. Following treatment, haematology and serum biochemistry were found to be normal (Table-1) and negative for *Anaplasma spp.* Oral supplementation of copper sulphate was given (@ 2g/kid) for weekly once for six weeks. Changes in hair colour and texture at the 6th week of the treatment (Figure – E) were noticed. Hair depigmentation associated with copper deficiency in cattle may be attributed to reduction in the activity of tyrosinase which is cu-dependent enzyme required for melanin synthesis (Fry, 2011). Deficiency symptoms

occur when dietary copper is less than 7 mg/kg and molybdenum is normal (Smith *et al.*, 2022). A suitable level for ration formulation is 10–20 mg/kg DM (AFRC 1998), and it is generally recommended to keep the Cu: Mo ratio above 2:1 and below 10:1 (Buck 1986) as adult goats are not as susceptible to copper toxicity as in sheep (Søli and Nafstad, 1978), in part because of lower uptake by the liver (Meschy, 2000). Liver copper stores are typically lower in normal goats than in sheep and cattle. Excess copper supplementation to deficient kids may cause death due to haemolytic crisis because of the fact that the pre-ruminant kid absorbs copper more efficiently than does the adult goat (Humphries *et al.*, 1987).



Figure D– Reduction in clinical sign and regrowth of hairs after 4 weeks of treatment



Figure E – Complete recovery noticed after 6 weeks of treatment

References

- AFRC (1998). The Nutrition of Goats. Agricultural and Food Research Council Technical Committee on Responses to Nutrients Report No. 10. New York: CAB International.
- Aravind, M., Gowrishankar, S., Soundararajan, C., Latha, B.R. (2020). Molecular Detection of *Anaplasma ovis* in Apparently Healthy Sheep and Goats in Tamil Nadu. *Int. J. Curr. Microbiol. App. Sci.*, **9(5)**:3589-3593. <https://doi.org/10.20546/ijcmas.2020.905.426>
- Constable, P. D., Hinchcliff, K.W., Done, S.H., Grünberg, W. (2016). Veterinary medicine: a textbook of the diseases of cattle, horses, sheep, pigs and goats. Elsevier Health Sciences.
- Fry, R.S. (2011). Dietary and Genetic Effects on Cellular Copper Homeostasis in Bovine and Porcine Tissues. Ph.D. Thesis, Faculty of North Carolina, State University.
- Humphries, W.R., Morrice, P.C., Mitchell, A.N. (1987). Copper poisoning in Angora goats. *Vet. Rec.*, **121**: 231.
- Smith, S., David, M., Van Metre, D. C. (2022). Goat medicine. Wiley-Blackwell.
- Meschy, F. (2000). Recent progress in the assessment of mineral requirements of goats. *Livestock Prod. Sci.* **64**: 9–14.
- Pugh, D. G., Baird, N. N. (2011). Sheep & Goat medicine-E-book. Elsevier Health Sciences.
- Søli, N.E., Nafstad, I. (1978). Effects of daily oraladministration of copper to goats. *Acta Vet. Scand.*, **19**: 561–568.