

Clinical Management of Sheep Pox in a Balami Ewe Using Radix Isatidis Polysaccharide Extract (Radixnor®): A Case Report

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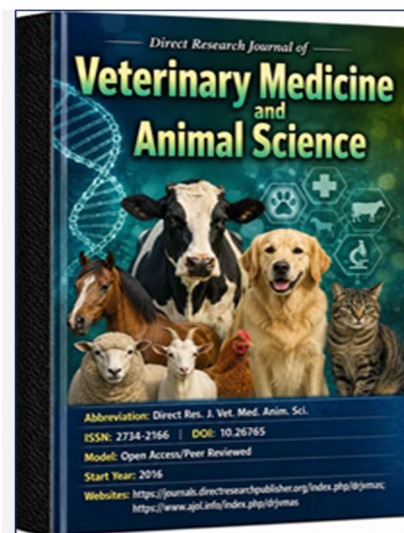
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ABSTRACT

Sheep pox is an economically important, highly contagious, notifiable viral disease of small ruminants caused by sheep pox virus (SPPV), a member of the genus Capripoxvirus, family Poxviridae. The aim of this report is to document the clinical presentation, haematological findings, diagnosis and supportive management of a naturally occurring case of sheep pox in a 3-year-old, 49.4 kg Balami ewe presented to the Large Animal Clinic of the Veterinary Teaching Hospital, University of Jos, with a chief complaint of generalised nodular skin lesions of a few days' duration. The ewe was recently introduced into an intensively managed, unvaccinated flock. Physical examination revealed pyrexia (41.0°C), generalised cutaneous nodules, oral lesions, congested ocular mucous membranes and enlarged submandibular and prescapular lymph nodes. A tentative diagnosis of sheep pox was made on history and clinical grounds, with contagious ecthyma (orf) considered as the principal differential; the diagnosis was subsequently confirmed by PCR of a skin nodule biopsy. Pre-therapeutic haematology revealed a marked leukopenia (total white blood cell count $0.50 \times 10^9/L$) with neutropenia and lymphopenia, while parasitological examination was negative for haemoparasites and gastrointestinal parasites. The ewe was managed with intramuscular Radix isatidis polysaccharide extract (Radixnor®, 50 mg/kg every 24 h for 5 days; empirical dose) as an antiviral/immunomodulatory agent, alongside diclofenac (1 mg/kg every 24 h for 3 days) for its antipyretic-analgesic action and vitamin B-complex (10 mg/kg every 24 h for 3 days) as a haematinic/metabolic supportive agent. Following treatment, clinical signs resolved, the leukogram recovered (total white blood cell count $10.25 \times 10^9/L$ with restoration of neutrophil and lymphocyte populations), and the ewe was successfully reintegrated into the flock in good body condition. This case describes the use of Radix isatidis polysaccharide as a plant-derived immunomodulatory adjunct in the management of sheep pox in a resource-limited veterinary setting. Because the case was uncontrolled and spontaneous recovery is possible, efficacy cannot be inferred, and controlled studies are warranted.

Keywords: Sheep pox; Capripoxvirus; Balami sheep; Radix isatidis polysaccharide; leukopenia; immunomodulation; case report; Nigeria



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INTRODUCTION

Sheep pox represents a significant threat to global small ruminant production, causing substantial economic losses through high morbidity and mortality rates, as well as trade restrictions. These transboundary infections are particularly devastating in endemic regions, where they compromise animal welfare and hinder the sustainability of pastoral production systems (Sarkar et al., 2025). As a member of the genus *Capripoxvirus*, the pathogen typically manifests through severe systemic symptoms, including persistent pyrexia, respiratory distress, and characteristic cutaneous lesions that lead to secondary complications (Hussaini et al., 2025b; Odoom et al., 2025; Oreiby et al., 2022). In naïve populations, the disease frequently presents with high morbidity and mortality, often resulting in fatal outcomes particularly among susceptible or newly introduced animals (Boumart et al., 2016). Furthermore, viral outbreaks frequently exacerbate economic burdens due to the high costs associated with both emergency vaccination efforts and the potential for treatment failure (Rawlins et al., 2021). Although vaccination remains the primary preventive strategy to mitigate such losses (Darwish et al., 2024), identifying effective therapeutic interventions for symptomatic animals is crucial for clinical management in resource-limited environments (Swamy et al., 2024; Malmarugan et al., 2015).

