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Research Article

Effect of lumpy skin disease on reproduction and production performance in cattle

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Abstract

Lumpy skin disease is a very common and rapidly widespread contagious disease in Bangladesh. However, very limited research has been performed to determine the effect of reproductive and productive performance in cattle after recovery from lumpy skin disease. Therefore, the research was conducted to evaluate the reproductive and productive performance in lumpy skin disease affected cattle from January to December, 2022. A total of 300 animals from different households and farms were selected from four different districts of Bangladesh which were recovered from lumpy skin disease. Data were collected through direct interviews with farm owners by using a pretested questionnaire. The animals were categorized into two groups- according to their breeds and age. The overall mortality rate was 15.3% in lumpy skin disease; the mortality rate was significantly higher (11%) at 0-1 years of age. No animals died over four (4) years of age. The mortality rates at the ages >1-2, >2-3 and >3-4 were 1%, 2% and 1.3%, respectively. Calf mortality was 32.7%. The abortion rate in LSD was 13.1%, and the abortion rate was significantly higher (10.7%) in crossbred. The repeat breeding rate was 45.2% in LSD, and there was no significant relationship between indigenous and crossbred cows. Milk production was significantly decreased after recovery from lumpy skin disease with a positive correlation. In conclusion, the findings from this research may be useful for farmers in learning the effects of lumpy skin disease on reproductive and productive performance in cows.

Keywords: Abortion, Calf mortality, Lumpy skin disease (LSD), Milk production, Repeat breeding

Highlights

- The overall mortality rate was 15.3% in LSD, which was significantly higher (11%) at 0-1 years of age.
- The abortion rate in LSD was 13.1%, and the abortion rate was significantly higher (10.7%) in crossbred.
- The repeat breeding rate was 45.2% in LSD, and there was no significant relationship between indigenous and crossbred cows.
- Milk production was significantly decreased after recovery from lumpy skin disease with a positive correlation.

INTRODUCTION

Lumpy skin disease (LSD) is a viral disease which was first identified and outbreak in Zambia in 1929 (Morris, 1931). LSD virus (LSDV) is responsible for this disease; it is a poxvirus under the genus Capri poxvirus (Alexander *et al*., 1957). Until 1980s, several outbreaks of LSD were confined to the African continent ((Davies, 1981). The first reports of LSD outside Africa were in 1989 from Israel (Shimshony, 1989). In 2016, Russia and South-East European nations were infected by LSD. In 2019, LSD was initially identified in Bangladesh within the Indian subcontinent, followed by India, China, Nepal, Vietnam, Bhutan, Myanmar and Hong Kong (Jolly and Scaria, 2021). The disease affects a variety of domestic animals namely cattle, buffalo, sheep and goats (El-Nahas *et al*., 2011; Alkhamis and Vander Waal, 2016). Fever, nodular lesions on the skin, mucous membrane of respiratory as well as digestive tracts are the main symptoms of lumpy skin disease (Coetzer and Tustin, 2004). Blood-feeding insects like mosquitoes and stable flies are responsible for virus transmission (Carn and Kitching, 1995; Chihota *et al*., 2003). It causes financial loss by reducing productivity, slowing growth rate, low-grade skin, reproductive issues as well as death. So, The World Organization for Animal Health (OIE) declared the disease as an important transboundary disease (Tuppurainen and Oura, 2012; Tuppurainen *et al*., 2017). In mid-2019, a pandemic occurred with the formation of nodules in the skin, which was unique, claimed local veterinary services authority in a commercial as well as courtyard population of cattle in Patiya, Anwara and Karnaphuli in the district of Chattogram, Bangladesh (Hasib *et al*., 2021). The same disease pattern was found in various places in

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Bangladesh (Giasuddin *et al.,* 2020; Khalil *et al.,* 2021). The morbidity rate was 10 to 20% in LSD, with a 1-5% mortality rate. Huge economic losses for farmers occurred due to a drastic fall in milk production, prolonged treatment cost as well as reproductive complications following LSD (Rahman, 2020). According to Angelova *et al*., 2018, the disease is devastating because it causes abortion, poor coat condition and sterility in bulls. LSD results in decreased beef production (Gari *et al.*, 2011). Young animals and cows at the peak of lactation are more susceptible to these diseases, causing huge production losses (Al-Salihi, 2014). LSD sometimes causes infertility in cattle (Davies, 1991). Still, the research report on the reproductive performances of LSD-affected animals in Bangladesh is limited. Therefore, the research work was undertaken to observe the effects of LSD on reproductive and productive performances in cattle and to compare the factors affecting the reproductive performances of LSD-affected cattle.

