BULETIN VETERINER UDAYANA

pISSN 2085-2495
eISSN 2477-2712

Received: 25 October 2025; Accepted: 23 November 2025; Published: 1 December 2025

LUMPY SKIN DISEASE AND ITS IMPACT ON REPRODUCTION AND PRODUCTION IN CATTLE: A LITERATURE REVIEW

Lumpy Skin Disease dan Dampaknya terhadap Reproduksi dan Produksi pada Sapi: Tinjauan Literatur

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How to cite: Prasetyo BP, Aprilia L, Sugesti M. 2025. Lumpy Skin Disease and its impact on reproduction and production in cattle: A literature review. *Bul. Vet. Udayana*. 17(6): 1781-1788. DOI: https://doi.org/10.24843/bulvet.2025.v17.i06.p01

Abstract

Lumpy Skin Disease (LSD) is a emerging infectious disease in cattle caused by the Lumpy Skin Disease Virus (LSDV) from the *Capripoxvirus* genus. The LSD is a severe infectious disease that has significant clinical and economic impacts on the cattle industry worldwide, and has spread to most Asian countries, especially Southeast Asia. Clinical symptoms include fever, skin nodules (with diameter ranging 0.5–5 cm, emaciation, enlarged lymph nodes, and in some fatal cases, death. The disease is spread by various vectors, such as ticks, mosquitoes, and certain flies. This literature review aimed to summarize scientific knowledge about LSD and its impact on livestock reproduction and production performance. The method used is a systematic literature review of academic databases, such as PubMed, Google Scholar, ResearchGate). The LSD causes significant economic losses due to reduced milk production, skin damage, and weight loss. Reproductive impacts include estrus failure or disorders, repeat breeding, abortion, endometritis, and infertility in bulls. The LSDV virus can persist in the testes, and viral DNA has been found in semen, potentially spreading the disease through artificial insemination. In conclusion, LSD has significant economic impacts due to reduced reproductive and production performance in cattle, threatening the sustainability of livestock business. Enhancements in disease management are needed via improved vaccination strategies and regulated vector control.

Keywords: Cattle, Lumpy Skin Disease, Production, Reproduction

Abstrak

Lumpy Skin Disease (LSD) adalah penyakit menular baru pada sapi yang disebabkan oleh *Lumpy Skin Disease Virus* (LSDV) dari genus *Capripoxvirus*. Penyakit ini merupakan penyakit infeksius parah yang memiliki dampak klinis dan ekonomi signifikan pada bisnis sapi di seluruh dunia, dan telah menyebar ke sebagian besar negara Asia, terutama Asia Tenggara. Gejala klinisnya meliputi demam, benjolan kulit atau nodul berdiameter 0,5–5 cm, kekurusan, pembesaran kelenjar getah bening, dan dalam beberapa kasus dapat menyebabkan kematian. Penyakit ini disebarkan oleh berbagai vektor, seperti kutu, nyamuk, dan lalat tertentu. Tinjauan literatur ini bertujuan merangkum pengetahuan ilmiah mengenai LSD dan

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dampaknya. terhadap performa reproduksi dan produksi sapi. Metode yang digunakan adalah tinjauan literatur sistematis dari basis data akademik seperti PubMed, Google Scholar, ResearchGate. Penyakit ini menyebabkan kerugian ekonomi yang besar akibat penurunan produksi susu, kerusakan kulit, dan penurunan bobot badan. Dampak reproduksi mencakup kegagalan estrus/gangguan estrus, kawin berulang, abortus, endometritis, dan kemandulan pada sapi jantan. Virus LSDV dapat bertahan di testis, dan DNA virus ditemukan dalam semen, berpotensi menyebarkan penyakit melalui inseminasi buatan. Kesimpulannya, LSD menghasilkan dampak ekonomi yang signifikan karena penurunan performa reproduksi dan produksi pada sapi, sehingga mengancam keberlanjutan usaha peternakan. Pengendalian penyakit harus ditingkatkan melalui optimalisasi vaksinasi dan pengelolaan vektor secara terkontrol.

