Research Article

Prevalence and Risk Factors Analysis of Bovine Foot Diseases in Certain Milk Pocket Areas of Sirajganj District, Bangladesh

Md. Zubael Islam, Rukhsana Amin Runa and Md. Mahmudul Alam*

Department of Surgery and Obstetrics, Faculty of Veterinary Science, Bangladesh Agricultural University, Mymensingh–2202.

Abstract | Shahjadpur dairy area of Sirajganj district plays a significant role to meet the demand for milk in Bangladesh. However, due to foot diseases the farmers face a considerable amount of economic loss. The study was carried out to determine the prevalence of foot diseases in cattle and also to explore the risk factors having a promoting role in developing foot affections in three unions (Potazia, Jalalpur, and Kaijuri) of Shahjadpur Upazila. Foot affections were physically investigated and examined from May to October 2019 and a total of 257 surgical affections were recorded, among them 46 cattle were diagnosed as different foot diseases. Among different surgical affections, the prevalence of foot diseases was as high as 17.89%. The most common foot affection was FMD (23.91%) which was followed by Laminitis (17.39%), Footrot (15.22%), Sole ulcer (13.04%), Interdigital dermatitis (10.87%), Upward patellar fixation (10.87%) and Digital dermatitis (8.69%). The highest prevalence of foot diseases was recorded in female animals (56.52%). The indigenous cattle were comparatively resistant to foot diseases than crossbred animals. One to two years old cattle were mostly affected in our investigation. In the rainy season, FMD, laminitis, and sole ulcer were more common compared to those in winter and summer. The prevalence of foot diseases was higher in the stall housing system (56.52%) compared to the open pack housing system (43.48%). This study highlights the prevalence and potential risk factors of bovine foot diseases in certain areas of Sirajgang district. It is recommended that further robust studies are required to address the foot disease burden in lactating cows.

Introduction

Livestock is an important component of the economy of Bangladesh. The contribution of the animal farming sector to GDP at a constant price is 1.53% and in the agricultural sector the contribution to GDP from this sector was 13.46% in the Fiscal Year 2017-18 (Bangladesh Economic Review, 2019). Though the share of the animal farming sub-sector in GDP is small, it makes an immense contribution towards meeting the requirements of daily essential animal protein. The number of livestock is 55.40 million and the amount of milk production is 7.01 million tons in Fiscal Year 2018-19 up to February 2019 (Bangladesh Economic Review, 2019). Milk has been producing domestically in all parts of Bangladesh. Shahjadpur Upazila of Sirajganj district is densely populated by cattle heads and has tremendous dairy significance in Bangladesh. There are 7600 dairy farms and 268 milk-producing co-operative societies at Shahjadpur Upazila. The amount of daily milk production of Shahjadpur Upazila is about 2,90,000

liters (District Statistics, 2013).

The bovine species are very much susceptible to various infectious and metabolic diseases. Besides, various congenital and acquired surgical affections are also responsible for decreased growth and performance of cattle (Hoda et al., 2018; Alam et al., 2014). The leading surgical affections in cattle that hinder the growth and performance in the context of Bangladesh are different foot affections, hernia, dermoid cysts, atresia ani, navel ill, myiasis, fractures, gangrenous mastitis, teat obstruction, teat crack (Alam and Rahman, 2012; Jaman et al., 2018). Foot diseases causing lameness in dairy cattle is a serious problem and causes significant economic losses, ranking third after mastitis and infertility (Whitaker et al., 2000) . Optimal animal production and performance will be reduced depending upon the severity of the problem (Hasan et al., 2014). Failure of proper treatment of these foot diseases to patients provides no alternative except the culling.

The majority of lameness in cattle occurs as a result of foot problems which may be caused by management and environmental factors, poor hygiene, and nutritional practices (Sadiq et al., 2017). However, there is no recent data on the prevalence of surgical affections especially foot problems in dairy cattle at milk pocket areas of Shahjadpur Upazila in Sirajganj District. So, a comprehensive survey is necessary to establish baseline information for field veterinarians to mitigate the problem in the cattle industry in Bangladesh. Therefore, the present investigation has conducted to investigate the prevalence of different foot affections and also to analyze the risk factors like age, sex, breed, season, and a housing system that may have promoting role in the occurrence of bovine foot diseases.

Materials and Methods

Study area and period
The study has been conducted in three unions (Potazia, Jalalpur, and Kaijuri) of Sirajganj district which has dairy significance in the country. Data have been recorded from May 2019 to October 2019.