Sheep pox is an acute to subacute, highly contagious, transboundary viral disease of sheep caused by sheep pox virus (SPPV), one of three closely related species within the genus *Capripoxvirus* (family Poxviridae) alongside goat pox virus (GTPV) and lumpy skin disease virus (LSDV) of cattle. The disease is enzootic across large parts of Africa, the Middle East and Asia and is listed as notifiable by the World Organisation for Animal Health because of the severe economic losses it inflicts through mortality, reduced productivity, hide and wool damage, and restriction of livestock trade (Karakurt et al., 2023). The genus *Capripoxvirus* produces systemic, multi-organ disease characterised by pyrexia, generalised cutaneous nodules, oculonasal discharge, lymphadenopathy and, in severe cases, pulmonary involvement and death (Zewdie et al., 2021); morbidity in naïve flocks may approach 75–100% with case fatality rates ranging from 10–85% depending on strain virulence, breed susceptibility and management factors; in contrast, mortality of about 5–10% has been reported in adult sheep and 50–80% in lambs (Azanbekova et al., 2025).

Sheep pox has long been recognised in Nigeria. Early transmission and electron-microscopic studies confirmed the presence of the virus in the country (Asagba and Nawathe 1981), and it is now understood to be endemic across several northern states, where seroprevalence and outbreak studies have identified the introduction of new animals into a flock, and a prior flock history of the disease, as key risk factors for exposure (Adedeji et al., 2021). These same risk factors — the recent introduction of a new

ewe into an intensively managed, unvaccinated flock — were present in the case described here. Field reports of sheep pox outbreaks in Nigeria continue to be documented (Emmanuel et al., 2026. and Husaini et al., 2025), underscoring the disease's ongoing clinical and economic relevance to small-ruminant production in the region.

Diagnosis in the field is largely clinical, based on history, characteristic cutaneous and mucosal lesions, and exclusion of differentials such as contagious ecthyma (orf), caused by a parapoxvirus and typically confined to proliferative labial, oral and interdigital lesions without the marked generalised nodular pattern or the degree of systemic illness seen in sheep pox. Confirmatory diagnosis relies on laboratory techniques such as real-time PCR, virus isolation, electron microscopy and serology, which are frequently unavailable in resource-limited field and teaching-hospital settings, making a sound clinical work-up essential.

Management of sheep pox is predominantly supportive, since no specific antiviral drug is licensed for sheep pox virus infection; control instead relies on vaccination, movement restriction and vector control (Tesgera et al., 2018). There is, however, growing interest in adjunctive phytotherapeutic agents with antiviral and immunomodulatory properties. Radix isatidis (Banlangen), the dried root of *Isatis indigotica/Isatis tinctoria*, is a traditional Chinese herbal medicine long used for its 'heat-clearing and detoxifying' properties (We & Zhang, 2013). Its major bioactive fraction, Radix isatidis polysaccharide (RIP), has been shown in vitro and in vivo to exert antiviral activity against several DNA and RNA viruses of veterinary importance including pseudorabies virus in swine testicle cells and QX-genotype infectious bronchitis virus in chickens and to enhance innate and adaptive immune responses through toll-like receptor-4 (TLR-4)/NF- κ B and MDA5/TLR3/IRF7 signalling, macrophage activation, and increased release of nitric oxide, TNF- α , IL-6, IFN- γ and IL-10 (Tong et al., 2020; Xiang et al., 2023; Wei et al., 2021).

These effects were demonstrated against an alphaherpesvirus (pseudorabies virus) and an RNA coronavirus (infectious bronchitis virus); their relevance to capripoxviruses, which are large cytoplasmic DNA viruses, has not been established and remains hypothetical. RIP-based products are marketed as antiviral/immunostimulant adjuncts for livestock, although published clinical case documentation in small ruminants, and specifically in sheep pox, remains limited. The aim of this report is to document the clinical presentation, laboratory findings (including a marked leukopenia) and clinical outcome of a PCR-confirmed case of naturally occurring sheep pox managed with Radixnor® (Radix isatidis polysaccharide) as the primary adjunctive antiviral/immunomodulatory agent, supported by an anti-inflammatory/antipyretic and a haematinic vitamin supplement.