MATERIALS AND METHODS

The research was conducted in four different districts in Bangladesh, namely Dinajpur, Thakurgaon, Bogura and Nilphamari, from January 2022 to December 2022. Three hundred cows were selected from 4 different districts that were affected by lumpy skin disease. Cows from households and farms were mainly considered for this research. All types of LSD-affected animals were considered for this research, including calf, heifer, adult cows and bull, to determine the incidence of the disease. Then, the data were collected by direct interview with the farm owner. The response of the owner was recorded in the pretested questionnaire. In some cases, available farm records were reviewed for additional information, and the animals were examined.

Grouping of animals: Animals were categorized into two groups for this research work. According to the breed, indigenous and crossbred were taken to observe the effect of LSD on productive and reproductive performance. According to the age of animals, from 0-6 months and up to 1 year were considered as calf for facilitating the research. Animals were categorized into different age groups (Table 1).

Data management and statistical analysis: Data were statistically analyzed by using SPSS software (version 25.0). Overall mortality, calf mortality, abortion and repeat breeding rate were calculated as percentages. Chi-square test was performed to estimate significant relationships within different age groups in case of mortality and different breeds in case of mortality, abortion and repeat breeding. Paired sample T-test was done to calculate the significant difference in milk production before and after lumpy skin disease. For all analyses, a P value of less than 0.05 was taken as the level of significance.

Table 1. Grouping of animals according to their age

Sl. No.	Age interval (Years)	No. of animals
1	0-1	102
2	>1-2	47
3	>2-3	82
4	>3-4	52
5	>4-5	17
Total		300

RESULTS

Overall mortality, calf mortality, abortion and repeat breeding rate in LSD: Among 300 LSD-affected animals, 46 were found to be dead, and the overall mortality rate in LSD was 15.3%. Out of 102 calves, 33 were death due to LSD, and the calf mortality rate was 32.7%. From 84 LSD-affected pregnant animals, 11 were found to be aborted, and the total abortion rate was 13.1%. Out of 31 inseminated animals immediately after recovering from LSD, 14 were found as repeat breeders, which were bred normally before being affected with LSD, and the overall repeat breeding rate due to LSD was 45.2% (Table 2).

Table 2. Overall mortality, calf mortality, abortion and repeat breeding rate in lumpy skin disease (LSD)

Parameters	Total experimented animals	Total positive number	Rate(%)
Mortality	300	46	15.3
Calf Mortality	102	33	32.7
Abortion	84	11	13.1
Repeat breeding	31	14	45.2

Age-wise mortality rate in LSD: The age-wise mortality rate in LSD is presented in (Table 3). The significantly highest (11%) mortality rate was found at the first year of age, where 33 animals died out of 102. Between 1-2 years of age, the mortality rate was significantly lowest (1%) than other ages. During 2-3 years of age, the mortality rate was 2%. The mortality rate was 1.3% at 3.1-4 years of age. No positive case was found at 4.1-5 years.

Table 3. Age-wise mortality rate in lumpy skin disease (LSD)

Age interval (Years)	No. of animals	Death No	Mortality rate (%)	P value
0-1	102	33	11[a]	0.00
>1-2	47	3	1[b]	
>2-3	82	6	2[c]	
>3-4	52	4	1.3[d]	
>4-5	17	0	0[e]	
Total	300	46	15.3	

[a-b-c-d-e]Values with different superscript letter in the same column are highly significant (p<0.05)

Breed-wise mortality, calf mortality, abortion and repeat breeding rate in LSD: Out of 185 crossbred cows, the mortality rate in LSD was 9.3%. Comparatively lower mortality rate (6%) was found in indigenous cows. The mortality rate due to LSD was not significant (p<0.05) within breeds. Among 54 crossbreds, 9 animals were shown positive results, and out of 30 indigenous cows, 2 were found positive. The abortion rate due to LSD was significantly (p<0.05) higher (10.7%) in crossbred cows than in indigenous cows (2.4%). The repeat breeding rate due to LSD was higher (32.3%) in crossbred cows than in indigenous cows (12.9%). The repeat breeding rate due to LSD was not significant (p<0.05) within breeds (Table 4).

