



Haematological and Biochemical Effects of Tick Infestation in Common Indian Goat

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ABSTRACT

In the present study, effect of ectoparasite on haematological and biochemical parameters of goats has been analyzed and compared with normal (control) animals. The experimental tick infected group showed lower values of Hb, PCV, TEC, neutrophil and MCHC in day 21 when compare to naturally infested groups. However first three weeks of study there was no significant difference in eosinophil, basophil and MCV values between naturally infested village flock and non-infected control group. Biochemical parameters like total protein and globulin were found higher a day 21 in experimental tick infected goats but albumin, A/G ratio, glucose, bilirubin and AST were considerably lower during 7 and day 21 in the experimental group when compare to naturally infested goats.

INTRODUCTION

The rapidly changing patterns of demand for livestock and livestock products point to livestock production being an increasing component of the agricultural economies of India. The extent to which the rural poor will benefit from these changes depends on how livestock can be integrated into developing markets and whether cheaper livestock products benefit the rural poor as consumers as well as producers. There is scope for goats (*Capre hircus*) to play an important role for smallholder farmers in accessing these new markets. They are often termed as the poor man's cow. Their small size compared to cattle and buffaloes permit them to be maintained on a limited area. Goats consume a wide variety of grasses, weeds, forbs, bushes, shrubs, tree leaves and crop residues that would otherwise go waste and cause pollution. Their small size makes them suitable for home slaughter and the meat can be consumed before it spoils in warm climate where no refrigeration facilities are available. The goats can be milked any time of the day and are therefore named as the moving refrigerators. Goat milk is prescribed for children, old and sick as it is easily digestible and has medicinal value. Goat meat (chevon) is preferred over other meats because it is leaner and there are no religious taboos against its consumption. The disease problems in the small ruminants are a major hurdle in better economic return in livestock industry, which need timely and effective intervention in management. The disease causing infectious organisms and ecto-parasites influence the economics of goat husbandry. Among these ecto-parasites; ticks, lice and mites are the most common ecto-parasites. The important diseases transmitted by ticks are piroplasmiasis caused by *Babesia bigemina* (transmitted by *Boophilus microplus*), theileriasis caused by *Theileria parva* (vector, *R. appendiculatus*), *T. annulata* (vector, *Hyalomma spp.*), *T. orientalis* (vector, *Haemaphysalis spp.*), *T. mutans* (vector, *Amblyomma spp.*); Anaplasmosis caused by *Anaplasma marginale* (vector *Rhipicephalus spp.*, *Hyalomma spp.*, *Boophilus spp.*). Ehrlichiosis caused by *Ehrlichia bovis* and *E. ondiri* (vectors, *Rhipicephalus* and others); Tick born fever (transmitted by *Rhipicephalus hemophysaloids*); Viral diseases, (Swine fever, Louping ill, Nairobi sheep diseases, Blue tongue) transmitted by tick and other diseases like Brucellosis, Heart water disease, Staphylococcal infection are also transmitted by ticks [1]. The bite of ticks causes varying grade of inflammation and irritation in the skin at the sites of their attachment leading to cutaneous abrasions and damage to hide resulting in depreciation of the quality and value of leather. Now, there is a lot of advancement in the field of animal science, instrumentation, techniques and diagnostics. So the researches on medicinal plants have become easier and comprehensive. Further understandings of effect of herbal therapy on the hematological, biochemical, immunological, hormonal and physiological profile of animals have become

obviously important. Since animal husbandry has become an industry and animals are being reared in masses, it has further necessitated the generation of scientific data of herbal therapy not only on the parameters related to efficacy but also to establish their safety and benefits of usage. As well as in the era of liberalization, privatization and globalization (LPG), it has become mandatory to establish the bioactive molecule available in the herbal formulations. Herbal research is now a days under heavy demand in global market. India is rich in flora and fauna, which can be exploited in this direction, to suit the need. But firstly, there is a need to assess the harmful effect of ticks on goats before taking further steps for use of herbal treatments in future studies. Realizing these aspects, specific attention is needed towards systematic research therefore the present study on ectoparasitic infestation especially on ticks in goats has been planned on their haematology and biochemistry.