Case Presentation

Signalment and History

On 12 June 2026, a 3-year-old Balami ewe weighing 49.4 kg from a flock of five sheep was presented to the Large Animal Clinic of the Veterinary Teaching Hospital (VTH), University of Jos, with a chief complaint of nodular lesions on the body. The lesions had been noticed a few days prior to presentation, with no medical intervention offered before referral. Further history revealed that the ewe had been newly purchased from open market with no vaccination and deworming history, was not pregnant or lactating and introduced into the flock, which was managed intensively and fed maize bran and bean husks. No vaccination record was available for the other flock members and were apparently healthy.

Physical Examination

On physical examination, the ewe was pyrexia, with vital parameters summarized in (Table 1). The body condition score was 2.5 in a scale 5, normal hydration status, mucous membrane colour was pinkish, normal rumen motility and generalised nodular lesion of various stages, sizes colour.

Table 1: Patient's vital parameters on the day of presentation.

Parameter	Patient's value	Reference range
Temperature (°C)	41.0	38–40
Pulse rate (beats/min)	80	65–90
Respiratory rate (cycles/min)	26	15–30

Reference range: Hassan and Hassan (2003).

Clinical Findings

Generalised nodular lesions were distributed over the skin of the trunk and limbs (Plate 1A), while discrete papular and pustular lesions with erosion and haemorrhagic crusting were present on the muzzle and oral commissures (Plate 1B). Generalised nodular lesions are not commonly seen in peste des petits ruminants (PPR). In addition to pyrexia and the cutaneous and oral lesions, the ewe presented with congestion of the bilateral ocular mucous membranes and enlargement of the submandibular and prescapular lymph nodes.

Differential Diagnosis

Sheep pox and contagious ecthyma (orf) were considered as the principal differentials on account of the papulo-nodular/pustular skin and oral lesions. Contagious ecthyma, caused by orf virus (genus Parapoxvirus), typically produces proliferative, wart-like scabby lesions localised to the lips, muzzle, oral commissures and, occasionally, the interdigital space, with affected animals

usually remaining otherwise systemically well; leukocytosis and lymphocytosis rather than leukopenia have been documented in confirmed orf cases (Saad et al., 2017; Baraya et al., 2022). In contrast, the generalized distribution of nodular lesions over the trunk and limbs, the degree of pyrexia, and the systemic lymphadenopathy observed in this ewe were considered more consistent with sheep pox (Emmanuel et al., 2026), a systemic capripoxvirus infection with multi-organ tropism, than with the largely localised, mucocutaneous presentation of contagious ecthyma. Peste des petits ruminants (PPR) and bluetongue, which can also cause pyrexia, oral lesions and leukopenia in sheep, were considered less likely because generalized nodular skin lesions are not typical of either disease and the PCR for sheep pox virus was positive.

Tentative Diagnosis

Based on the history, clinical presentation and differential exclusion above, a tentative diagnosis of sheep pox was made.

Diagnostic and Management Plan

Blood was collected in EDTA anticoagulant sample bottle and submitted to the Clinical Pathology Laboratory for a complete manual blood count immediately after blood sample collection. Blood and faecal samples were also submitted to the Parasitology Laboratory for haemoparasite and ova/oocyst screening, respectively, to rule out concurrent parasitic disease as a contributor to the clinical presentation. Skin nodule biopsy was collected and sent to Virology Division of National Veterinary Research Institute for PCR confirmatory test on the same day of presentation. Conventional PCR assay targeting RNA polymerase subunit-30ka (RPO30) gene of the virus was used. The result came out one day after the last treatment.