Effects of LSD on milk production in lactating cows: Forty six lactating cows recovered from LSD were considered for taking the results. Milk production was affected significantly (p<0.05) after recovery from LSD. The average milk production was significantly decreased after recovery with a positive correlation (0.992) (Table 5).

DISCUSSION

The current study showed that the overall mortality rate in LSD was 15.3%; the result was higher than the findings (1.10%) of Chouhan *et al*. (2022). According to Salib and Osman (2011), the overall mortality rate due to LSD was 1.8%, which was also lower than this finding. The mortality rate of LSD is usually not so high (1 to 3%), but in some cases, it can reach 40% (Coetzer and Tustin, 2004; Babiuk *et al*., 2008). According to Zafar *et al*. (2023), the mortality rate varied from 10-15%; sometimes, in the pandemic areas, it can reach up to 40%. According to Abdulqa *et al*. (2016), the mortality rate was not more than 10%. The mortality rate of LSD in Oman in 2009 was 12% (Wainwright *et al*., 2013). According to Gari *et al*. (2011), significantly higher annual mortality was found in Holstein crossbred (7.43%) than in local indigenous cattle (1.25%) in LSD. According to the current study, the calf mortality rate was 32.7%. In a study conducted by Chouhan *et al*. (2022) in the case of calves (not more than 1 month), the mortality rate of 12.5% due to LSD was lower than this finding. In this analysis, the mortality rate in crossbred cows was 9.3%, and the mortality rate of indigenous cows was 6%. Analysis of data revealed that the result was not significant. No other research has been performed yet on the mortality rate due to LSD in relation to breed in cows. According to this research, significantly higher mortality was found at 0-below 1 year of age, and the percentage was 11%. Significantly lower mortality was found at >1-2 years of age that was 1%. No animals died due to LSD over 4 years of age. Over two years of age and three years of age, the mortality rates due to LSD were 2% and 1%, respectively. According to

Table 4. Breed wise mortality, calf mortality, abortion and repeat breeding rate in lumpy skin disease (LSD)

Parameters	Breed		Positive case		Rate		P value
	Cross	Indigenous	Cross	Indigenous	Cross	Indigenous	
Mortality	185	115	28	18	9.3[a]	6[a]	0.820
Abortion	54	30	9	2	10.7[A]	2.4[B]	0.012
Repeat breeding	20	11	10	4	32.3[c]	12.9[c]	0.17

[a-a] Values is a superscript letter in the same row aren't significant (p<0.05); [A-B] Values with different superscript letter in the same row are significantly different (p<0.05); [c-c] Values is a superscript letter in the same row aren't significant (p<0.05)

Table 5. Effect of milk production before and after lumpy skin disease

No of observation	Mean		Correlation	Paired sample T test
46	Before LSD	8.5109[a]	.992	0.00
	After LSD	6.4457[b]		

[a-b] Values with different superscript letter in the same column are highly significant (p<0.05)

Chouhan *et al*. (2022), in the case of calves (not more than 1 month), the mortality rate was 12.5%. The current study was outlined to investigate the overall abortion percentages in LSD-affected animals. The abortion rate in LSD was 13.1%, which was higher (10%) than in the study of Abdulqa *et al*. (2016). According to the current study, animals were aborted significantly more in crossbred (10.7%) compared with the indigenous or local ones (2.4%). No other study has been performed yet on abortion in different breeds of cows due to lumpy skin diseases. In the current study, the overall repeat breeder due to LSD was found 45.2%. No other research has been performed yet on repeat breeding rates due to LSD in cows. The repeat breeding rate due to LSD was higher (32.3%) in crossbred cows than in indigenous cows (12.9%). The result was not significant. No research was conducted on the incidence rate of repeat breeding in relation to the breed of cows due to LSD. From 46 LSD-recovered animals, average milk production was recorded. The average milk production before and after LSD infection was 8.5109 L and 6.4457 L, respectively. There was a significant relationship of drop of milk production due to LSD. According to Abutarbush (2014), a significant difference was observed between vaccinated as well as non-vaccinated LSD affected animals in milk production. Milk production was reduced in non-vaccinated and vaccinated animals, which was 76.9% and 21.4%, respectively.

Conflict of interest: Authors have no conflict of interest in this study.

Author's contribution: BMM: Data collection, statistical analysis and writing; SN: Compilation and management; FI: Supervising the research work and final editing; BFZ: Concept creation, methodology and editing.

Data availability statement: All the data supporting the research findings have been presented in this paper. The corresponding author is willing to provide the raw data upon reasonable request.

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