Kata kunci: Sapi, *Lumpy Skin Disease*, Produksi, Reproduksi

INTRODUCTION

Lumpy skin disease (LSD) is a contagious viral infection caused by the Lumpy Skin Disease Virus (LSDV), belonging to the genus *Capripoxvirus*, subfamily *Chordopoxvirinae*, family *Poxviridae*. It is known by several names, including "LSD," "Pseudo-urticaria," "Neethling virus disease," "exanthema nodularis bovis," and "knopvelsiekte" (Gupta *et al.*, 2020). The disease is characterized by fever and the development of numerous, well-defined to coalescing, firm, flat nodules or papules measuring 0.5 to 5 cm in diameter. These nodules affect the skin and underlying dermal tissue, and in rare cases, the muscle. They are most commonly found on the head, neck, perineum, genitalia, legs, and mammary glands (Korde *et al.*, 2025).

The LSD is transmitted by various vectors, including biting flies, fleas, ticks, mosquitoes, and wasps, as well as through close contact with infected animals or contaminated feed and water sources. Hot and humid climates promote vector proliferation and activity, making rainy summer and autumn seasons, as well as low-lying swampy areas, more favorable for the disease's occurrence (Akhter *et al.*, 2023).

Morbidity and mortality rates vary widely depending on cattle breed, population immune status, vector species involved in mechanical transmission, and the virulence of the virus strain (Adamu *et al.*, 2024). Morbidity may range from 2% to 45%, while mortality is generally below 5% but can rise to 15% in severe outbreaks (Manjunathareddy *et al.*, 2024). Cattle in herds with no previous exposure to LSD typically show higher morbidity and mortality compared to those in endemic regions (Arjkumpa *et al.*, 2022).

The LSD was first reported in Zambia in 1929 and was initially thought to be restricted to various regions of Africa, where periodic outbreaks occurred until 1986. The first cases outside Africa were detected in Israel between 1986 and 1988, followed by gradual spread into the Middle East, Eastern Europe, Russia, and later the Balkans. In 2019, new outbreaks emerged in South and East Asia, posing a growing threat to Indo-Asian countries including Afghanistan, Pakistan, and India (Akhter *et al.*, 2023). The virus subsequently spread to Central Asia, with Bhutan and Nepal reporting their first cases in 2020. That same year, Hong Kong, Myanmar, Sri Lanka, and Vietnam also reported outbreaks. By 2021, the disease had reached additional Asian countries such as Mongolia, Pakistan, and Taiwan, and entered Southeast Asia, with Cambodia, Thailand, and Malaysia reporting initial cases. Finally, in 2022, Afghanistan and Indonesia confirmed their first outbreaks (Kaur *et al.*, 2025).

This disease has a substantial economic impact on the cattle industry due to decreased milk production, skin damage, reduced meat quality, weight loss, infertility in both cows and bulls, mastitis, abortion, and mortality (Akther *et al.*, 2023; Degu, 2020). Despite its major economic

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impact, studies documenting the reproductive and production performance of cattle exposed to LSD remain limited. Therefore, this literature review aims to summarize current scientific knowledge on LSD and its impact on cattle reproductive and production performance, providing a scientific foundation for the development of more effective disease control and management strategies in the field.

RESEARCH METHODS

The data collection technique was carried out through a systematic literature review method. The literature search was conducted from July to September 2025 through databases such as Google Scholar, ResearchGate, PubMed, and ScienceDirect, using the keywords "Lumpy Skin Disease," "Reproduction," and "Production" in cattle. Inclusion criteria included journals, articles, or scientific works published between 2018 and 2025, written in Indonesian or English, and specifically discussing the impact of Lumpy Skin Disease on cattle production and reproduction.