Laboratory Results

Pre-therapeutic haematology (Table 2) revealed a markedly reduced total white blood cell count with neutropenia and lymphopenia (eosinophil and monocyte counts were within reference limits), consistent with a virally induced leukopenia (Emmanuel et al., 2026). Packed cell volume was within reference limits. Parasitological examination showed no ova, oocysts or helminth larvae on simple flotation and sedimentation analyses, and no haemoparasites were observed on a Giemsa-stained thin blood smear, effectively ruling out concurrent gastrointestinal parasitism or haemoparasitic infection as causes of the presenting signs. PCR of the skin nodule biopsy was positive for sheep pox virus, confirming the diagnosis.



Plate 1: The ewe on the day of presentation. (A) Generalised nodular lesions on the body; (B) Oral/muzzle lesions with erosion and haemorrhagic crusting.

Table 2: Pre-therapeutic Haemogram.

Parameter	Patient's value	Reference range
PCV (%)	40.0	27.00–45.00
Total WBC ($\times 10^9/L$)	0.50	4.00–8.00
Segmented neutrophils ($\times 10^9/L$)	0.22	0.70–6.00
Band neutrophils ($\times 10^9/L$)	0.06	Rare
Lymphocytes ($\times 10^9/L$)	0.14	2.00–9.00
Eosinophils ($\times 10^9/L$)	0.04	0.00–0.10
Monocytes ($\times 10^9/L$)	0.04	0.00–0.75
Basophils ($\times 10^9/L$)	0.00	0.00–0.30

Reference values: Hassan and Hassan (2003).

Table 3: Treatment protocol.

Drug	Dose	Route	Frequency/Duration
Radixnor® (Radix isatidis polysaccharide, 500 mg/ml)	50 mg/kg (5 ml)	IM	Once daily $\times$ 5 days
Diclofenac (25 mg/ml)	1 mg/kg (2 ml)	IM	Once daily $\times$ 3 days
Vitamin B-complex (100 mg/ml)	10 mg/kg (5 ml)	IM	Once daily $\times$ 3 days

Table 4: Post-therapeutic haemogram

Parameter	Patient's value	Reference range
PCV (%)	41.0	27.00–45.00
Total WBC ($\times 10^9/L$)	10.25	4.00–8.00
Segmented neutrophils ($\times 10^9/L$)	4.61	0.70–6.00
Band neutrophils ($\times 10^9/L$)	0.51	Rare
Lymphocytes ($\times 10^9/L$)	5.02	2.00–9.00
Eosinophils ($\times 10^9/L$)	0.10	0.00–0.10
Monocytes ($\times 10^9/L$)	0.00	0.00–0.75
Basophils ($\times 10^9/L$)	0.00	0.00–0.30

Reference values: Hassan and Hassan (2003).

Management

On the basis of the tentative diagnosis, the following treatment regimen was instituted:

Radixnor® (Batch No: N20250722, Expiry Date: 07/2029, NAFDAC Reg. No: A9-101583. For Veterinary Use) was administered as the primary antiviral/immunomodulatory agent empirically, at a dose for which no ruminant pharmacokinetic or dose-finding data exist; diclofenac provided antipyretic and anti-inflammatory/analgesic support to address the pyrexia and lesion-associated discomfort; and vitamin B-complex was given as a haematinic and metabolic supportive supplement during the acute illness. No antibiotics were required, as there was no clinical evidence of secondary bacterial infection (Table 3).

Post-therapeutic Haemogram

The complete blood count repeated following completion of therapy (Table 4) showed marked improvement, with the neutrophil and lymphocyte counts returning to within reference limits, the total white blood cell count ($10.25 \times 10^9/L$) rising slightly above the quoted reference interval, and a mild residual band neutrophilia ($0.51 \times 10^9/L$), indicative of resolution of the leukopenia and recovery of total and differential leukocyte counts, with a mild residual band neutrophilia.

Outcome

Clinical signs resolved progressively over the course of treatment, with regression of the skin nodules, healing of the oral lesions, and resolution of pyrexia and lymphadenopathy. The ewe regained a bright, alert demeanour and was successfully reintegrated into the flock (Plate 2), maintaining good body condition at follow-up 2 days after the last dose. The flock members were not showing any apparent illhealth during the follow-up. Post-therapeutic haemogram was performed that same day. The State veterinary authorities were notified as required by Law.



