Research Article

Impact of Lumpy Skin Disease on Productive and Reproductive Performance of Cattle in Noakhali Sadar, Bangladesh

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Abstract | Lumpy Skin Disease (LSD) is an emerging transboundary disease causing substantial economic losses in cattle production systems. The present study was carried out to assess the overall impact of Lumpy Skin Disease on cattle health, productivity, and reproductive performance in Noakhali Sadar, Bangladesh. A cross-sectional survey was conducted among 167 cattle farms comprising 351 recovered LSD-affected cattle between May 2025 and April 2026. Data were collected through structured questionnaires and farm visits and analyzed using descriptive statistics and paired sample t-test to compare selected productive parameters before and after LSD infection. The investigation covered multiple production and health parameters, including milk yield, meat production performance, feed and water intake behavior, reproductive efficiency, and treatment outcomes in affected and recovered animals. The findings revealed that LSD significantly reduced milk yield and body weight. Feed and water intake were markedly reduced during the acute phase of infection. Reproductive performance was also adversely affected, with a considerable proportion of cows exhibiting reproductive disturbances after recovery. Among the studied animals, 60% returned to normal reproductive function, while 20% experienced repeat breeding and 20% showed abortion history, suggesting possible long-term reproductive complications associated with the disease. Most animals require several months (3-4 months) to regain normal productivity after recovery. The results indicate that LSD imposes considerable production, reproductive, and economic burdens on cattle farming systems. However, the findings should be interpreted with caution because the study was limited to one geographic area, used a cross-sectional design, and partly depended on farmer-reported information. Strengthening vaccination programs, ensuring early diagnosis, and improving treatment and nutritional management may help reduce the impact of the disease.

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Introduction

Lumpy Skin Disease (LSD) is a highly contagious viral disease of cattle caused by the Lumpy Skin Disease Virus (LSDV), a member of the genus Capripoxvirus under the family Poxviridae. Lumpy Skin Disease (LSD), also called pseudo-urticaria, Neethling Virus Disease, Exanthema Nodularis Bovis. The disease is primarily transmitted through arthropod vectors (Siddiqui *et al*., 2025) such as mosquitoes, biting flies, and ticks, and is characterized by fever, nodular skin lesions, lymphadenopathy, and varying degrees of systemic involvement (Goud *et al*., 2023). LSD has emerged as one of the most important transboundary animal diseases, causing significant economic losses due to its substantial impact on animal health, productivity, and livestock-based economies worldwide. Since its emergence and rapid spread across several regions, LSD has become a major concern for animal health authorities and livestock farmers due to its profound impact on cattle health and productivity. The disease not only affects animal welfare but also causes significant economic losses through reduced milk production, loss of body weight, decreased growth performance, reproductive disorders, deterioration of hide quality, increased treatment costs, and mortality in severe cases. LSD reduces milk production during the active stage of the disease, but even after the visible signs disappear, cattle may not fully regain their previous production level.

Lumpy skin disease (LSD) was first reported and outbreak in Zambia in 1929 (Akther et al., 2023). After fourteen years, in 1943, another outbreak of the disease occurred in Botswana and was provisionally named Ngamiland cattle disease as the case occurred for the first time in Ngamiland (Wankhade *et al*., 2023). After two years, in 1945, the disease spread to Zimbabwe and South Africa, where the disease named Lumpy Skin Disease. Until the 1980s, LSD was largely confined to the African continent (Kumar et al., 2025). However, the disease gradually expanded beyond Africa, with the first documented outbreak outside the continent occurring in Israel in 1989 (Mazloum et al., 2023). In 2016, outbreaks were reported in Russia and several Southeast European countries. In 2019, LSD was initially identified in Bangladesh within the Indian subcontinent, followed by India, China, Nepal, Vietnam, Bhutan, Myanmar, and Hong Kong (Parvin et al., 2022; Hasib *et al*., 2021; Siddiqui *et al*., 2025). The disease affects a variety of domestic animals, namely cattle, buffalo, sheep, and goats (Bala et al., 2023; Alkhamis and Vander Waal, 2016). It causes financial loss by reducing productivity, slowing growth rate, causing low-grade skin, reproductive issues, as well as death (Modethed *et al*., 2025). Due to its transboundary nature and significant socioeconomic impact, the World Organization for Animal Health (OIE/WOAH) declared the disease as an important transboundary viral disease (Tuppurainen and Oura, 2012; Tuppurainen et al., 2017).