Collection of data
Data were randomly collected from the free rearing system (open pack system) and stall-feeding system. During the period of study 257 cases of surgical affections were recorded, among them 46 cattle were diagnosed with different foot diseases.

Risk factors analysis
Risk factors that were directly or indirectly promoted the prevalence of various foot affections were identified and categorized under breed, age, sex, season, and housing system.

The survey in free rearing system
In the free rearing system, cattle were reared in open grazing land. Here, the housing and feeding system were observed. The houses were well ventilated. The floor was slippery when the soil was wetted with rain. The cattle were allowed to graze freely in the adjacent open yard containing full of green grass. They were supplied with little concentrates in the morning and evening. To collect data, at first history was taken from the owner and handler of cattle to get information of surgical affections. The affected cattle were then clinically examined by visual inspection of the foot, gait of animals, the posture of the patients, palpation of the affected area, percussion of foot with a hoof tester.

The survey in the stall feeding system
In the stall feeding system, the house was completely roofed and ventilated. The floor was non-slippery and impervious. The cattle were supplied with little fodder and concentrates. Concentrates were provided twice a day. Straw, wheat bran, and mastered oil cake were the feeding practice of these animals. The owner and handler were asked to know the history of surgical affections and the non-affected animals examined to confirm the affections. The clinical examination was done by visual inspections of the foot, gait of animals, the posture of the patients, palpation of the affected area, percussion with a hoof tester.

Case classification
Classification of case based on age: Based on age, the animals were divided into three groups:
- Age up to 1 year
- Age between 1-2 years
- Age above 3 years

Classification of case based on sex: Based on sex, the animals were divided into two groups:
- Male
- Female

Classification of case based on breed: Based on breed, the animals were divided into two groups:
- Local/indigenous
- Crossbred

Classification of cases based on season: Based on the season, the animals were divided into three groups:
- Winter (November to February)
- Summer (March to June)
- Rainy (July to October)

Classification of cases based on the housing system: Based on the housing system, the animals were divided into two groups:
- Free rearing system or open pack system
- Stall feeding system

Statistical analysis

The obtained data were organized in the Microsoft Excel spreadsheet and the prevalence of foot disease was calculated based on breed, sex, age, seasons, and rearing system.

The prevalence of surgical affections was calculated by using the following formula:

$$\text{Prevalence of specific affection} = \frac{\text{Number of specific surgical affection}}{\text{Total number of cases}} \times 100$$

Results and Discussion

Prevalence of surgical affections of cattle in selected milk pocket areas of Shahjadpur Upazila

In this study, the overall surgical affections in selective areas of Shahjadpur Upazila in Sirajganj district were foot diseases (17.89%), myiasis (7.78%), hernia (7.39%), arthritis (7.00%), navel ill (6.61%), abscess (5.45%), hump sore (5.06%), atresia ani (4.67%), dermoid cyst (4.67%), teat obstruction (4.67%), tail gangrene (4.28%), traumatic wound (4.28%), horn affection (4.28%), fracture (3.89%), gangrenous mastitis (3.50%), tympany (3.11%), urolithiasis (2.72%), and dislocation of the hip joint (2.72%) (Figure 1). Therefore, it was clear that foot diseases were predominant among the surgical affections in cattle in the concerned areas.

Prevalence of different foot diseases in three unions of Shahjadpur Upazila

We have found the highest prevalence of foot diseases of cattle in Potazia (52.17%) and this was followed by (28.26%) in Kaijuri and (19.56%) in Jalalpur (Table 1). Among the different foot diseases, the most common foot affections causing serious problem in dairy herd was FMD (23.91%) which was followed by Laminitis (17.39%), Footrot (15.22%), Sole Ulcer (13.04%), Interdigital dermatitis (10.87%), Upward Patellar Fixation (10.87%) and Digital dermatitis (8.69%).
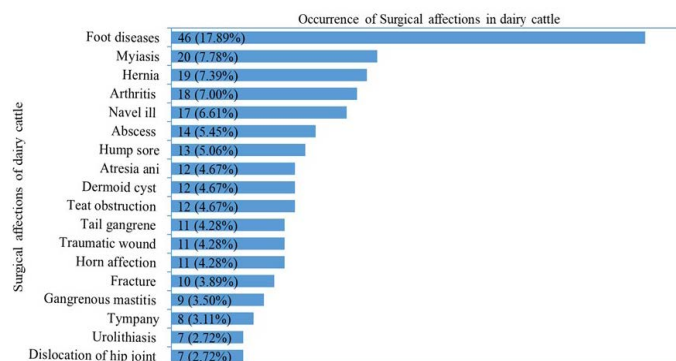

