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RESEARCH ARTICLE

Hemato-biochemical alterations in Sheep affected with Brucellosis in Anantapur district, Andhra Pradesh, India

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ABSTRACT

Brucellosis, a zoonotic disease caused by *Brucella* spp., significantly impacts the health and productivity of sheep, leading to economic losses and public health concerns. This study evaluated the hematobiochemical alterations in sheep affected with brucellosis in Anantapur district, Andhra Pradesh, India. A total of 100 serum samples from 100 animals (50 male and 50 female) were collected and screened for brucellosis using the Rose Bengal Plate Test (RBPT) and Indirect Enzyme-Linked Immunosorbent Assay (I-ELISA), revealed seroprevalence rates of 16% and 30%, respectively. Hematological and biochemical analyses were conducted on 20 seropositive sheep, with results compared to seronegative controls. Significant hematological changes ($P<0.01$) included reduced hemoglobin, packed cell volume and total erythrocyte count, accompanied by increased total leukocyte count, neutrophils and eosinophils. Lymphocytes, monocytes and basophils were reduced. Biochemical profiles showed elevated aspartate aminotransferase and alanine aminotransferase with decreased total protein and albumin ($P<0.05$).

Keywords: ALT, AST, Brucella, hemoglobin, I-ELISA, neutrophils, PCV, RBPT

INTRODUCTION

Sheep and goats played a crucial role in the livestock sector, serving as vital sources of nutrition and supporting the rural economies of developing nations through their ability to convert forages and residues into valuable products like meat, wool and milk[1]. In India, the sheep population was estimated at 65.07 million and goats at 135.2 million, constituting 12.71% and 26.4% of the total livestock population, respectively[2]. However, small ruminants faced numerous diseases, including brucellosis, a major zoonotic bacterial infection caused by *Brucella spp*., which resulted in substantial economic losses and posed risks to human health[3,4]. Brucellosis transmission occurred through direct contact with infected animals, consumption of contaminated products or exposure to aborted materials, affecting both animals (e.g., abortions, infertility) and humans, particularly farmers and Veterinarians[5,6] . Although bacterial isolation remained the diagnostic gold standard, its limitations-such as the need for BSL-3 facilities-necessitated alternative methods like serological tests (RBPT, ELISA) and PCR, which offered sensitivity and practicality[7-9].

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MATERIALS AND METHODS

The present study was conducted from April to December 2024 in various villages of Anantapur District, Andhra Pradesh, India with sample analyses performed at the Department of Veterinary Pathology, Sri Venkateswara Veterinary University, Tirupati and ICAR-National Institute of Veterinary Epidemiology and Disease Informatics (NIVEDI), Bangalore with prior approval of IAEC under proposal no. 281/go/ReBi/S/2000/CPCSEA/CVSc/TPTY/049/ Veterinary Pathology.

A total of 100 blood samples (male & female each 50) were collected aseptically from the jugular vein of sheep across eight villages. Samples were drawn into serum clot activator tubes, allowed to clot for 2-3 hours and centrifuged at 3000 rpm for 2-4 minutes. Serum was stored at -20^{O}C until analysis.

From seropositive samples, 20 blood samples were selected for hematological analysis using EDTA-collected blood and serum was separated from blood for biochemical analysis using plane vial. Parameters included Hb (Sahli's method), PCV (microhematocrit), TEC and TLC (dilution technique) and DLC (Field's stain, Battlement technique)[10,11]. Biochemical analysis assessed ALT, AST, total protein and albumin in serum centrifuged at 4000 g for 20 minutes, using an Auto Span analyzer with ERBA and Biosystem kits. Statistical

Table 1. Hematological values of sheep affected with brucellosis.

Parameter	Control Sheep (N = 6)	Sheep affected with Brucellosis (N = 20)
Hb - Haemoglobin (g/dl)	10.60 ± 0.20*	7.90 ± 0.20*
PCV - Packed Cell Volume (%)	36.50 ± 0.70*	30.40 ± 0.50*
TEC - Total erythrocyte count (10^6/µl)	10.90 ± 0.45*	4.15 ± 0.18*
TLC - Total leukocyte count (10^3/µl)	5.97 ± 0.45*	22.53 ± 2.52*
MCV - Mean Corpuscular Volume	30.0 ± 0.49*	37.20 ± 0.09*
MCHC - Mean Corpuscular Haemoglobin Concentration	32.40 ± 0.40*	52.70 ± 1.70*
MCH - Mean Corpuscular Haemoglobin	10.60 ± 0.30*	19.60 ± 0.60*
DLC - Differential leukocyte count		
Neutrophils (%)	39.50 ± 0.22*	62.15 ± 2.82*
Lymphocytes (%)	58.17 ± 0.17*	39.33 ± 0.36*
Eosinophils (%)	1.25 ± 0.18*	2.45 ± 0.18*
Monocytes (%)	1.33 ± 0.21*	1.90 ± 0.20*
Basophils (%)	0.58 ± 0.26*	0.83 ± 0.11*
Band cells (%)	0.00 ± 0.00	0.00 ± 0.00