MATERIALS AND METHODS

Animals

The present study was planned for the epidemiological survey of ticks in organized farms of Jamunapari and Barbari goats maintained at Central Institute for Research on Goats, Makhdoom, Farah, Mathura and farmer's flock of goats. The general topography of the institute area is mostly undulating with difference of up to 5-6 meters between the low level land and top. The geo-climatic conditions, as per the report of National Bureau of soil survey and land use planning points to alluvial nature of Jamuna belt and the ecology of this region boarding arid conditions.

The Jamunapari breed were found in chambal ravines and kept for meat and milk, whereas the Barbari is medium sized and is reared for meat production owing to its high proficiency. The management of institute flocks involves grazing / browsing for 6-8 hrs daily and supplementary feeding with concentrate. Goats were housed in shades, (one for each breed/flock) during inclement weather. The epidemiology of ticks population was also investigated from village Jalal on non-descriptive breed of goats from farmer's flock. The animals of farmers generally grazed / browse from 8 AM to 5 PM. Some of the farmers also provide supplementary feeding along with concentrate. Farmers keep their goats in open coral made up of thatched huts.

Chemicals

The chemical was supplied by Sisco Research Laboratories Pvt. Ltd, Mumbai. All the chemicals/ reagents used were of analytical grade. Biochemical Kits were obtained from Span Diagnostics Ltd, Surat, India. The following kits have been used for biochemical estimation in blood serum-

Glucose kit comprised of 4 reagents. (i) Glucose reagents contains phosphate buffer, glucose oxidase peroxides 4-AAP stabilisers (ii) Glucose diluents contains phenol preservative, (iii) Glucose standard contains dextrose preservative. Total protein kit comprised of 2 reagents. (i) Biuret reagents contains copper sulphate, sodium hydroxide, sodium-potassium tartrate, surfactant (ii) protein standard BSA and preservative. Albumin kit comprised of 2 reagents (i) Succinic acid, bromocresol green, sodium hydroxide, Buffer pH 3.68 (ii) Albumin standard contains BSA and preservative. AST Kit comprised of 2 Reagents (i) Buffer reagents contains tris buffer (pH 7.8), L-Aspartate, MDH (malate dehydrogenase), (LD) Lactate dehydrogenase (ii) Substrate reagents contains α -ketoglutarate (NADH), Nicotinamide adenine Dinucleotide. ALT Kit comprised of 2 Reagents (i) Buffer reagents contains tris buffer (pH7.5), L-alanine, (LD) Lactate dehydrogenase (ii) Substrate reagents contains α -ketoglutarate, (NADH) Nicotinamide adenine Dinucleotide. Total and direct bilirubin kit comprised of 4 reagents. (i) Sodium nitrite reagents contain sodium nitrite stabilizers. (ii) Sulphanilic acid reagents contains sulphanilic acid HCL, preservative (iii) Caffeine reagents contains caffeine Sodium-benzoate stabilizers (iv) Artificial standard reagents contains colored dye Preservative.

Equipments

Rotary evaporator (Heidolph, Germany), Soxhlet Apparatus, BOD Incubator (Toshiba, Japan), Biochemical Analyzer (Nexgen), Dessicator, Centrifuge, Sahli's Haemoglobino meter, Wintrobe haematocrit tubes, Pasture pipette, Centrifuge machine, Hemocytometric chamber.

Laboratory wares

Glass wares, syringes and needles were sterilized by usual standard procedure. Disposable Petri dishes supplied by M/s Axiva, New Delhi were used. "Borosil" brand of glasswares were used during the course of this study. Other material like forceps, drawing brush (camel), muslin net cloth, cello tape, whatman filter paper No.1(5.5 c.m. in diameter), thread, lens, sprit lamp, binocular microscope were used.

Collection of Blood Samples

The blood samples were collected from jugular vein at day 0, 7, 21 after complete spread of total ecto-parasites on goats. 10 ml blood from each goat was collected in 2 test tubes, one containing EDTA and other one without EDTA. For biochemical studies, serum was separated from blood and kept immediately in refrigerator at 4 °C.