Reproductive performance of cattle is particularly sensitive to systemic illnesses such as LSD. The disease can disrupt normal reproductive physiology through fever, stress, anorexia, and direct or indirect effects on reproductive organs. Reported reproductive complications include delayed estrus, reduced conception rates, temporary infertility, repeat breeding, abortion, and prolonged calving intervals. These reproductive complications may persist even after apparent clinical recovery, thereby affecting herd fertility and long-term productivity. However, information regarding the extent of these reproductive effects under field conditions remains limited in many regions, including Bangladesh.

Noakhali Sadar is a densely populated livestock-rearing area where many small and medium scale farmers depend on cattle farming for their livelihood. During recent LSD outbreaks, a large number of cattle in this area were affected. Despite the widespread occurrence of LSD, limited information is available regarding its long-term effects on productive and reproductive performance in recovered cattle under field conditions.

Therefore, the present study was conducted to evaluate the impact of Lumpy Skin Disease on the productive and reproductive performance of cattle in Noakhali Sadar, Bangladesh. Specifically, the study assessed changes in milk production, body weight, feed intake, water intake, recovery time, and general health status of LSD-affected cattle after recovery. It also evaluated post-recovery reproductive performance, including delayed estrus, repeat breeding, infertility, abortion, and conception-related problems. In addition, the study examined treatment response and recovery patterns and estimated the farm-level economic impact of LSD on cattle farmers in the study area.

Materials and Methods

Study area and duration

A cross-sectional study was conducted in Noakhali Sadar Upazila of Noakhali district, Bangladesh. This area was selected because of its high cattle population, and the occurrence of LSD outbreaks has been reported in recent years. The investigation was conducted from May 2025 to April 2026 (Figure 1).

Study design

This cross-sectional survey was carried out among cattle farmers whose animals were affected by Lumpy Skin Disease and later cured. The study focused on evaluating changes in physical, productive, and reproductive performance after recovery from LSD on the based on farmers' responses at the time of the survey.

Study population and sample size

The study included cattle farmers randomly selected from different villages of Noakhali Sadar, purposively based on the following criteria:

- Farmers had at least one recovered cattle affected by LSD, which was diagnosed by a registered veterinarian and/or laboratory confirmation via PCR.
- The affected animal had recovered from the disease.
- They were willing to participate and provide information.

To conduct this study, data were collected from 167 farms after confirming the above criteria. The total number of LSD affected recovered cattle was 351.

Data collection method

Data were collected through using a structured questionnaire, conducted by direct farm visits, and face-to-face interviews with the farmer or farm manager. This structured questionnaire was used to collect information, which includes:

- Farmers' socioeconomic status
- Physical Characteristics of LSD cured cattle
- Treatment History of LSD affected cattle
- Production Performance (Milk production, Meat production, and feeding performance)
- Reproductive performance of Cattle

Parameters or variables measured

The main variables included:

- Physiological state after recovery from LSDV
- Milk yield before and after infection via Lumpy Skin Virus (LSV)
- Body weight changes
- Feeding and water intake
- Reproductive outcomes (normal, repeat breeding, abortion)
- Recovery duration