Test: T - Test Significance: ($P < 0.05$); *Values were significantly different at ($P < 0.05$)

significance was determined by T-tests for hematological/ biochemical data.

RESULTS

Hematological analysis (Table 1, Fig. 1) showed significant reductions ($P < 0.05$) in hemoglobin (Hb), packed cell volume (PCV) and total erythrocytes count (TEC) in infected sheep compared to controls, indicating anemia and decreased red blood cell counts. Total leukocytes count (TLC) was significantly elevated ($P<0.05$) in infected sheep, with differential counts showing significant increases ($P<0.05$) in neutrophils, eosinophils and monocytes compared to control sheep, while lymphocytes decreased significantly ($P<0.05$) in positive sheep compared to *Brucella* negative sheep. Basophils elevated slightly in seropositive sheep compared to seronegative sheep ($P<0.05$). Red blood cell indices also shifted: MCV, MCHC and MCH increased in sheep confirmed with brucellosis compared to control sheep ($P<0.05$).

Biochemical analysis identified significant changes ($P<0.05$) in infected sheep with elevated alanine aminotransferase (ALT) in seropositive sheep and increased aspartate aminotransferase (AST) in sheep infected with brucellosis compared to controls, indicating hepatic stress. Significant decrease in total protein and serum albumin was observed in seropositive sheep compared to seronegative sheep ($P<0.05$), suggesting metabolic disruption.

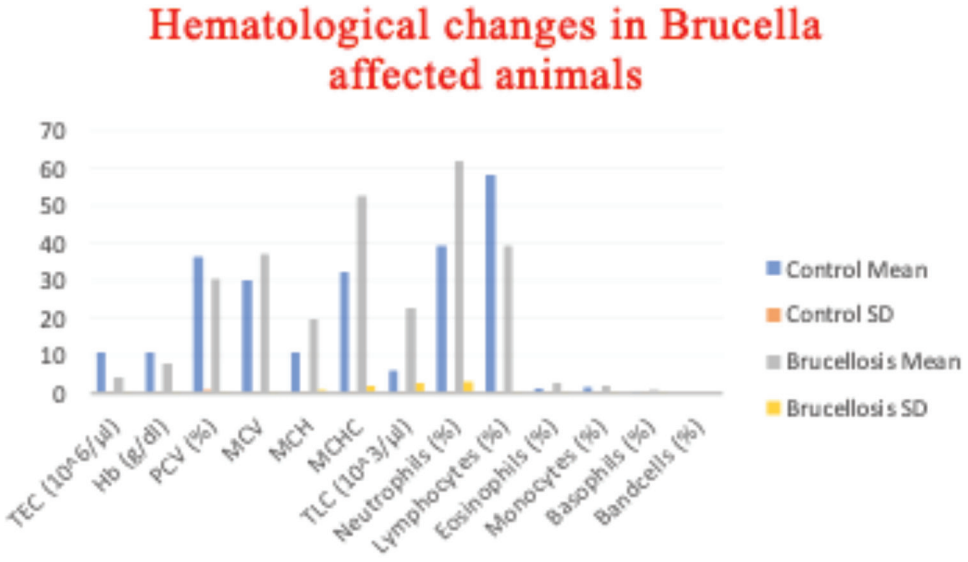

Fig. 1. Hematological values of sheep affected with brucellosis.

