RESEARCH ARTICLE

Haemato-Biochemical Alterations in Cattle Naturally Infected with Lumpy Skin Disease

Jigar B. Raval[1]*, Sunant K. Raval[1], Amit N. Kanani[2], Dashrath B. Sadhu[1]

Abstract

Lumpy skin disease (LSD) is an emerging viral disease of cattle, causing substantial economic losses due to decreased productivity and increased morbidity. This study investigated haematological and biochemical alterations in LSD-affected cattle (n=150) compared to healthy controls (Group A, n=25). LSD-infected animals were categorised according to the severity of infection based on clinical signs in to Group B: Mild LSD infection (n=42), Group C: Moderate LSD infection (n=84), and Group D: Severe LSD infection (n=24). Infected animals exhibited significant leukopenia, lymphopenia, neutrophilia, macrocytic hypochromic anaemia, and thrombocytopenia in accordance with the severity of the disease. Biochemical analysis showed reduced total protein and albumin with elevated blood urea nitrogen, creatinine, ALT, and AST, particularly in severe cases, and these alterations were also in accordance with the severity of the disease. The values of almost all haemato-biochemical parameters were significantly ($p<0.01$) altered from those of healthy controls. These findings highlight the utility of blood and serum biochemical profiling as valuable diagnostic and prognostic tools for timely disease detection and effective management in endemic regions.

Key words: Cattle, Diagnosis, Haematology, Lumpy skin disease, Serum biochemistry.

Ind J Vet Sci and Biotech (2026): 10.48165/ijvsbt.22.1.31

Introduction

Lumpy Skin Disease (LSD) is a serious infectious transboundary infection that affects cattle and buffaloes of all ages and breeds. It is a vector-borne disease with no zoonotic potential. This is an emerging viral disease having important economic significance across the world. LSD is also known as 'Neethling Virus Disease,' 'Pseudo-Urticaria,' 'Exanthema Nodularis Bovis,' and 'Knopvelsiekte,' (Tuppurainen *et al*., 2011, Yadav *et al*., 2024). LSD causes temporary to permanent skin damage characterised by fever, anorexia, lymph node swelling, circumscribed nodules on the skin causing severe emaciation, decreased milk production, and infertility. Overall, it has an impact on the animal's economic value because it affects meat and milk production, hide quality, animal draught power, and reproductive efficiency (abortion and infertility) (Amenu *et al*., 2018; Feyisa, 2018). The disease first appeared in Zambia in 1929 and later spread to the entire African continent, except Libya, Algeria, Morocco, and Tunisia. After nearly 60 years of confinement in Sub-Saharan Africa and Egypt, the disease has spread to Middle Eastern countries (Tuppurainen and Oura, 2012; Tuppurainen *et al*., 2017). Lumpy skin disease was first reported in India in August 2019 in the districts of Mayurbhanj and Bhadrak in Odisha (Sudhakar *et al*., 2020).

Lumpy skin disease virus (LSDV), which causes Lumpy skin disease, is a member of the *Poxviridae* family (Quinn *et al*., 2016). It can survive in desiccated skin crusts for 35 days, necrotic nodules for 33 days, and air-dried hides for at least 18 days. The virus is sensitive to ether (20%), chloroform, formalin (1%), phenol (2% for 15 min), sodium hypochlorite (2-3%), iodine compounds (1:33 dilution), and quaternary ammonium compounds (0.5%) (OIE, 2013). LSD is a disease that affects cattle and Asian water buffaloes (*Bubalus bubalis*). *Bos taurus* breeds with high milk production are more vulnerable than African/Asian indigenous cattle (*Bos indicus*). Asian water buffaloes have a lower morbidity rate, varying from 2 to 45 %. Cattle mortality is typically less than 10%, but it can be higher in certain breeds, age groups, or high milk-producing cows (Tuppurainen *et al*., 2017). Mechanical transmission by vectors is the prime route of the spread of disease. Other routes of spread are through direct or indirect contact, artificial insemination, and iatrogenic cause. The

[1]Department of Veterinary Medicine, College of Veterinary Science and animal Husbandry, Kamdhenu University, Anand-388001, Gujarat, India

[2]Regional Joint Director of Animal Husbandry, Government of Gujarat, Junagadh-261001, India

Corresponding Author: Dr. Jigar B. Raval, Department of Veterinary Medicine, College of Veterinary Sciences and Animal Husbandry, KU, Anand-388001, Gujarat, India. E-mail: jigarraval074@gmail.com

How to cite this article: Raval, J. B., Raval, S. K., Kanani, A. N., & Sadhu, D. B. (2026). Haemato-Biochemical Alterations in Cattle Naturally Infected with Lumpy Skin Disease. Ind J Vet Sci & Biotech, 22(1) 160-164.

