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Haemato-biochemical alterations in caprine theileriosis

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Abstract

Theileriosis is an important haemoparasitic disease of goats which causes serious economic losses to farmers. There is a paucity of information on the clinico-haemato-biochemical aspects of caprine theileriosis in Kerala. The present study was undertaken to evaluate the haemato-biochemical alterations associated with clinical cases of caprine theileriosis in twenty five smear positive goats in Thrissur district, Kerala. Major clinical signs observed were anaemia, fever, lymphnode enlargement, anorexia, respiratory distress. Haemato-biochemical analysis revealed macrocytic hypochromic anaemia with low Hb, Volume of Packed Red Cells (VPRC), platelet, Total Erythrocyte Count (TEC) and hyperproteinaemia with hyperglobulinaemia in the affected goats.

Keywords: Theileriosis, macrocytic hypochromic anaemia, hyperproteinemia, hyperglobulinaemia

1. Introduction

Theileriosis is an economically important tick-borne disease affecting wild and domestic ruminants in the tropics and subtropics. They are transmitted by ixodid ticks of the genus *Haemaphysalis*, *Hyalomma* and *Rhipicephalus*. Small ruminants play a pivotal role in sustaining the economic status of an agriculture nation like India. Tick and tick-borne diseases are now considered as the major threat to the animal production sector. Among the tick-borne diseases in goats theileriosis is the major aetiology of anaemia and decrease in productivity while considering the Kerala scenario. Extensive studies and information regarding bovine theileriosis are already available from all over the country including Kerala. Even though there exists a paucity of information on detailed clinical and haemato-biochemical alterations associated with the theileriosis in goats. Among the *Theileria* spp. that affect small ruminants such as sheep and goats, *T. uilenbergi*, *T. lestoquardi*, and *T.*

luwenshuni are considered as highly pathogenic (Uilenberg, 1981 and Yin *et al.*, 2007) [16, 18]. Nonpathogenic or mildly pathogenic species are *T. separata*, *T. ovis*, and *T. recondita* (Alani and Herbert, 1988) [1]. The acute cases of theileriosis are manifested by fever, lymphnode enlargement, anaemia and high mortality rate.

Prevalence of *Theileria* spp. in goats were reported from different regions of India including Kerala till recently, but detailed studies on clinico-therapeutic and haemato-biochemical changes associated with the disease was not yet revealed. Hence in the light of increase in number of caprine theileriosis being reported from Thrissur district, the present study was undertaken to findout the haemato-biochemical alterations associated with theileriosis in goats.

2. Materials and methods

The study was conducted at the Department of Veterinary Epidemiology and Preventive Medicine, College of Veterinary and Animal Sciences, Mannuthy during the period from June 2019 to December 2020. Occurrence of caprine theileriosis and haemato-biochemical changes associated with theileriosis was studied among goats presented to Kerala Veterinary and Animal Sciences University Hospitals at Mannuthy and Kokkalai, Veterinary hospitals under Animal Husbandry Department and also those belonging to organized farms and house-holds in and around Thrissur district. One hundred goats which had shown predominant clinical signs suggestive of theileriosis like anaemia, fever, lymphadenopathy, cough and nasal discharge were screened for theileriosis. Detailed clinical examination of the animals was done. Anamnesis and signalment were recorded for all the animals. Peripheral blood smear examination was done to identify the goats positive for theileriosis. Thin blood smears were prepared on glass slides using a drop of blood collected from ear vein and air dried. The blood smears were stained with Field's staining method.

Methanol fixed slides were flooded with stain B and allowed to act for 30 seconds. The slides were washed in running tap water, stain A was added and allowed to act for 30 seconds. The slides were washed, air dried and observed under 100X objective of the light microscope. Among the one hundred animals screened for theileriosis twenty five smear positive goats were selected for the study.

Whole blood was collected aseptically from the jugular vein of 25 smear positive goats in EDTA vial (2ml) and clot activator vials (5ml). The samples were transported to laboratory on ice in an insulated carrier. Serum was separated and stored in sterile microcentrifuge tubes at -20⁰ C. A complete blood count, including the following parameters such as total erythrocyte count (TEC) (10⁶/μl), haemoglobin (Hb), volume of packed red cells (VPRC), total leukocyte count (TLC) (10³/μl), differential leukocyte count, mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), platelet count were analysed using an Automatic haematological analyser (Orphee Mythic Vet 18).

Serum biochemical values of creatinine, blood urea nitrogen (BUN), aspartate aminotransferase (AST), total protein and albumin were estimated using commercially available kits (SPINREACT, INDIA). The assays were performed in semiautomatic analyser (Erba Mannheim, Chem-5 Plus v2, USA).

Data were entered into a Microsoft Excel spreadsheet, verified for correctness, and IBM-SPSS software version 26.0 was used to analyse the numerical data

recorded in the present study. One sample t-test was performed to compare haematological and biochemical parameters with normal reference ranges.

3. Results and Discussion

The twenty five animals which were positive for theileria piroplasms in blood smear examination were checked for clinico-haemato-biochemical alterations associated with theileriosis. The selected animals included both males and females. Out of twenty five goats eighteen were female and seven were male. Age varied from four months to six years.

Majority of the animals were in between the age group of 6 months to 3 years.