Hematological estimations

All the hematological parameters were done with the help of auto analyzer at Pandit Deen Dayal Upadhyay Veterinary University, Mathura following standard procedures and protocols.

RESULTS AND DISCUSSION

Hematological estimation in blood serum of natural infested goats of village flock and goats infected experimentally with tick was conducted to know the systemic effect of these parasites on animals.

The hematological parameters estimated were Hb, PCV, TEC, DLC, MCV, MCHC and Platelets. The mean values of these parameters recorded in the experimentally tick infested group were Hb (7.53±0.13 gm/dl), PCV (23.00±1.52%), total erythrocytes count (4.10±0.25x10⁶/μl), total leucocytes count (9.70±0.29X10³/μl), neutrophil (35.0±4.93%), eosinophil (1.83±0.16%), lymphocytes (61.83±4.94%) basophil (0.00±0.00%), monocyte (1.33±0.21%), MCV (56.58±3.42 fl), MCHC (334.33±25.18 gm/l) and platelets (2.89±0.19X10⁵ μl) at day 21 infection respectively. However, in natural tick infested village goat flock, the mean values recorded were Hb (9.49±0.40gm/dl), PCV (29.00±1.21%),TEC (5.15±0.25x10⁶/μl),TLC (12.20±1.01x10³/ μl),neutrophil (63.00±1.71%), eosinophil (1.66±0.33%), lymphocytes (32.83±1.49%), basophil (0.16±0.16%), monocyte (2.16±0.16%), MCV (55.44± 3.00 fl), MCHC (327.56±0.01%), and platelets (3.23±0.23 X 10⁵/μl) respectively. It showed that Hb concentration, PCV(%), TEC, neutrophil, MCHC (gm/l) and platelets counts were reduced at day 21 tick infected goats as compare to natural infested village flock and control group of goats. The mean value of most of the hematological parameters was lower at day 21 than day 7 infected goats. The mean hematological values of natural infected goats of village flock were slightly lower as compared to mean values of non infected control goats. Haemoglobin concentration in experimental tick infected goats at day 7 and 21 were significantly lower (P<0.05) than the natural infected and non-infected control goats however, day 0 value was not different from the natural infested animals. Similarly, mean value of PCV was also significantly (P<0.05) lower in natural infestation than the non-infected control group but higher in day 7 and 21 values of experimentally infected goats. Neutrophil (%), lymphocyte (%) and monocyte (%) were significantly different (P<0.05) between non-infected control group and goats of natural tick infested village flock. The platelet counts in all the groups were significantly lower (P<0.05) when compared to non-infected control. There was no significant difference of mean values of eosinophil and basophil and MCV in experimentally tick infested goats at day 0, 7, and 21 as well as from natural tick infected village flock and non-infected control groups. Biochemical parameters estimated in experimental infected goats at day 21 were total protein (7.31±0.17 g/dl), albumin (2.94±0.13 g/dl), globulin (4.36±0.26 g/dl), A/G ratio (0.68±0.06), glucose (38.01±0.63 g/dl), bilirubin (0.80±0.03 mg/dl), AST (43.40±3.18 U/ml) and ALT (15.69±1.27 U/ml) and goats of natural infested village flock were total protein (7.41± 0.17 g/dl), albumin (2.93±0.12g/dl), A/G ratio (0.67±0.06), glucose (39.16±0.57 g/dl), bilirubin (0.82±0.04), AST (45.58±3.28 U/ml) and ALT (17.33±1.17 U/ml) respectively. The biochemical parameters in experimentally infected goats revealed that total protein and globulin were higher significantly (P<0.05) at day 21 than day 0 infected goats. When these biochemical values were compared with non-infected control goats, it was observed that albumin, A/G ratio, glucose, bilirubin and AST were lower at day 7 and 21 in experimental infected and natural infested animals. It was further recorded that total protein, albumin, globulin, A/G ratio and ALT were not significantly different between the mean values of day 7 and 21 in case of animals infected experimentally with tick, and, natural infested goats of village flock, but significant difference was observed in the values of these parameters from non-infected control group of animals with experimentally infected animals showing significantly lower values.