Source of support: Nil

Conflict of interest: None

Submitted 25/11/2025 **Accepted** 12/12/2025 **Published** 10/01/2026

virus is found in all infected animals' secretions, including blood, saliva, sperm, nasal discharge, lachrymal discharge and milk, and cutaneous lesions. The virus is not found in urine or faeces (Babiuk *et al*., 2008).

LSD is diagnosed based on typical clinical signs and laboratory confirmation of the presence of the virus or antigen. Early skin biopsies are suitable for histopathology and should be preserved in 10% buffered formalin. The isolation and identification of a virus is required for the confirmation of lumpy skin disease in a new area. The enzyme-linked immunosorbent assay (ELISA) is made by using expressed recombinant antigen to produce P32 monospecific polyclonal antiserum and monoclonal antibodies (MAbs) (Carn et al., 1994). The polymerase chain reaction (PCR) and loop-mediated isothermal amplification (LAMP) assays have been used to detect capripox viruses with greater sensitivity (Bowden et al., 2009). There is currently no effective treatment for LSD. Symptomatic treatment includes anti-inflammatory and antibiotic medications. To control the disease, effective control and prevention measures are required (Tuppurainen et al., 2017). The aim of this study was to describe the haematological and serum biochemical findings associated with natural clinical infection of lumpy skin disease in cattle.

Materials and Methods

Study Population

A total of 175 cattle were included in the study, and were classified into four groups according to normal health or severity of infection based on clinical signs observed (Table 1): Group A included healthy control animals (n=25), Group B was of Mild LSD infection (n=42), Group C: Moderate LSD infection (n=84), and Group D was made of Severe LSD infection (n=24). Diagnosis of LSD was confirmed by clinical examination and, wherever possible, PCR-based molecular identification as per OIE guidelines (OIE, 2021). Molecular diagnosis of LSD was done by PCR method at Gujarat Biotechnology Research Center (GBRC), Gandhinagar.

Table 1: Classification of lumpy skin disease infected animal based on severity of infection

Group	Severity of Infection	Clinical Signs observed
A (n=25)	Healthy Control	Normal healthy without any abnormal sign
B (n=42)	Mild Infection	Fever, eruption of few nodules, swelling of leg
C (n=84)	Moderate Infection	Fever, nodules present over particular region of body, watery nasal discharge, dyspnea
D (n=24)	Severe Infection	Fever, nodules present over whole body, nasal discharge containing mucous, ocular discharge, severe dyspnea, secondary bacterial infection

Fig. 1: Mild infection

Fig. 2: Moderate infection

Fig. 3: Severe infection

Blood collection

Blood samples were collected from all animals aseptically from the jugular vein in EDTA tubes for haematological assessment and serum clot activator vials for serum biochemical analysis.

Haemato-Biochemical Analysis

The haematological parameters measured included haemoglobin (Hb), haematocrit (PCV), red blood cell count (RBC), total leukocyte count (TLC), differential leukocyte count, mean corpuscular volume (MCV), mean corpuscular haemoglobin concentration (MCHC), and platelet count. Analyses were performed using an automated blood cell analyser (Abacus junior Vet-5)

Serum was separated via centrifugation of blood samples at 780 x g for 5 min. Serum biochemical parameters assessed included total protein, albumin, globulin, blood urea nitrogen (BUN), creatinine, alanine transaminase (ALT), and aspartate transaminase (AST) using assay kits on an automated serum clinical chemistry analyser (CKK 300) at Veterinary Clinical Complex of the College as per manufacturer's instructions.

Statistical Analysis

Data were analyzed using SPSS (version 24.0) and expressed as mean ± standard deviation. One-way ANOVA with Tukey's *post-hoc* test was used to compare differences between groups. Statistical significance was set at $p < 0.05$.

Results and Discussion

The present study evaluated haematological and biochemical alterations in cattle naturally infected with lumpy skin disease (LSD) of different severity in relation to healthy control cattle. The findings are presented in Table 2 and 3, respectively. The findings reveal that LSD produces pronounced and statistically significant changes in both haematology and serum biochemical parameters, correlating with the clinical severity of the disease.