Plate 2: The ewe (foreground) at follow-up, reintegrated into the flock, showing resolution of cutaneous lesions and restored body condition.

DISCUSSION

The signalment, history and clinical presentation in this case were characteristic of sheep pox, and the diagnosis was confirmed by PCR. The recent introduction of the ewe into an intensively managed, unvaccinated flock reflects a well-documented risk pathway for capripoxvirus exposure in Nigerian small-ruminant systems, where the introduction of new animals and a prior flock history of the disease have both been identified as significant risk factors for sheeppox/goatpox seropositivity (Adedeji et al., 2021). The pattern of generalised nodular skin lesions together with oral involvement, pyrexia, conjunctival congestion and regional lymphadenopathy is consistent with descriptions of sheep pox from Nigeria and elsewhere in Africa, where pyrexia in the range of 39.5–41°C, skin eruptions and lymphadenopathy are commonly reported at presentation (Hussaini et al., 2025b).

Contagious ecthyma was considered the main differential because of the shared involvement of oral and muzzle tissue; however, orf is typically localised to the lips, muzzle and interdigital skin with proliferative rather than truly generalised nodular lesions (Teshale, 2018), and haematological studies of confirmed orf cases have reported leukocytosis and lymphocytosis (Saad et al., 2017; Baraya et al., 2022) rather than the marked leukopenia observed in the present case, further supporting the clinical distinction made here. In field settings without ready access to PCR, electron microscopy or virus isolation the recognised confirmatory methods for capripoxvirus infection (Hassanien et al., 2021) a carefully reasoned clinical diagnosis of this kind, based on lesion distribution, systemic signs and exclusion of parasitic causes, remains the mainstay of case management, as similarly practised in other reported Nigerian field cases of sheep pox (Bida et al., 2021).

The pre-therapeutic haemogram in this case was notable for a marked leukopenia involving neutrophils and lymphocytes (Emmanuel et al., 2026) rather than the neutrophilic leukocytosis more typically associated with bacterial infection or generalised inflammatory disease. Leukopenia has been documented in viral infections of ruminants; for example, naturally occurring lumpy skin disease virus infection in cattle caused by a closely related capripoxvirus — has been associated with leukopenia alongside thrombocytopenia and evidence of oxidative stress, while other sheep pox virus studies have instead reported leukocytosis with elevated pro-inflammatory cytokines, illustrating that the haematological response to capripoxvirus infection can vary with the stage of disease, strain virulence and host factors at the time of sampling. Darwish et al. (2025) reported anaemia and leukocytosis in Egyptian Barki ewes with sheep pox, and Emmanuel et al. (2026) reported significantly lower PCV in Nigerian sheep with pox lesions; the severe leukopenia with a normal PCV in the present ewe differs from both. Experimental bluetongue virus infection of sheep produced leukopenia between 2 and 7 days post infection

followed by leukocytosis (Khorajiya et al., 2019), so co-infection or the stage of sampling cannot be excluded. In the present case, the profound reduction in neutrophil and lymphocyte counts observed early in the clinical course could reflect, as untested hypotheses, virus-associated bone marrow suppression and peripheral leukocyte sequestration/margination into the heavily affected skin and oronasal tissues, which are recognized sites of intense capripoxvirus replication. These explanations are speculative. Marked leukopenia is also a recognised feature of other viral diseases of small ruminants, notably bluetongue and peste des petits ruminants (PPR). The generalised nodular lesions and the positive sheep pox virus PCR favour sheep pox as the primary diagnosis, but PPR virus and bluetongue virus were not tested for, so concurrent infection cannot be excluded.