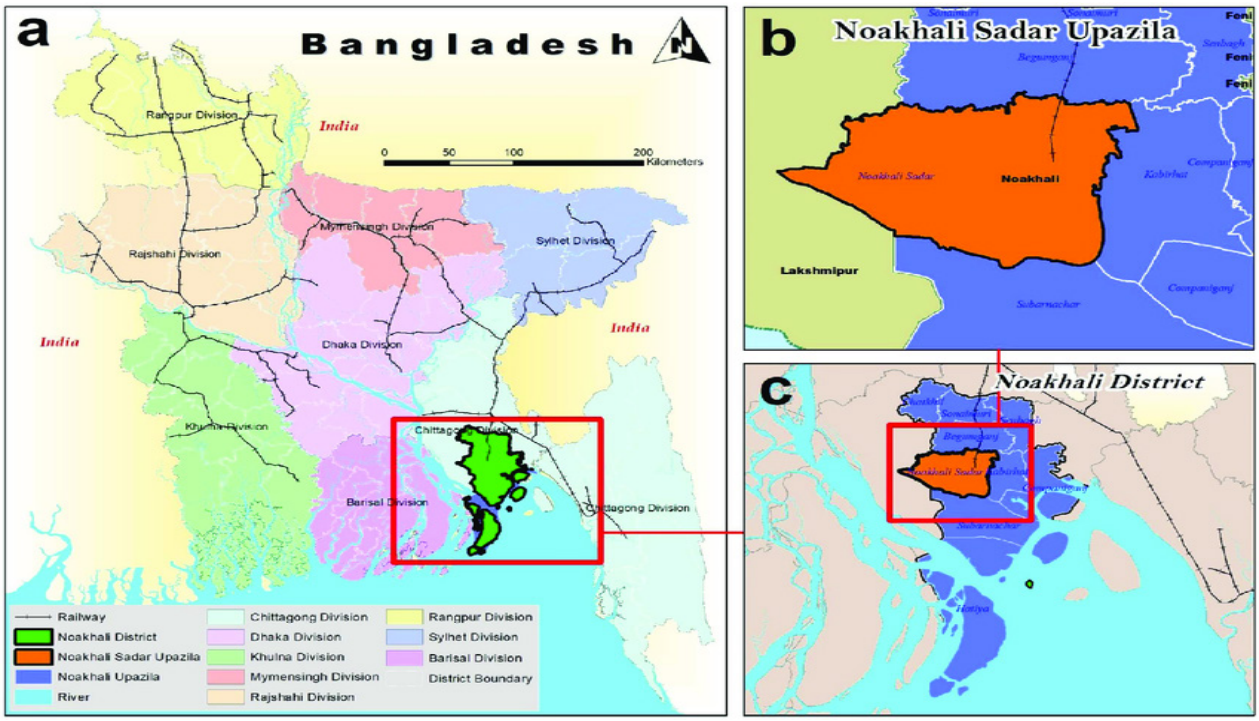

Figure 1: *Representing the map of the study area.*

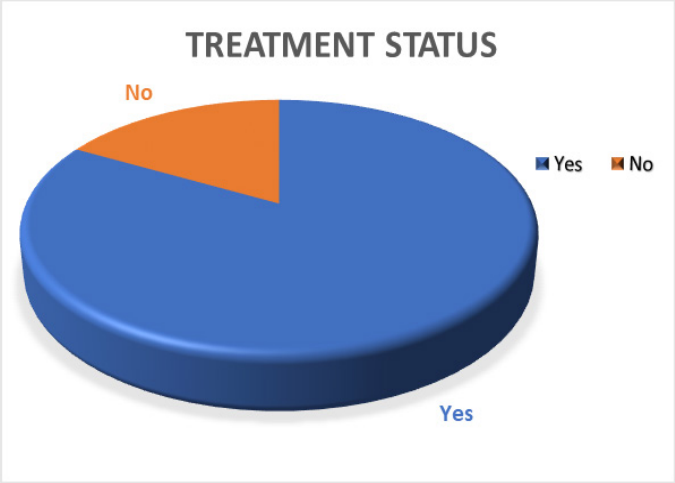

Figure *2: The treatment status of LSD affected cattle. Out of 351 cattle, 305 animals (86.89%) received treatment, whereas 46 animals (13.11%) did not receive any treatment. Among the treated animals, 97% completed the course of treatment.*

Data recording and management

Data recording was carried out in a systematic and structured manner throughout the entire study period to ensure accuracy, reliability, and consistency of the collected information. All relevant data, including animal identification, age, breed, health condition, production performance, reproductive status, feeding practices, and treatment history, were recorded directly from field observations, farmer interviews, and clinical examination. A pre-designed questionnaire and data recording sheet were used to minimize errors and maintain uniformity in data collection.