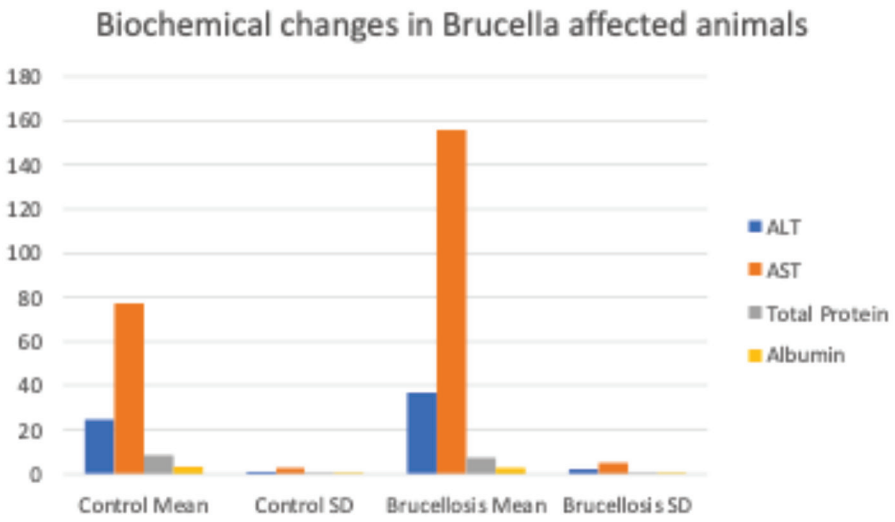

Fig. 2. Serum Biochemical results of Brucella seropositive animals.

DISCUSSION

The hematobiochemical alterations observed in this study revealed the systemic impact of brucellosis on sheep physiology, revealing patterns of anemia, inflammation and hepatic dysfunction. The significant reduction in Hb, PCV and TEC in infected sheep resembled findings by previous reports[12], who documented similar declines in *Brucella*-infected cattle, attributing them to anemia from impaired erythropoiesis or oxidative stress induced by inflammatory cytokines[13]. Previous findings[14,15] also reported anemia in 43.5% and 74% of human brucellosis cases, respectively, supported that Brucella disrupted red blood cell production across species. However, [16]observed stable Hb and PCV in infected cattle, suggesting variability possibly linked to infection stage or host-specific responses.

Table 2. Serum Biochemical results of Brucella seropositive animals.

S.No.	Parameters	Control Sheep (N = 6)	Sheep affected with brucellosis (N = 20)
1.	ALT	24.80 ± 0.77*	36.87 ± 1.86*
2.	AST	77.13 ± 2.70*	155.63 ± 5.16*
3.	Total Protein	8.62 ± 0.18*	7.36 ± 0.11*
4.	Albumin	3.04 ± 0.02*	2.65 ± 0.18*

Test: T - Test Significance: (P < 0.05); *Significant level of significance (P < 0.05)

The elevated MCV, MCHC and MCH in infected sheep indicated larger, hemoglobin-rich erythrocytes, likely a compensatory mechanism for reduced TEC, as suggested by[17] in cows. This contrasted with[16] who noted stable MCHC in cattle, highlighting potential species differences or dehydration effects in sheep[15]. The marked increase in TLC and neutrophilia reflected an acute inflammatory response aligning with[18], who reported neutrophilia in cattle (26.6%), though at lower levels. The lymphocytopenia in this study agreed with[10] in cattle and human studies[14,15], suggesting immune suppression or bone marrow exhaustion, unlike the lymphocytosis observed in cattle[18] and horses[19]. Elevated eosinophils and monocytes further supported an active immune response, differing from[16], who noted only mild changes in cattle. The slight rise in basophils was less pronounced but consistent with systemic inflammation. These discrepancies likely stemmed from species-specific immune dynamics or the intracellular nature of Brucella, which might suppress certain leukocyte populations while stimulating others[20,16].

Biochemically, the increase in AST and ALT in infected sheep indicated hepatic injury, supporting[21,13,22] who correlated liver enzymes to inflammation and hepatocyte necrosis driven by *Brucella*-induced oxidative stress. The reduced total protein and albumin aligned with[23,21], reflecting impaired hepatic synthesis or renal loss as hypothesized by[24]. In contrary, [25]reported increased total protein in cattle, highlighted species-specific metabolic responses.

CONCLUSION

This study described the hematobiochemical alterations in sheep affected by brucellosis in Anantapur District, revealing a 30% seroprevalence and significant physiological impacts. The marked reductions in Hb, PCV and TEC, coupled with elevated TLC and shifts in leukocyte populations, confirmed anemia and inflammation as hallmarks of the disease in sheep. Elevated AST and ALT was associated with decreased total protein and albumin, highlighting hepatic dysfunction and metabolic disruption, consistent with Brucella's

systemic pathogenicity. These findings aligned with prior research in ruminants and humans, though variations demonstrated species-specific responses and infection stages. The higher sensitivity of I-ELISA over RBPT reinforced its value in epidemiological surveillance. Collectively, these results emphasized brucellosis as a multifaceted disease necessitating integrated diagnostic and management strategies to mitigate its economic and zoonotic toll in India's livestock sector.