RESULTS AND DISCUSSIONS

The Impact of LSD on Production

Lumpy Skin Disease (LSD) is a non-zoonotic viral disease that affects ruminants such as cattle and buffalo, leading to significant economic losses in the livestock sector. Clinical impacts include weight loss, reduced appetite, skin lesions, and decreased milk production (Akther *et al.*, 2023). The disease causes both direct and indirect losses to the meat, dairy, and leather industries (Das *et al.*, 2021). A decline in milk production is one of the most immediate consequences, particularly due to high mortality rates in calves and heifers, which reduce the economic value of cattle and overall dairy herd size (Modethed *et al.*, 2025). Even after recovery, cows often continue to show reduced milk yield, resulting in long-term financial losses. Previous studies have demonstrated an inverse correlation between the number of lactating cows infected with LSD and milk output, with reports of production declines reaching up to 85% due to high fever and secondary mastitis (Namazi & Tafti, 2021). A case reported from the Rejotangan Animal Health Center in Tulungagung Regency showed a reduction in milk production in 12 dairy cows with LSD, which also exhibited clinical symptoms such as high fever (up to 41.5°C), conjunctivitis, hypersalivation, and nasal discharge, ultimately leading to inappetence and weight loss (Huda, 2024).

Research in Kenya demonstrated that milk yield can drop by more than 50%, with both local and exotic breeds being susceptible to infection. Losses were more severe in exotic breeds, which have thinner skin and are more vulnerable to lesions. An economic assessment over 70 days showed a greater reduction in productivity in local livestock systems. Milk production in local cows decreased from 11.9 L to 2.0 L per day, while in imported cows it dropped from 4.0 L to 2.5 L per day, representing declines of 83.2% and 37.5%, respectively. Overall productivity losses in intensive farming systems are estimated at 45–65% (Kiplagat *et al.*, 2020). Smallholder farmers in developing countries are the most severely affected, as they rely heavily on cattle for their livelihoods (Tuppurainen *et al.*, 2021). Milk yield reductions are influenced by multiple factors, including reproductive management, feed availability, husbandry practices, farm infrastructure, and disease control efforts (Huda, 2024). Elevated body temperature and mastitis are also major contributors to decreased milk output (Akther *et al.*, 2023). In South Asia, which is home to 21% of the world's dairy cattle population, LSD results in marked declines in milk production. Research conducted in three regions of Turkey to assess the epidemiology, risk factors, economic burden, and the role of *Culicoides* spp. in LSDV transmission found that average milk yield per lactation declined by 15.9 liters in infected cows (Das *et al.*, 2021). Given that Asia contributes 31% of global cow milk and 98%

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of global buffalo milk production, the economic consequences of LSD in this region are substantial (Roche *et al.*, 2021).

The largest economic losses associated with LSD are attributed to cattle mortality and reduced milk production. Mortality alone accounts for an estimated 67–71% of total losses, while milk production declines contribute 17–23%. Differences in loss magnitude are related to breed resistance; local cattle and buffalo generally show greater resilience to infection than imported breeds. A study in Nepal reported an overall morbidity rate of 4.85% (16 sampled animals: 12 cattle and 4 buffalo), with a higher prevalence in cattle (7.23%) than buffalo (2.44%), and an average milk yield reduction of 58.7% (FAO Nepal, 2020). Additionally, LSD significantly affects the leather industry. Skin lesions and scarring reduce hide quality and market value. For example, Bangladesh, where the leather industry previously contributed around 3.5% of national export value, experienced a substantial decline due to reduced cowhide quality, which accounts for 56% of total leather production (Akther *et al.*, 2023). The same trend is observed in India, the world's 10th largest leather producer, with annual revenues of approximately USD 8.5 billion (Akther *et al.*, 2023). According to Alliance France Cuir (AFCuir), Asia accounted for around 59% of global leather product exports in 2017, meaning LSD outbreaks can disrupt the global supply chain (Tuppurainen *et al.*, 2021). Outbreaks also create significant additional costs, including diagnostics, disease investigation, eradication measures, farmer compensation, disinfection, treatment, vaccination programs, surveillance, and community awareness activities (Roche *et al.*, 2021).