After collection, all raw data were carefully checked, verified, and cross-validated to remove inconsistencies, missing values, and possible recording errors. The cleaned data were then coded and organized into categories for easier handling and analysis. Both manual registers and digital formats (Microsoft Excel) were used for data storage to ensure data security and prevent loss. Proper labeling, file naming, and backup systems were maintained throughout the study period. This organized data management system ensured smooth processing and provided a reliable foundation for subsequent statistical analysis and interpretation of results.

Data analysis

The collected data were analyzed using appropriate statistical and descriptive methods to evaluate the impact of the study variables. Initially, all data were compiled, coded, and entered into Microsoft Excel for proper organization and processing. Descriptive statistics such as mean, percentage, frequency, and standard deviation were used to summarize the overall findings on production, reproduction, health status, and treatment outcomes. Comparative analysis was conducted by paired sample t-test to observe differences in performance indicators before and after recovery from LSD infection, as well as among different categories of animals.

Results and Discussion

Farmer's socioeconomic status

A total of 167 farmers with recovered LSD-affected cattle were included in the survey conducted in the Noakhali Sadar area. The socio-economic characteristics of the respondents are presented based on age, gender, educational qualification, occupation, and training status (Table 1). Regarding age distribution, the highest proportion of cattle farmers belongs to the 25–40 years age group (31.73%), followed by 29.94% above 55 years of age in the Noakhali Sadar area, Bangladesh. This result indicates that, regarding age distribution, middle-aged and older farmers were more actively involved in cattle farming in the study area. In terms of gender, male farmers were dominant, representing 64.67% of the respondents, whereas female farmers accounted for 35.33%. The higher involvement of male farmers may be due to their greater participation in cattle management, marketing, and decision-making activities in rural areas. Educational status revealed that nearly half of the respondents were illiterate (45.51%). Farmers having primary education constituted 19.76%, secondary education 17.96%, and graduate-level education 16.77%. The findings suggest that most cattle farmers had low educational attainment, which may influence their knowledge of disease prevention, treatment, vaccination, and modern livestock management practices. Occupation-wise, agriculture was the major occupation of the respondents, accounting for 48.71%. This indicates that cattle farming was mainly associated with agricultural households and small business owners in the study area.

Regarding training status, only 23.35% of respondents had received any livestock-related training, whereas 76.65% had not. The low proportion of trained farmers indicates limited access to extension services, awareness programs, and technical support regarding cattle disease management and recovery practices.

Table 1: *Socioeconomic status of respondents.*

Variable	Categories	Number	Percentage (%)
Age	Below 25	30	17.96
	25-40	53	31.73
	40-55	34	20.36
	Above 55	50	29.94
Gender	Male	108	64.67
	Female	59	35.33
Education	Illiterate	76	45.51
	Primary	33	19.76
	Secondary	30	17.96
	Graduate	28	16.77
Occupation	Agriculture	73	43.71
	Service in GO	18	10.78
	Service in NGO	23	13.77
	Business	53	31.73
Training on cattle farming	Yes	39	23.35
	No	128	76.65

GO= Government Organization, NGO= Non-Governmental Organization.

Table 2: *Physical traits of LSD cured animal.*

Trait	Category	Number	Percentage
Coat Color	White	63	17.95
	Red	135	38.46
	Black	90	25.64
	Mixed	63	17.95
Age	Less Than 6 Months	117	33.33
	6 Months to 2 Years	108	30.76
	More Than 2 Years	126	35.91
Breed	Local	270	76.92
	Cross	81	23.08
Sex	Male	198	56.41
	Female	153	43.59
Muzzle	Dry	36	10.26
	Moist	315	89.74
Eye complications	Normal	328	93.45
	Corneal Opacity	14	3.99
	Conjunctivitis	8	2.28
	Blindness	1	0.28
Respiration complications	Normal Respiration	311	88.60
	Chronic Pneumonia	23	6.55
	Breathing Difficulty	17	4.84
Musculoskeletal complications	Normal Posture	294	83.76
	Lameness	31	8.83
	Joint swelling	26	7.41