In the current study, a statistically significant reduction in haemoglobin concentration (Hb), packed cell volume (PCV), RBC count, and mean corpuscular haemoglobin concentration (MCHC) was detected in LSD-affected cattle. At the same time, a significant rise in mean corpuscular volume (MCV) was recorded (Table 2). These findings were indicative of macrocytic hypochromic anaemia, which was consistent with the observations of Rouby *et al.* (2021) and Keshta *et al.* (2020). The anaemia may arise from the inhibitory effects of systemic inflammation on erythropoiesis, viral-related bone marrow suppression, or blood loss from ulcerative skin lesions. Thrombocytopenia (reduced platelet count) was also evident in diseased animals as per the severity of infection over controls. As suggested in earlier studies, it could point to splenic involvement, increased peripheral destruction of blood cells, or viral-induced bone marrow dysfunction.

A marked leukopenia (decreased total leukocyte count), particularly lymphopenia, was observed in moderate and severely affected groups when compared with mild or controls ($p<0.05$). Elevated neutrophil and eosinophil counts were noted, especially in cattle showing acute inflammatory lesions. The significant reduction in lymphocytes and total leukocytes reflects immunosuppression during active LSD (Table 2). These findings are in agreement with previous reports of Ahmed and Dessouki (2013) and Manjunathareddy *et al.* (2024). Neutrophilia may be interpreted as a physiological

Table 2: Mean (± SE) values of haematological parameters in lumpy skin disease affected cattle

Blood Parameters	Healthy Group-A (n=25)	LSD affected cattle			P value
		Group-B (n=42)	Group-C (n=84)	Group-D (n=24)	
Hb (g/dL)	$9.40^{d} \pm 0.04$	$9.11^{c} \pm 0.03$	$8.72^{b} \pm 0.03$	$8.20^{a} \pm 0.04$	0.000
PCV (%)	$34.54^{b} \pm 0.27$	$34.10^{b} \pm 0.20$	$33.73^{a} \pm 0.16$	$33.32^{a} \pm 0.30$	0.015
RBCs ($\times 10^6$/µL)	$7.82^{d} \pm 0.06$	$7.38^{c} \pm 0.05$	$6.74^{b} \pm 0.03$	$6.25^{a} \pm 0.04$	0.000
WBCs ($\times 10^3$/µL)	$10.01^{d} \pm 0.17$	$8.87^{c} \pm 0.24$	$7.88^{b} \pm 0.05$	$7.03^{a} \pm 0.11$	0.000
Lymphocytes (%)	$55.06^{d} \pm 0.88$	$51.54^{c} \pm 0.50$	$46.73^{b} \pm 0.34$	$43.33^{a} \pm 0.59$	0.000
Monocytes (%)	3.22 ± 0.17	3.10 ± 0.19	2.97 ± 0.21	2.74 ± 0.34	0.734
Neutrophils (%)	$37.79^{a} \pm 0.86$	$41.12^{b} \pm 0.55$	$45.60^{c} \pm 0.42$	$48.87^{d} \pm 0.55$	0.000
Eosinophils (%)	$3.77^{a} \pm 0.13$	$4.07^{a} \pm 0.13$	$4.54^{b} \pm 0.09$	$4.91^{b} \pm 0.16$	0.000
Basophils (%)	0.06 ± 0.01	0.06 ± 0.01	0.06 ± 0.01	0.06±0.01	0.798
MCV (fl)	$45.48^{b} \pm 0.75$	$46.90^{b} \pm 0.82$	$48.79^{a} \pm 0.32$	$50.13^{a} \pm 0.72$	0.000
MCH (pg)	12.33 ± 0.22	12.70 ± 0.40	12.97 ± 0.28	13.38 ± 0.27	0.411
MCHC (g/dL)	$27.62^{d} \pm 0.32$	$26.76^{c} \pm 0.33$	$25.64^{b} \pm 0.14$	$24.79^{a} \pm 0.21$	0.000
PLT ($\times 10^5$/µL)	261.92d ± 4.70	$218.93^{c} \pm 2.56$	$195.04^{b} \pm 1.76$	$173.38^{a} \pm 1.83$	0.000

$p<0.01$) = highly significant, $p<0.05$ = significant, $p>0.05$= non-significant.

Means with uncommon superscripts within the row (a,b,c,d) differ significantly($p<0.05$).

stress response and an indicator of acute inflammation, while eosinophilia can be attributed to tissue injury and hypersensitivity reactions often seen in viral dermatoses.

Analysis of serum biochemical parameters further indicated that total protein and albumin concentrations were significantly reduced in LSD-affected cattle as per the severity of the disease. While globulin concentration was lower, it did not reach statistical significance (Table 3). The hypoproteinemia and hypoalbuminemia most likely reflect hepatic dysfunction, malnutrition due to poor feed intake, or increased catabolism, as has been described by Manjunathareddy et al. (2024) and El-hamed and Ali (2017).