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Conflicts of Interest: None

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REFERENCES

1. Ndegwa EN, Mulei CM and Munyua SJM. 2001. Common diseases of small ruminants in Kenya. *Kenya Vet J* **25:** 45-50.
2. Singh BB, Kostoulas P and Gill JPS. 2018. Brucellosis burden in Indian livestock. *Transbound Emerg Dis* **65:** 745-52.
3. Alton GG. 1982. Economic impact of brucellosis in sheep and goat farming. *Vet Rec* **110:** 102-5.
4. Al-Talafhah AH, Lafi SQ and Al-Tarazi Y. 2003. Brucellosis: a zoonotic threat to animal and human health. *J Vet Med B Infect Dis Vet Public Health* **50:** 121-8.
5. Lopes LB, Nicolino R and Haddad JPA. 2010. Brucellosis risk factors in humans and animals. *Vet Res* **41:** 46.
6. Xavier MN, Paixão TA and Santos RL. 2010. Transmission of brucellosis in animals and humans. *Open Vet Sci J* **4:** 12-8.
7. Baily GG, Krahn JB, Drasar BS and Stoker NG. 1992. Detection of Brucella DNA by PCR. *J Clin Microbiol* **30:** 2960-3.
8. Shome R, Nagalingam M and Shome BR. 2014. Serological diagnosis of brucellosis in ruminants using ELISA. *Indian J Anim Sci* **84:** 632-7.
9. Yagupsky P, Morata P and Colmenero JD. 2019. Laboratory diagnosis of brucellosis. *Clin Microbiol Rev* **32:** e00018-19.
10. Jain NC. 1986. Schalm's Veterinary Hematology. 4th ed. Philadelphia: Lea & Febiger.
11. Coles EH. 1986. Veterinary Clinical Pathology. 4th ed. Philadelphia: WB Saunders.
12. Kushwaha N, Rajora VS and Mohan N. 2014. Hematobiochemical profile of Brucella-infected cattle. *Indian J Anim Res* **48:** 234-8.
13. Abdallah AA, El-Boshy ME and Nayel MA. 2014. Biochemical and hematological changes in Brucella-infected ruminants. *J Vet Sci* **15:** 123-30.
14. Crosby E, Llosa L and Miro-Quesada M. 1984. Hematologic changes in brucellosis. *J Infect Dis* **150:** 419-24.
15. Soudbakhsh A, Mortazavi H and Hajiabdolbaghi M. 2007. Hematological alterations in human brucellosis. *Iran J Infect Dis* **12:** 45-50.
16. Sikder S, Rahman MS and Bari MA. 2012. Hematological changes in Brucella-infected dairy cattle. *Bangladesh Vet J* **46:** 23-8.
17. Giudice E, Pugliese A and Piccione G. 2012. Circadian rhythms of hematological parameters in Brucella-infected cows. *Vet Res Commun* **36:** 189-94.
18. Chahotal MK, Sharma VK and Katoch RC. 2003. Hematological changes in bovine brucellosis. *Indian Vet J* **80:** 543-7.
19. Gul ST, Khan A and Ahmad M. 2013. Hematological alterations in Brucella-infected horses. *Pak Vet J* **33:** 145-9.
20. Seleem MN, Boyle SM and Sriranganathan N. 2010. Brucellosis: a re-emerging zoonosis. *Vet Microbiol* **140:** 392-8.
21. Arslan S, Çelebi Ö and Özdemir D. 2011. Biochemical changes in Brucella-infected sheep. *Vet Res Commun* **35:** 231-8.
22. Hashem MA, El-Kharbotly A and Abdel-Hady A. 2020. Biochemical and immunological changes in Brucella-infected ruminants. *Vet Microbiol* **245:** 108-695.
23. Al-Hussary NA, Al-Taei JA and Al-Zubaidy AJ. 2010. Biochemical alterations in sheep with brucellosis. *Iraqi J Vet Sci* **24:** 45-50.
24. Hamada MM, El-Malt M and El-Sayed M. 2013. Renal dysfunction in brucellosis: a biochemical perspective. *J Anim Health* **5:** 34-9.
25. Rita Nath S, Das S and Sarma K. 2014. Biochemical changes in bovine brucellosis. *Indian J Vet Pathol* **38:** 89-93.