Figure 1: *The overall occurrence of surgical affections in cattle in Jalalpur, Potazia and Kaijuri union of Shahjadpur Upazila.*

Table 1: *Comparative analysis of the prevalence of different foot diseases in three unions of Shahjadpur Upazila (n=46).*

Foot diseases	Unions			Total
	Jalalpur (%)	Potazia (%)	Kaijuri (%)	
FMD	3 (27.27)	4 (36.36)	4 (36.36)	11 (23.91)
Laminitis	2 (25.00)	3 (37.50)	3 (37.50)	8 (17.39)
Foot rot	1 (14.28)	4 (57.14)	2 (28.57)	7 (15.22)
Sole ulcer	0 (0.00)	5 (83.33)	1 (16.67)	6 (13.04)
Interdigital dermatitis	1 (20.00)	2 (40.00)	2 (40.00)	5 (10.87)
Upward patellar fixation	2 (40.00)	3 (60.00)	0 (0.00)	5 (10.87)
Digital dermatitis	0 (0.00)	3 (75.00)	1 (25.00)	4 (8.69)
Total	9 (19.56)	24 (52.17)	13 (28.26)	46 (100)

Prevalence of bovine foot diseases in relation to age

In this investigation the highest percentage of foot diseases of cattle were recorded between 1-2 years of age (47.83%) followed by at the age up to 1 year (10.87%) and then at above 3 years old cattle (41.30%). Upward patellar fixation (80.0%), Foot root (57.14%), Sole ulcer (50.0%), Digital dermatitis (50.00%) and FMD (45.45%) were recorded at higher percentages in between 1 to 2 years ages. On the other hand, Laminitis (62.50%) and Interdigital dermatitis (60.0%) were recorded in comparatively higher percentages at ages above 3 years (Table 2).

Table 2: *Prevalence of bovine foot diseases based on age.*

Foot diseases	Age			Total
	Up to 1 year (%)	1-2 years (%)	>3 years (%)	
FMD	2 (18.18)	5 (45.45)	4 (36.36)	11 (23.91)
Laminitis	1 (12.50)	2 (25.00)	5 (62.50)	8 (17.39)
Foot rot	0 (0.00)	4 (57.14)	3 (42.86)	7 (15.22)
Sole ulcer	1 (16.67)	3 (50.00)	2 (33.33)	6 (13.04)
Interdigital dermatitis	0 (0.00)	2 (40.00)	3 (60.00)	5 (10.87)
Upward patellar fixation	0 (0.00)	4 (80.00)	1 (20.00)	5 (10.87)
Digital dermatitis	1 (25.00)	2 (50.00)	1 (25.00)	4 (8.69)
Total	5 (10.87)	22 (47.83)	19 (41.30)	46 (100)

Prevalence of bovine foot diseases based on sex

The study exhibited that the cumulative highest prevalence of foot diseases in cattle was recorded in female animals (56.52%) than those of male counterparts (43.48%). Among different foot affections, we found that FMD (63.64%), Laminitis (62.50%), Digital dermatitis (75%), Upward patellar fixation (60%), Footrot (57.14%) were more prevalent in female animals. On the other hand, Sole ulcer (66.67%) and Interdigital dermatitis (60.00%) were recorded in greater percentages in male bovine species (Table 3).

Table 3: *Prevalence of bovine foot diseases according to sex.*

Foot diseases	Age		Total
	Male (%)	Female (%)	
FMD	4 (36.36)	7 (63.64)	11 (23.91)
Laminitis	3 (37.50)	5 (62.50)	8 (17.39)
Foot rot	3 (42.86)	4 (57.14)	7 (15.22)
Sole ulcer	4 (66.67)	2 (33.33)	6 (13.04)
Interdigital dermatitis	3 (60.00)	2 (40.00)	5 (10.87)
Upward patellar fixation	2 (40.00)	3 (60.00)	5 (10.87)
Digital dermatitis	1 (25.00)	3 (75.00)	4 (8.69)
Total	20 (43.48)	26 (56.52)	46 (100)

Prevalence of bovine foot diseases on the basis of breed

In our investigation, we have found at much higher level of different foot diseases in cattle in crossbred animals (67.39%) than those of indigenous types (32.61%) (Table 4).