Following the institution of therapy with Radixnor® (Radix isatidis polysaccharide), diclofenac and vitamin B-complex, the total white blood cell count rose from $0.50 \times 10^9/L$ to $10.25 \times 10^9/L$, with restoration of segmented neutrophil and lymphocyte populations and clinical resolution of lesions. While a single, uncontrolled clinical case cannot establish causality, this pattern is consistent with the immunomodulatory and antiviral properties attributed to Radix isatidis polysaccharide (RIP) in the pharmacological literature. However, sheep pox can resolve spontaneously, and case fatality in endemic areas is often low (Zewdie et al., 2021); the recovery observed here may therefore simply reflect the natural course of the disease, and no benefit of Radixnor® can be inferred without a control group. In vitro and in vivo studies have shown that RIP enhances macrophage activation and nitric oxide release, up-regulates toll-like receptor-4 (TLR-4) expression, and increases secretion of TNF- α , IL-6, IFN- γ and IL-10, thereby improving both innate and adaptive immune function (Wei et al., 2021). In poultry, RIP pretreatment reduced infectious bronchitis virus-induced kidney damage and viral load via activation of the MDA5/TLR3/IRF7 innate antiviral signalling pathway (Xiang et al., 2023) and, in an experimental model of gouty arthritis, inhibited inflammasome (including NLRP3) activation, leading to anti-inflammatory effects (Ren et al., 2022). Direct antiviral activity of RIP has also been demonstrated against pseudorabies virus in swine testicle cells, where the polysaccharide inhibited viral replication, prevented cellular infection and exerted virucidal effects in a concentration-dependent manner (Tong et al., 2020). These converging lines of evidence spanning enhanced innate antiviral signalling, cytokine-mediated immune activation, and direct virucidal/replication-inhibitory effects provide, at most, a hypothetical rationale for the haematological recovery and clinical resolution observed in this ewe following Radixnor® therapy, complementing the antipyretic/analgesic support provided by diclofenac and the metabolic support from vitamin B-complex. These mechanisms were demonstrated against non-poxvirus

pathogens in other species and have not been shown for capripoxviruses, so their relevance to sheep pox remains hypothetical. The 50 mg/kg dose used here was empirical, as no pharmacokinetic or dose-finding data exist for ruminants. This case adds to a limited body of field-level clinical documentation on the use of Radix isatidis polysaccharide extracts in ruminant viral disease management, extending observations previously reported mainly in poultry and swine, to a naturally occurring case of sheep pox in a sheep. Given the endemicity of sheep pox in Nigeria (Rawlins et al., 2021) and the practical constraints on confirmatory diagnostics and specific antiviral therapy in many field settings, plant-derived immunomodulatory agents such as RIP may represent a useful, accessible adjunct to supportive care. Nonetheless, the findings reported here are limited by the single-case, uncontrolled design, the absence of a control for spontaneous recovery, the empirical dose, the absence of blood biochemistry and of a repeat PCR to show viral clearance, the absence of virus isolation or sequencing, the lack of testing for other viral causes of leukopenia (PPR and bluetongue), and the concurrent use of an NSAID and vitamin supplementation, which precludes attribution of the observed recovery to Radixnor® alone. Controlled clinical studies with confirmatory virological diagnosis and comparison groups are warranted to more rigorously evaluate the efficacy of Radix isatidis polysaccharide in the management of capripoxvirus infections of small ruminants.

Conclusion

A PCR-confirmed case of naturally occurring sheep pox in a Balami ewe, presenting with generalised nodular skin lesions, oral lesions, pyrexia and lymphadenopathy alongside marked leukopenia, recovered after treatment with Radixnor® (Radix isatidis polysaccharide) as an antiviral/immunomodulatory agent, supported by diclofenac and vitamin B-complex. Clinical resolution was accompanied by recovery of the leukogram. A causal role for Radixnor® cannot be established in this uncontrolled case, in which spontaneous recovery is possible; the outcome was merely consistent with the immunostimulatory and antiviral properties reported for Radix isatidis polysaccharide in other livestock species (Wei et al., 2021), although such effects have not been demonstrated for capripoxviruses. This case supports further investigation of RIP-based products as an adjunctive treatment option for sheep pox and other capripoxvirus infections, particularly in endemic, resource-limited settings where specific antiviral therapy and confirmatory diagnostics are not readily accessible. Clinicians should consider testing for co-infection when sheep pox presents with severe leukopenia, repeat the leukogram, and report suspected cases to the veterinary authorities.

Consent

Informed consent for clinical management, diagnostic sampling and use of case details and photographs for academic/case-report purposes was obtained from the flock owner.

Conflict of Interest

The authors declare no conflict of interest in the preparation of this report. Radixnor® was supplied or sponsored by its manufacturer.

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