Blood urea nitrogen (BUN), creatinine, alanine transaminase (ALT), and aspartate transaminase (AST) levels were significantly elevated in affected animals, with the highest values observed in severe clinical cases (Group D) followed by moderate (Group C) and mildly infected (Group B) ones, and the lowest values were noted in healthy controls (Group A). The values of all the parameters in all these groups differed significantly from one another (Table 3). The elevation in BUN and creatinine signifies renal involvement and possible dehydration, in concurrence with reports by Sevik *et al*. (2016) and Adamu *et al*. (2024). The increase in ALT and AST underlines hepatocellular injury and generalized tissue damage, which are recognized pathological events in capripox virus infections (Liang *et al*., 2022; Neamat-Allah, 2015).

The degree of alteration in these parameters directly corresponded with the clinical group and disease progression, with severe group animals (Group D) exhibiting the most pronounced deviations. This association highlights the clinical relevance of these blood markers in gauging disease severity and monitoring therapeutic response, aligned with findings from other endemic countries. Present investigation confirms previous literature that LSD in cattle is characterized by significant haematological and biochemical disturbances, many of which can serve as practical diagnostic and prognostic indicators. Routine blood and serum biochemical profiling should be integrated into the clinical evaluation and management of LSD to facilitate prompt diagnosis, monitor progression, and optimize therapeutic interventions.

Conclusion

This study demonstrates that LSD in cattle leads to profound haematological and biochemical changes, including leukopenia, anaemia, thrombocytopenia, and hepatic/renal dysfunction. Severity of alterations is proportional to clinical presentation, highlighting the value of these laboratory measures in diagnosis, monitoring, and case management. Routine blood and serum analysis, integrated with clinical assessment, can improve detection, guide treatment, and ultimately reduce disease impact in cattle populations.

Acknowledgement

The authors gratefully acknowledge the support and cooperation of the Department of Veterinary Medicine and Veterinary Clinical Complex, College of Veterinary Sciences and Animal Husbandry, KU, Anand for providing the necessary facilities and technical guidance. The authors also acknowledge the Gujarat Biotechnology Research Center (GBRC), Gandhinagar for providing access to PCR equipment and support essential for the molecular diagnosis in this study. We thank the staff and field veterinarians for their assistance in sample collection and data recording. Special thanks are extended to all cattle owners for their valuable participation and cooperation.

References

Adamu, K., Abayneh, T., Getachew, B., Mohammed, H., Deresse, G., Zekarias, M., ... & Gelaye, E. (2024). Lumpy skin disease virus isolation, experimental infection, and evaluation of disease development in a calf. *Scientific Reports*, *14*(1), 20460.

Ahmed, A.M., & Dessouki, A.A. (2013). Clinical, haematologic, and biochemical studies on cattle naturally infected with lumpy skin disease. *Veterinary World*, *6*(6), 279-282.

Amenu, A., Bekuma, F., Abafaji, G., & Abera, D. (2018). Review on epidemiological aspects and economic impact of lumpy skin disease. *Journal of Dairy and Veterinary Science*, *7*(4), 555-716.

Babiuk, S., Bowden, T.R., Boyle, D.B., Wallace, D.B., & Kitching, R.P. (2008). Capripoxviruses: An emerging worldwide threat to sheep, goats, and cattle. *Transboundary and Emerging Diseases, 55*(7), 263-272.

Table 3: Mean (±SE) values of serum biochemical parameters in LSD-affected cattle

Serum Parameters	Control Group-A (n=25)	LSD affected cattle			P value
		Group-B (n=42)	Group-C (n=84)	Group-D (n=24)	
Total protein (g/dL)	7.35^{d}±0.78	6.95^{c}±0.59	6.58^{b}±0.45	5.91^{a}±0.84	0.00
Albumin (g/dL)	3.86^{d}±0.59	3.51^{c}±0.46	3.22^{b}±0.02	2.66^{a}±0.06	0.00
Globulin (g/dL)	3.48±0.51	3.44±0.48	3.36±0.43	3.25±0.51	0.217
BUN (mg/dL)	15.40^{a}±0.36	17.17^{b}±0.22	18.22^{c}±0.16	18.54^{c}±0.29	0.00
Creatinine (mg/dL)	1.30^{a}±0.05	1.41^{b}±0.03	1.68^{c}±0.02	1.83^{d}±0.03	0.00
ALT (IU/L)	23.47^{a}±1.20	26.55^{b}±0.75	30.81^{c}±0.36	35.72^{d}±0.53	0.00
AST (IU/L)	51.45^{a}±0.73	69.39^{b}±0.91	79.67^{c}±0.60	104.91^{d}±2.54	0.00

Bowden, T.R., Coupar, B.E., Babiuk, S.L., White, J.R., Boyd, V., Duch, C.J., & Boyle, D.B. (2009). Detection of antibodies specific for sheep pox and goat pox viruses using recombinant capripoxvirus antigens in an indirect enzyme-linked immunosorbent assay. *Journal of Virological Methods*, *161*(1), 19-29.