Prevalence of foot affections of cattle based on season

The study exhibited that the highest occurrence of foot diseases of cattle was recorded in the rainy season (41.30%) followed by in summer (36.96%) and winter (21.74%). Here, Laminitis (50.00%), Sole ulcer (50.00%), and FMD (45.45%) was more prevalent in the rainy season and least in winter (Table 5). On the other hand, the occurrence of Upward Patellar Fixation was maximum in the winter season (60%) and least in summer (20%) and the rainy season (20%).

Table 4: *Prevalence of bovine foot diseases in relation to breed.*

Foot diseases	Breed		Total
	Indigenous (%)	Cross (%)	
FMD	3(27.27)	8(72.73)	11(23.91)
Laminitis	3(37.50)	5(62.50)	8 (17.39)
Foot rot	2(28.57)	5(71.43)	7 (15.22)
Sole ulcer	2(33.33)	4(66.67)	6 (13.04)
Interdigital dermatitis	1(20.00)	4(80.00)	5 (10.87)
Upward patellar fixation	2(40.00)	3(60.00)	5 (10.87)
Digital dermatitis	2(50.00)	2(50.00)	4 (8.69)
Total	15(32.61)	31(67.39)	46 (100)

Table 5: *Prevalence of bovine foot diseases in relation to season.*

Foot diseases	Season			Total
	Rainy (%)	Summer (%)	Winter (%)	
FMD	5 (45.45)	4 (36.36)	2(18.18)	11(23.91)
Laminitis	4 (50.00)	2 (25.00)	2(25.00)	8(17.39)
Foot rot	3 (42.86)	3 (42.86)	1(14.28)	7(15.22)
Sole ulcer	3 (50.00)	2 (33.33)	1(16.16)	6(13.04)
Interdigital dermatitis	2 (40.00)	2 (40.00)	1(20.00)	5(10.87)
Upward patellar fixation	1 (20.00)	1 (20.00)	3(60.00)	5(10.87)
Digital dermatitis	1 (25.00)	3 (75.00)	0(0.00)	4(8.69)
Total	19(41.30)	17(36.96)	10(21.74)	46(100)

Prevalence of bovine foot diseases according to the housing system

The housing system is one of the most important influential factor for foot diseases. We have found that foot diseases in cattle were more prevalent in the stall housing system (56.52 %) than the open pack system (43.48%). The occurrence of Digital dermatitis (75.00%), Sole ulcer (66.66%), Laminitis (62.50%), Upward patellar fixation (60.00%), FMD (54.54%) were maximum in stall housing system (Table 6). On the other hand, Interdigital dermatitis (60.00%) and Footrot (57.14%) were recorded at a higher level in

the stall housing system compared to those in the open pack system.

Table 6: *Prevalence of bovine foot affections in relation to housing system.*

Foot diseases	Housing system		Total
	Stall housing system (%)	Open pack system (%)	
FMD	6 (54.54)	5 (45.45)	11 (23.91)
Laminitis	5 (62.50)	3 (37.50)	8 (17.39)
Foot rot	3 (42.86)	4 (57.14)	7 (15.22)
Sole ulcer	4 (66.66)	2 (33.33)	6 (13.04)
Interdigital dermatitis	2 (40.00)	3 (60.00)	5 (10.87)
Upward patellar fixation	3 (60.00)	2 (40.00))	5 (10.87)
Digital dermatitis	3 (75.00)	1 (25.00)	4 (8.69)
Total	26 (56.52)	20 (43.48)	46 (100)

Comparative analysis of the prevalence of foot diseases in three regions of Shahjadpur Upazila

When we compared the data, we have seen that the highest prevalence of listed foot diseases in cattle were encountered in Potazia (52.17%) which was followed by Kaijuri (28.26%) and in Jalalpur (19.56%) (Figure 2).
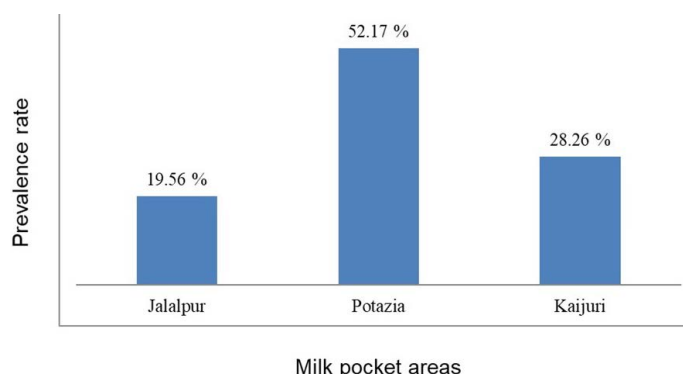