Hematological estimation in blood serum was studied to find out systematic effect of tick infection in goats. Mean value of Hb, PCV, TEC, neutrophil, and platelets count were decreased at day 7 and 21 in experimentally infected goats as compare to naturally infested goats of village flock and control group of animal. Decrease in the level of these parameters was also observed in natural infested village flock of goats.

Table 1. Hematological changes in goats of village flock natural infested and goats infected experimentally of ticks (Mean \pm S.E.)

Parameters	Experimental infection			Natural infection	Control
	Days intervals				
	0 day	7 day	21 day		
Hb. Conc. (g/dl)	9.50 ^{bc} \pm 0.40	8.76 ^b \pm 0.27	7.53 ^a \pm 0.13	9.49 ^{bc} \pm 0.40	10.33 ^c \pm 0.23
PCV (%)	29.00 ^{bc} \pm 1.21	27.16 ^b \pm 0.83	23.00 ^a \pm 1.52	29.00 ^{bc} \pm 1.21	30.66 ^c \pm 0.76
TEC ($\times 10^6/\mu$ l)	5.15 ^b \pm 0.25	4.34 ^b \pm 0.17	4.10 ^a \pm 0.25	5.15 ^b \pm 0.25	5.24 ^b \pm 0.18
TLC ($10^3/\mu$ l)	12.20 ^b \pm 1.01	10.62 ^{ab} \pm 0.60	9.70 ^a \pm 0.29	12.20 ^b \pm 1.01	11.84 ^b \pm 0.38
Neutrophil (%)	63.00 ^b \pm 1.71	57.83 ^b \pm 6.15	35.0 ^a \pm 4.93	32.83 ^a \pm 1.49	62.33 ^b \pm 2.02
Eosinophil (%)	1.83 ^a \pm 0.40	1.33 ^a \pm 0.21	1.83 ^a \pm 0.16	1.66 ^a \pm 0.33	1.50 ^a \pm 0.22
Lymphocyte (%)	32.83 ^a \pm 1.49	39.16 ^a \pm 6.37	61.83 ^b \pm 4.94	63.00 ^b \pm 1.71	34.83 ^a \pm 1.86
Basophil (%)	0.16 ^a \pm 0.16	0.00 ^a \pm 0.00	0.00 ^a \pm 0.00	0.16 ^a \pm 0.16	0.00 ^a \pm 0.00
Monocyte (%)	2.16 ^b \pm 0.16	2.0 ^b \pm 0.25	1.33 ^a \pm 0.21	2.16 ^b \pm 0.16	1.33 ^a \pm 0.21
MCV (fl)	55.44 ^a \pm 3.00	61.84 ^a \pm 4.18	56.58 ^a \pm 3.42	55.44 ^a \pm 3.00	58.28 ^a \pm 0.92
MCHC (gm/l)	327.16 ^a \pm 1.30	331.83 ^{ab} \pm 11.52	334.33 ^b \pm 25.18	327.56 ^a \pm 0.01	335.50 ^b \pm 1.78
Platelets ($\times 10^5/\mu$ l)	3.21 ^a \pm 0.22	2.95 ^a \pm 0.13	2.89 ^a \pm 0.19	3.23 ^a \pm 0.23	4.20 ^b \pm 0.28

Means with similar superscripts between columns did not differ significantly ($P < 0.05$)

Table 2. Biochemical changes in goats of village flock natural infested and goats infected experimentally of ticks (Mean \pm S.E.)