The World Organization for Animal Health (WOAH) classifies LSD as a notifiable disease due to its major impact on dairy, meat, and leather production (Tuppurainen *et al.*, 2021). In Ethiopia, LSDV infection contributes to annual production losses estimated at 1.2% in local cattle and 6.2% in Friesian cattle (Akther *et al.*, 2023). Although beef from LSD-infected animals may still be safe for consumption following strict inspection, the risk of secondary bacterial infections remains a concern (Das *et al.*, 2021).

The Impact of LSD on Reproduction

The LSD causes substantial financial losses due to reduced production and growth rates, skin damage, impaired reproduction, and mortality. The WOAH classifies LSD as an important transboundary disease (Tuppurainen *et al.*, 2018). In addition to reductions in milk and meat yield, LSD negatively affects reproductive performance in cattle and buffalo, leading to conditions such as anestrus and repeat breeding (Adamu *et al.*, 2024). These reproductive complications are critical, as they can result in miscarriage in cows and infertility in bulls. Characteristic skin lesions, i.e., firm nodules measuring 5–20 mm, commonly develop on areas such as the flanks, paralumbar fossa, abdomen, and scrotum (Angelova *et al.*, 2018). Perforating lesions and dysfunction of reproductive organs further contribute to infertility (Gunawan *et al.*, 2024; Adamu *et al.*, 2024).

Research in breeding bulls demonstrated that LSD can cause scrotal skin nodules, scrotal edema, palpable nodules particularly at the epididymal tail, and reduced scrotal circumference (Annandale, 2020). Histopathological examination revealed degeneration and necrosis of seminiferous tubules, with loss of primary tubules and spermatogonia, associated with obliteration of the epididymal duct. This obstruction preventing sperm maturation and storage, can result in infertility. Detection of LSDV in semen through virus isolation and PCR confirmed viral DNA persistence up to day 28 post-infection, particularly in severely affected bulls. The virus can persist in the testes and epididymis, enabling prolonged shedding through semen. However, there is currently no evidence confirming whether semen containing LSDV

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can induce clinical infection in inseminated females, and the specific mechanisms underlying viral release into the ejaculate remain unclear (Annandale, 2020).

In females, LSD infection also causes a variety of reproductive disorders, including abnormal estrus, pregnancy loss, anestrus, endometritis, and repeated breeding (Suwarno *et al.*, 2025). Annandale (2020) reported that vulvar swelling typically appears around ten days after infection as an early clinical sign. In severe cases, embryos collected from infected cattle tested PCR-positive for LSDV. Artificial insemination (AI) using semen contaminated with viral DNA poses a high risk for transmitting LSD both domestically and internationally, making LSDV a significant concern for the global trade of semen and genetic material. Macroscopic lesions observed during necropsy include severe diffuse hemorrhagic vulvovaginitis, deep necrosis with tissue sloughing, and metritis.

A study by Muktafi *et al.* (2024) involving 300 LSD-infected cattle reported a calf mortality rate of 32.7% (33/102), an abortion rate of 13.1% (11/84), and a repeat-breeding rate of 45.2% (14/31) (Table 1). Chouhan *et al.* (2022) similarly documented a calf mortality rate of 12.5% (6/48) within less than one month of infection. To date, limited research has evaluated repeat-breeding rates associated with LSDV infection. The impact of LSD on reproductive and production performance in cattle are summarized in Figure 1.

CONCLUSION

The LSD has a significant economic impact due to its severe reduction of both reproductive performance and production in cattle, thereby threatening the sustainability of livestock operations. The primary production losses are attributed to a marked decline in milk yield, extensive skin damage, and increased mortality, particularly in calves. From a reproductive standpoint, LSD contributes to anestrus, repeat breeding, abortion, endometritis, and infertility. The detection of viral DNA in bull semen further highlights the risk of disease transmission through artificial insemination. To reduce these substantial losses, improved and effective control measures are essential, including strategic vaccination programs, strengthened vector management, and continued research to support the development of more efficient prevention and mitigation strategies.