Physical characteristics of LSD cured cattle

The physical characteristics of recovered LSD-affected cattle included in the study (Table 2). Among the coat colors observed, red-colored cattle were the most common (38.461%), followed by black (25.64%), while white and mixed coat colors each accounted for 17.948% of the animals. Regarding age distribution, the majority of recovered cattle were below 6 months of age (43.58%), followed by 1-year-old cattle (30.76%), whereas cattle above 2 years represented 25.62% of the total population. In terms of breed, local cattle were more common than crossbred cattle, accounting for 76.92% and 32.076%, respectively. Most of the animals had a moist muzzle (89.743%), while only 10.256% had a dry muzzle. Male cattle represented 56.410% of the study population, whereas female cattle accounted for 43.589%. Hair regrowth in the lesion area or affected area was observed in 79.48% of recovered cattle, while 20.502% of cattle did not show proper hair regrowth in the damaged skin area (Table 2).

Treatment history of LSD affected cattle

The study found that approximately 86.89% of the recovered animals received proper treatment and completed the full course of medication during infection with Lumpy Skin Disease. These treated animals showed comparatively better recovery outcomes, improved health status, and gradual return of normal feeding and productive performance. The use of supportive therapy, including antibiotics, anti-inflammatory drugs, and nutritional care, likely contributed to faster recovery and reduced complications in most cases. However, a small proportion of animals did not receive proper or complete treatment during the disease period. These animals were either partially treated or left without adequate veterinary care, which may have delayed their recovery and increased the severity of clinical signs. Lack of proper treatment can lead to prolonged weakness, reduced productivity, and secondary infections, further affecting overall health performance. The study also observed that most of the affected animals required approximately 3 to 4 months to fully recover from LSD. Even after visible clinical recovery, animals often took additional time to regain normal body condition, appetite, and productive efficiency. This extended recovery period may be associated with slow healing of skin lesions, persistent weakness, and gradual restoration of metabolic and immune functions.

Production performance

Milk production performance

A total of 61 lactating cows affected with LSD

were evaluated for milk production before and after infection. As shown in the table, the total milk yield decreases in the crossbred at 9.49% and the local breed at 11.52%, which is a significant reduction. The milk production performance before and after LSDV infection in dairy cattle is shown in Table 3.

Meat production performance

In this study, 39 meat-producing cattle were observed to assess the impact of Lumpy Skin Disease on body weight. Among the observed cattle, 21 were 1 year old and 18 were more than 2 years of age. The overall percentage reduction in body weight was 8.87%. Statistical analysis showed that the decrease in body weight was significant ($P<0.05$). The findings are presented in the following table (Table 4).

Feeding performance

According to the present study, feed intake and water intake were markedly reduced in cattle affected by Lumpy Skin Disease. During the disease period, most of the affected animals showed loss of appetite and consumed less water than normal. This reduction was mainly associated with fever, weakness, pain from skin nodules, and general discomfort caused by the disease. Many farmers reported that affected cattle became dull and reluctant to eat concentrate feed, roughage, and green grass. Water consumption was also lower during the acute stage of the disease. After recovery from LSD, feed intake and water intake gradually returned to normal in most cattle. The recovered animals regained their appetite and started consuming normal amounts of feed and water. The study also found that most owners did not provide any additional feed supplements, vitamins, or mineral mixtures during the disease period.

Reproductive performance of cattle

A total of 15 cows recovered from Lumpy Skin Disease were studied to evaluate reproductive performance. As shown in Table 5, cows (60%) showed normal reproductive performance after recovery. Repeat breeding was observed in 3 cows (20%), while 3 cows (20.00%) had a history of abortion after recovery. The results indicate that a considerable proportion of cows experienced reproductive disorders following LSD infection.