Parameters	Experimental infection			Natural infection	Control
	Days intervals				
	0 day	7 day	21 day		
Total protein (g/dl)	6.86 ^a \pm 0.28	7.03 ^c \pm 0.20	7.31 ^c \pm 0.17	7.41 ^c \pm 0.17	7.21 ^b \pm 0.08
Albumin (g/dl)	3.28 ^c \pm 0.06	2.83 ^a \pm 0.08	2.94 ^a \pm 0.13	2.93 ^a \pm 0.12	3.26 ^c \pm 0.10
Globulin (g/dl)	3.58 ^a \pm 0.27	4.25 ^c \pm 0.24	4.36 ^c \pm 0.26	4.41 ^c \pm 0.24	3.95 ^b \pm 0.13
A/G Ratio	0.93 ^b \pm 0.07	0.68 ^a \pm 0.05	0.68 ^a \pm 0.06	0.67 ^a \pm 0.06	0.82 ^c \pm 0.05
Glucose (g/dl)	40.25 ^b \pm 0.42	38.55 ^{ab} \pm 0.57	38.01 ^a \pm 0.63	39.16 ^a \pm 0.57	40.64 ^a \pm 0.48
Bilirubin (mg/dl)	1.39 ^a \pm 0.10	0.91 ^{ab} \pm 0.02	0.80 ^a \pm 0.03	0.82 ^a \pm 0.04	0.99 ^b \pm 0.00
AST (U/ml)	87.21 ^c \pm 0.85	59.91 ^b \pm 1.17	43.40 ^a \pm 3.18	45.58 ^a \pm 3.28	47.74 ^c \pm 2.54
ALT (U/ml)	15.69 ^a \pm 1.27	15.25 ^a \pm 1.20	15.69 ^a \pm 1.27	17.33 ^a \pm 1.17	9.90 ^a \pm 0.96

Means with similar superscripts between columns did not differ significantly ($P < 0.05$)

The mean Hb concentration of non-descript goat of village flock was slightly lower than the mean values of non-infected control group of goats. Haemoglobin concentration in experimental tick infected goats at day 7 and 21 were significantly lesser ($P < 0.05$) than the natural infested and non-infested control goats, however, day 0 value was not significantly different from the naturally infested animals than the experimentally infested, The PCV values were significantly lower ($P < 0.05$) in the day 7 and 21 of experimentally group than the non-infected control and naturally infested group. The low level of these hematological parameters of village flock in tick infested goats might be due to higher infection rate than organized farm flock. The mean value of Hb, PCV, TEC, neutrophil, monocyte and platelets were lower at day 21 in experimental infected goats than day 7 values. This might probably due to that the infection has reached a peak level at day 21. The variation in haematological parameters in tick infested goats of village flock was not very pronounced when these values were compared with non infected control goats. Rajendran and Hafeez [2] studied hematological and biochemical changes in crossbred cattle and reported significant reduction in PCV, Hb, TEC and TLC in tick infested group which is in close agreement with present findings. Lymphocyte count was higher in experimental infected goats at day 21 and natural infested village flock of goats than the control group however significant difference was not observed in mean of eosinophil, basophil and MCV values in all the tick infected goats and control group. Padmaja *et al.*[3] reported a significant decline in TEC, Hb and PCV in endoparasitic infestation in sheep than the healthy group of animals whereas TLC and eosinophil count was significantly increased. Sengupta and Basu [4] also observed significant reduction in Hb concentration and higher counts of TLC and eosinophils in goats infected with sarcoptic mange. The similar was supported by Basu *et al.*[5]; Bock *et al.*[6] and Adejinmi *et al.*[7]. Biochemical parameters viz., total protein, albumin, globulin, glucose, bilirubin, AST and ALT were estimated in goats of village flock of natural infested and goats infected experimentally with ticks and found that total protein, globulin were higher at day 21 than 0 day infection and non-infected control. There was significant difference in total protein and globulin values between day 21 of experimental infected goats and natural infested goats of village from the day 0 and control group of animals. Rajendran and Hafeez [2] and Padmaja *et al.* [3] also reported significant decrease in total serum protein, albumin in tick infested animals which is in close agreement with our findings. Glucose, bilirubin and AST levels were significantly lower in tick infected animals than the control and day 0 groups of animals. Dalpati *et al.* [8] reported decrease in blood glucose, serum protein; calcium and inorganic phosphorous level in *Ixodid* tick infected animals. The findings also gain support with the findings of Belozarov[9], Chhabra *et al.*[10], Gray[11], Das[12] and Clover and Lane[13].

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