The major observations found in goats with theileriosis were anorexia, mucosal pallor, pyrexia, lethargy, increased respiratory rate, cough and nasal discharge, lymphnode enlargement, ruminal hypomotility, diarrhoea and lameness. Similar results were obtained by Hassan *et al.* (2015) [7].

The intra-erythrocytic piroplasm of theileria appeared as pleomorphic that is rod shaped, comma shaped, annular form, arch shaped and nail form in the oil immersion objective of the light microscope. Similar pleomorphic morphological form of theileria piroplasms were observed in studies of Mohammadi *et al.* (2017) [10].

Analysis of the haematological parameters of the twenty five theileria positive goats revealed marked decrease in the total erythrocyte count, haemoglobin, MCHC, platelet and VPRC. Haematological alterations in goats positive for theileriosis are mentioned in Table 1.

There was significant increase in the parameters like total white blood cell count, monocyte per cent, MCV and MCH. The occurrence of anaemia in theileria infected animals might be due to the functioning of macrophages in removing the piroplasms from the infected erythrocyte (AL-Amery and Hassso, 2002) [2].

Thrall (2012) [15] explained that the presence of more number of reticulocytes which could not attain the haemoglobin concentration as that of mature erythrocytes might be the reason for decrease in MCHC in theileria infected animals. The excessive destruction of erythrocytes or increase in the number of immature erythrocytes could lead to the increase in average mass of haemoglobin (MCH) per RBC Schalm *et al.* (2010) [14].

The significant increase in total white blood cells in this study might be due to the increased proliferation of lymphocytes in the initial stage of the disease as a part of defense mechanism, similar to the result obtained by the studies of Alsaad *et al.* (2009) [4]. Thrombocytopenia was observed in the goats with theileriosis which was in accordance with Nagaraj *et al.* (2019) [11] which might be due to increased destruction of platelets by mononuclear phagocytic cells.

Table 1: Haematological values in theileria positive goats

Sl no	Variable	Mean±SE	Test value	t value
1	Total RBC (x106/mm3)	7.96 ** ±0.492	13	10.254
2	Total WBC (x103/mm3)	14.68 * ±1.766	9	3.216
3	Granulocyte (%)	36.64 ns ± 3.251	35.759	.271
4	Lymphocyte (%)	53.92 ns ± 3.175	60	1.915
5	Monocyte (%)	4.72 ** ± 0.481	2	5.650
6	Hb (g/dL)	6.92 ** ± 0.395	10	7.788
7	MCV (fl)	25.32** ± 0.645	19.5	9.026
8	MCH (pg)	8.72 * ± 0.672	6.5	3.303
9	MCHC (g/dl)	28.36* ± 1.508	33	3.078
10	Platelets (x103/ μl)	401.48** ±37.757	579.5	4.715
11	VPRC %	24.88 *± 1.236	28.5	2.929

ns non-significant

** Highly significant

* Significant

The values of selected biochemical parameters of animals affected with theileriosis are given in Table 2. In our study the serum biochemical estimation revealed significant increase in total protein, globulin and BUN. But contrary to our result Al-fetly (2012) [3] revealed significantly lower values of total protein and albumin in sheep infected with theileriosis when

compared to healthy control group.

Jackson (2018) [9] and Izzo *et al.* (2010) [8] observed significantly elevated level of serum total protein and globulin in *T. orientalis* affected cattle which is in accordance with our result. This elevated values might be due to the chronic immune response in the affected animals.

Binta *et al.* (1998) [6] recorded significant hyperglobulinaemia in cattle infected with *T. taurotragi* and *T. mutans*. This was because of the increased production of acute phase proteins as a result of inflammatory response to tissue injury or foreign antigen.

Significantly lower values were obtained in parameters like creatinine and AST in the present study. Omer *et al.* (2003) [13] reported a significant decrease in the serum creatinine value of cattle infected with theileriosis, which is similar to our findings. Baghshani *et al.* (2011) [5] observed a non-significant decrease in serum creatinine levels of sheep infected with theileriosis.

The rise in the BUN in our study might be due to the increased protein catabolism due to anorexia in theileria positive animals or due to dehydration.

Baghshani *et al.* (2011) [5] and Al-fetly (2012) [3] observed increased level of AST in goats and sheep infected with theileria species which is not in accordance with our result. They were of the opinion that significant damage to the liver might have lead to the elevation of liver specific enzymes.

Table 2: Serum biochemical parameters in theileria positive goats

2	Albumin (g/dL)	2.64 ns ± 0.181	2.85	1.157
3	Globulin (g/dL)	6.48 ** ± 0.421	4.1	5.656
4	Creatinine (mg/dL)	0.96 ** ± 0.070	1.55	8.400
5	BUN (mg/dL)	20.44* ± 2.171	14	2.966
6	AST (U/L)	79.44** ± 12.850	170	7.047

ns non-significant

** Highly significant

* Significant

4. Conclusion

In the present study among 25 animals selected which were positive for theileriosis, majority of animals showed the clinical signs like anaemia, lymphnode enlargement and respiratory distress. Blood smear evaluation revealed pleomorphic theileria piroplasms appearing as rod, comma and arch shape. Haemato-biochemical analysis revealed macrocytic hypochromic anaemia with hyperproteinemia and hypoglobulinaemia.

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