Figure 2: *Comparative analysis of the prevalence of different foot diseases in Jalalpur, Potazia and Kaijuri of Shahjadpur Upazila.*

Lameness is a serious concern of dairy cattle worldwide and hoof health and limb examination are essential step in lameness monitoring. Previous studies reported that hoof disorders are majorly responsible for the occurrence of lameness in dairy cattle (Somers and O'Grady, 2015; Solano et al., 2016). The prevalence of different foot diseases varies with the species, ages, sex, breed of the animal, and season of the year (Davis-Unger et al., 2019). The present study revealed that among the different surgical affections in the selective areas of Shahjadpur Upazila, the maximum occurrence was various kinds of foot problems (17.89%). This value is comparatively higher than the previous study reported by Noman

et al. (2012) where the occurrence of foot diseases was 10.59% in the Pabna-Sirajganj area dairy. They have collected data from different Upazila Veterinary hospitals but in our study, we have collected data directly from farmer's house and that may be the reason for the variation.

In the present study, among different foot diseases, the most common affection was FMD (23.91%) which was followed by Laminitis, Footrot Sole ulcer Interdigital dermatitis, Upward patellar fixation and Digital dermatitis (Table 2). This finding is in agreement with the earlier investigation of Ali et al. (2017) who found the highest prevalence of FMD among all foot diseases. Our study revealed that the occurrence of foot diseases of cattle was higher in female animals than those of males. This study agrees with the previous work of Sultana et al. (2017) who reported that the occurrence of foot diseases of cattle was higher in female animals. This may be due to the frequent handling of female animals for milching purpose which may influence the foot affections. This study revealed that the occurrence of foot diseases was higher in 1-2 years of age and lower in age until 1 year. This finding is similar to the previous findings of Ali et al. (2017) who found a higher prevalence of foot diseases in adult animals than the younger group. Adults are frequently handled for dairy and other purposes, which may have role on the development of foot affections. Our findings have shown that the crossbred animals were more prone to have foot affections than indigenous cattle. This finding is similar to that of Sultana et al. (2017) who observed that the prevalence of foot diseases was common in crossbred animals. Indegenous animals are immunologically stronger than crossbred animals and this may be one of the important reason for less prevalence in indigenous animals. Animal's body weight is another important factor for developing foot affections particularly claw affection. Normally crossbred cows are heavier than the indigenous one.

We observed the highest occurrence of foot diseases of cattle in the rainy season and lowest in the winter season. This finding is similar to the report of Ali et al. (2017) who recorded a higher prevalence of foot diseases in the rainy season. The higher prevalence of foot diseases during the rainy season may be due to increased humidity, softening of the soil, more mud slippery floor.

There was a greater percentage of foot affections in the open pack housing system than the stall housing system in our study. This finding is similar to the results of Sadiq et al. (2017) who reported increased lameness of cows kept in stall system rather than open housing. The reason may be due to longer stay of animals in the uncomfortable and unhygienic condition of the stall. It is also a stress where infections overcome the host's immune system leading to the development of foot diseases.

Conclusions and Recommendations

Lameness remains a condition with significant impact and burden to optimal production and welfare in cattle especially dairy cattle. With the majority of lameness events attributed to foot or claw lesions, assessment of the painful condition warrant techniques for early detection of cows in discomfort prior to the development of obvious signs of lameness. Our findings revealed that foot diseases are the most prevalent affections of cattle in Shahjadpur milk pocket areas of Sirajgang district and animal type, gender, age, environment, and housing were associated with these foot problems. This report may be an effective tool for the field vets to determine the appropriate course of action against such foot affections. Further works are needed to investigate the impact of specific claw and foot lesions on dairy cow welfare. Such a result could enhance the adoption of definite preventive measures and management practices to reduce the occurrence of lameness in dairy herds.

Authors' Contributions

Md. Zubael Islam conducted the research and extracted data. Rukhsana Amin Runa helped in editing the manuscript. Md. Mahmudul Alam designed the study, performed analysis, interpreted data, wrote the manuscript, and acted as supervisor of Md. Zobayel Islam and the corresponding author of this paper. All authors read and approved the final manuscript.

Conflict of interest
The authors have declared no conflict of interest.

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