Milk production performance

The present investigation documented a statistically significant decline in milk yield in the local breed following Lumpy Skin Disease (LSD) infection, with a mean reduction of 11.515%, decreasing from an average of 2.75 liters per cow per day before infection to 2.43 liters after recovery, and cross breed, a mean reduction of 9.49%. This decrease was statistically significant ($p < 0.001$), suggesting that LSD infection had a measurable negative effect on post-recovery milk production. These results are corroborated by the findings of Chouhan *et al.* (2022), who reported the reductions in lactational performance among LSD-affected cattle in the Mymensingh and Gaibandha districts of Bangladesh**.** This may due to the combined effects of pyrexia, anorexia, systemic metabolic stress, and diminished feed and water intake, which collectively compromise mammary gland function and biosynthetic efficiency. During infection, nutrients and energy are used for immune response and tissue repair rather than milk synthesis. Differences in local environmental conditions and the level of vector exposure may affect the severity of LSD and its impact on milk production in different regions. Milk production declined in LSD affected

Table 3: *Comparative milk production of LSD cured cow before and after recovery.*

No of observation	Breed	Total milk production (L)		Mean milk production per cow (L)	Percentage of decrease	Correlation coefficient ®	Paired t-test value	P value
61	Cross Breed (27)	Before LSD	235.98	8.74	9.49%	0.83	t=6.72	0.001
		After LSD	213.57	7.91				
	Local Breed (34)	Before LSD	93.5	2.75	11.52%	0.97	t=8.42	<0.001
		After LSD	82.62	2.43				

Table 4: *Body weight reduction of LSD cured cow before and after recovery.*

No of cattle observation		Total body weight before LSD (kg)	Total body weight after recovery from LSD (kg)	Total amount of decrease (kg)	Percentage of decrease (%)	P value
Total (39)	Less than 2 years old (21)	5920	5395	525	8.87	0.039
	More than 2 years old (18)					

Table 5: *Reproductive performance of cattle after recovery from LSD.*

Reproductive status	Number of cattle	Percentage (%)	P-value
Normal reproduction	9	60	<0.05
Repeat breeding	3	20	<0.05
Abortion History	3	20	<0.05

lactating cows, showing that LSD had a consistent negative effect on dairy performance (Vinitchaikul *et al*., 2023). Alterations in the level of milk reduction reported by different studies may be related to variations in farm management, nutrition, breed, disease severity, and the timing and completeness of treatment (Kiplagat *et al*., 2020; Hossen, 2026). Therefore, improved vaccination coverage, early disease detection, timely treatment, and proper supportive care may cause the remedy of reducing milk production losses and protect farm income.

Meat production performance

The present study also showed a significant reduction in body weight among LSD-affected meat-producing cattle. Total body weight decreased from 5920 kg before infection to 5395 kg after infection, representing an overall loss of 8.87% across the 39 observed animals. This finding is closely similar with the study of Chouhan *et al*. (2022), where substantial deterioration in body condition and impairment of growth performance were similarly reported in cattle recovering from LSD outbreaks. Body weight loss in infected cattle may occur due to fever, pain from skin nodules, reduced feed intake, weakness, and decreased grazing activity. When cattle eat less during illness, they receive fewer nutrients for growth and body maintenance. Concurrently, in addition, the body uses energy to fight infection, which may further delay weight gain. This immune-metabolic competition may fundamentally impair protein accretion and adipose tissue deposition, culminating in measurable body condition deterioration and delayed achievement of market weight. The current study also identified a differential susceptibility among age categories, where, in younger cattle, owing to their higher nutritional demands per unit metabolic weight, relatively underdeveloped immune competence, and ongoing growth trajectories exhibited proportionally greater susceptibility to growth retardation compared to more mature animals. This age-related vulnerability further compounds productivity losses at the herd level, as young stock represents the future productive capital of the farming system. Minor quantitative variations in weight loss percentages between the present and preceding studies may be explained by differences in breed composition, basal nutritional status, grazing availability, access to veterinary infrastructure, and the quality and duration of post-recovery nutritional rehabilitation. Therefore, LSD may reduce meat production efficiency and cause financial losses to cattle farmers.