Carn, V.M., Kitching, R.P., Hammond, J.M., & Chand, P. (1994). Use of a recombinant antigen in an indirect ELISA for detecting bovine antibody to capripoxvirus. *Journal of Virological Methods*, *49*(3), 285-294.

El-hamed, A.H.A., & Ali, M.M. (2017). Clinical, haematological and biochemical findings in cattle naturally infected with lumpy skin disease. *Alexandria Journal of Veterinary Sciences, 54*(1), 173-181.

Feyisa, A.F. (2018). A case report on clinical management of lumpy skin disease in a bull. *Journal of Veterinary Science Technology*, *9*(3), 538.

Keshta, H.G., Allam, A.M., Fadl, S.E., & El Beskawy, M. (2020). Detection of lumpy skin disease during an outbreak in summer 2019 in Menoufia Governorate, Egypt using clinical, biochemical and molecular diagnosis. *Zagazig Veterinary Journal*, *48*(4), 378-389.

Liang, Z., Lin, S., Deng, Q., *et al.* (2022). Research advances on lumpy skin disease: Epidemiology, pathogenesis, and novel diagnosis and control strategies. *Viruses*, *14*(5), 1085.

Manjunathareddy, G.B., Rathinam, T., Elangovan, R., *et al.* (2024). Pathological, immunological and molecular study on lumpy skin disease outbreak in cattle. *Veterinary Research Communications*, *48*(1), 173-184.

Neamat-Allah, A.N. (2015). Immunological, haematological, biochemical, and histopathological studies on cows naturally infected with lumpy skin disease. *Veterinary World*, *8*(9), 1131.

OIE (2013). World Organization for Animal Health. Lumpy Skin Disease. Technical Disease Card

OIE (2021). *Lumpy skin disease*. Manual of Diagnostic Tests and Vaccines for Terrestrial Animals (pp. 1–17).

Quinn, P.J., Markey, B.K., Leonard, F.C., FitzPatrick, E.S., & Fanning, S. (2016). *Concise Review of Veterinary Microbiology*. 2nd edn., Chicheser, West Sussex, UK; Ames, Iowa: John Wiley & Sons, Inc.

Rouby, S.R., Shehata, O., Abdel-Moneim, A.S., Hussein, K.H., & Mahmoud, M.M. (2021). Lumpy skin disease in calves: The association between clinical signs and biochemical alterations. *Advances in Animal and Veterinary Sciences*, *9*(11), 1863-1868.

Şevik, M., Avci, O., Doğan, M., & İnce, Ö.B. (2016). Serum biochemistry of lumpy skin disease virus-infected cattle. *BioMed Research International*, *2016,* 1-6.

Sudhakar, S.B., Mishra, N., Kalaiyarasu, S., Jhade, S.K., Hemadri, D., Sood, R., & Singh, V.P. (2020). Lumpy skin disease (LSD) outbreaks in cattle in Odisha state, India in August 2019: Epidemiological features and molecular studies. *Transboundary and Emerging Diseases*, *67*(6), 2408-2422.

Tuppurainen, E.S.M., & Oura, C.A.L. (2012). Lumpy skin disease: an emerging threat to Europe, the Middle East, and Asia. *Transboundary and Emerging Diseases*, *59*(1), 40-48.

Tuppurainen, E.S., Stoltsz, W.H., Troskie, M., Wallace, D.B., Oura, C.A.L., Mellor, P.S., & Venter, E.H. (2011). A potential role for ixodid (hard) tick vectors in the transmission of lumpy skin disease virus in cattle. *Transboundary and Emerging Diseases*, *58*(2), 93-104.

Tuppurainen, E., Alexandrov, T., & Beltrán-Alcrudo, D. (2017). Lumpy skin disease - A manual for veterinarians. *FAO Animal Production and Health Manual*, *20,*1-60.

Yadav, P., Kumar, A., Nath, S.S., Devasurmutt, Y., Shashidhar, G., Joshi, M., & Tatu, U. (2024). Unravelling the genomic origins of lumpy skin disease virus in recent outbreaks. *BMC Genomics*, *25*(1), 196.