ACKNOWLEDGEMENTS

The authors would like to express their sincere gratitude to all parties who contributed to the completion of this literature review, especially the researchers whose work served as valuable references. It is our hope that this review will be beneficial and contribute to the advancement of scientific knowledge.

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Table

Table 1. Percentage of total mortality, calf mortality, abortion and repeat breeding due to LSD

Parameter	Total number of cows used in the research	Total positive cattle	Percentage (%)
Mortality	300	46	15.3
Calf Mortality	102	33	32.7
Abortion	84	11	13.1
Repeat breeding	31	14	45.2

Reference: Muktafi *et al.* (2024)

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Figure

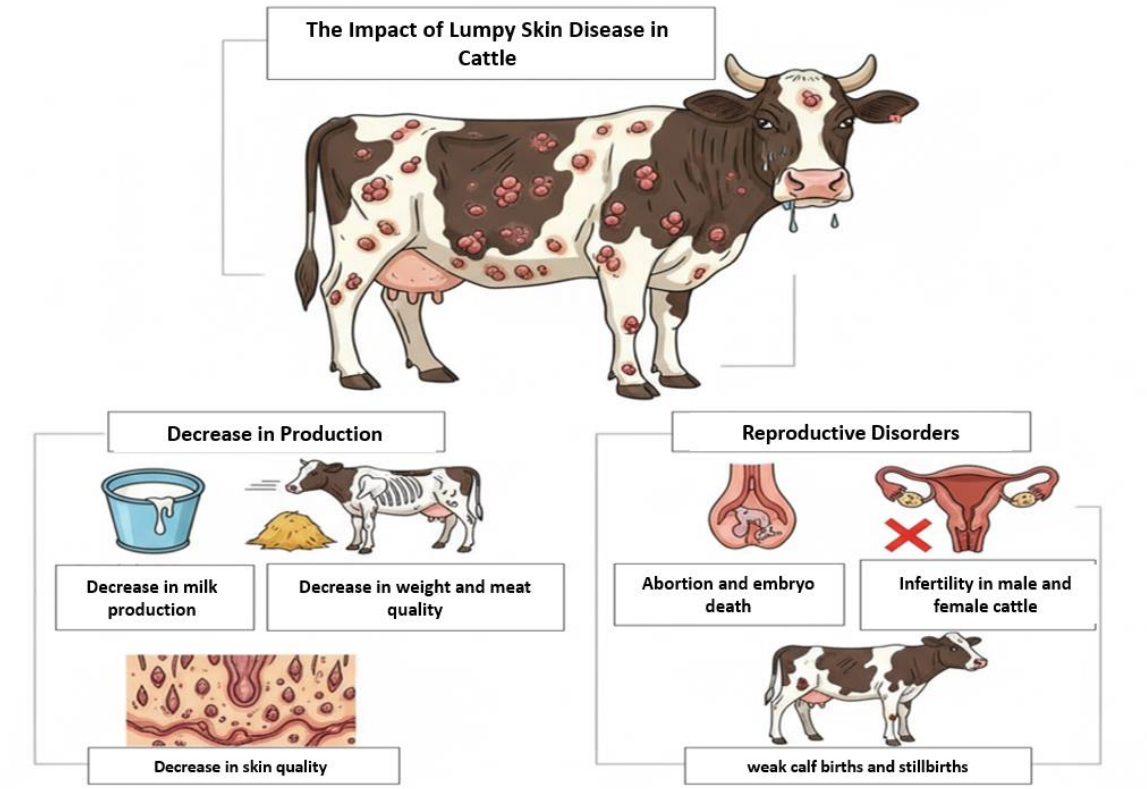

Figure 1. Illustration of the impact of LSD on reproduction and production in cattle

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