Reproductive performance

The present study revealed that LSD shows a considerable and lasting adverse impact on the reproductive performance of cattle, even after clinical recovery from the disease. In this study, 60% of cows returned to normal reproductive function, while 20% showed repeat breeding and 20% had a history of abortion after recovery. These findings is corroborate with the previous studies of Chouhan *et al*. (2022), who also have reported reproductive complications such as delayed estrus, reduced conception, temporary infertility, repeat breeding, and abortion in cattle affected by LSD. These problems may occur because fever, stress, poor body condition, and reduced feed intake can disturb normal reproductive function. Secondary bacterial uterine infections may occur during acute LSD, which might contribute to endometritis, poor embryo implantation, early embryonic loss, and mid-gestational abortion, especially in cattle with poor body condition and negative energy balance. Severe illness may also affect pregnancy maintenance and delay the return to normal estrous cycles. Though this study have few limitations as small sample size and duration of study but variations in the reported prevalence of post-infection reproductive disorders across different studies may reflect differences in herd reproductive management practices, the nutritional plane offered during the recovery phase, the thoroughness of post-recovery veterinary surveillance, and the availability and quality of reproductive healthcare services in different agro-ecological settings. Therefore, clinical recovery from LSD does not always mean complete reproductive recovery. Post-recovery reproductive monitoring, improved nutrition, and veterinary follow-up are important to reduce long-term fertility losses in affected herds.

Conclusion

The present study demonstrates that Lumpy Skin

Disease has substantial post-infection effects on cattle productivity, reproductive performance, and economic stability in Noakhali Sadar, Bangladesh. LSD was associated with reduced milk yield, body weight loss, decreased feed and water intake, delayed recovery, and post-recovery reproductive problems, including repeat breeding and abortion. These findings indicate that clinical recovery alone should not be considered the final endpoint of disease management. Besides this, affected cattle may require continued nutritional, productive, and reproductive monitoring after visible recovery. Effective LSD control should include timely vaccination, early disease detection, complete treatment, vector control, and post-recovery nutritional and reproductive monitoring. Future research should include economic modeling to estimate direct and indirect losses and long-term surveillance to monitor outbreak patterns, vaccination coverage, recovery outcomes, and reproductive performance after infection.

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Novelty Statement

To the best of our knowledge, this study provides one of the first field-based assessments of the impact of lumpy skin disease on both productive and reproductive performance of cattle in Noakhali Sadar, Bangladesh. The findings generate region-specific evidence that may assist veterinarians and livestock policymakers in designing effective disease prevention and management strategies.

Author's Contribution

Johora Akter: conceptualized and designed the study, conducted the field investigation, collected the data, performed the statistical analysis, and prepared the original manuscript draft. Md. Ashiqur Rahman: contributed to the study design, data analysis, interpretation of the results, manuscript writing, and critical revision of the manuscript. Jannatul Naima, Kohaly Alam, Rupon Islam Shuvo, Md. Johir Raihan, Shyam Kumar Yadav, Subarna Jalal Rikta, and Tasmim Akter assisted with field data collection, laboratory and technical support, and manuscript revision. Md. Saiful Islam Siddiqui supervised the research, contributed to the study design, validated the findings, critically revised the manuscript for important intellectual content, secured funding, and approved the final version of the manuscript. All authors read and approved the final manuscript.

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Data availability statement

Data available on request from the corresponding author.

Ethics approval

All methods were carried out in accordance with the relevant guidelines and regulations of the "Animal Experimentation and Ethics Committee", Sylhet Agricultural University, Bangladesh. The approved Animal Use Protocol No. was [#AUP2023032] for conducting the experiment. Confirm that all methods are reported in accordance with ARRIVE guidelines (https://arriveguidelines.org).

Generative AI and AI assisted technology statement

The authors declare that no generative AI and AI assisted technology was used in the creation of this manuscript.

Conflict of interest

The authors have declared no conflict of interest.

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