



## Investigation of incidence and case fatality rate of Foot and Mouth Disease at Jhenaidah Sadar Upazila, Bangladesh

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### ABSTRACT

Foot and Mouth Disease (FMD) is an acute, highly contagious, transboundary viral disease of cloven-footed animals affecting mainly cattle, sheep, goats, buffalo, pigs, and many wild herbivores. It is the most widespread viral disease of the cattle population in Bangladesh as well as in the Jhenaidah Sadar Upazila, Bangladesh. This study was conducted to assess the incidence and case fatality rate of FMD in the cattle population at Jhenaidah Sadar Upazila, Bangladesh. This study was performed at Jhenaidah Sadar Upazila, Bangladesh from November 2019 to April 2020. A total of 187 cattle were examined during this study period. Data were collected using a pre-tested structured questionnaire through interviews of farmers and from the record book of Upazila Livestock Office and Veterinary Hospital, Jhenaidah Sadar Upazila, Bangladesh. The incidence of FMD was 56.68%, which was higher in females (62.6%) than males (45.3%). Cross-breed cattle (59.12%) showed a higher incidence than that of indigenous breed cattle (50%). The disease incidence was highest in November-January (62.5%) and lowest in March-April (46.94%). The incidence was higher in 1 to 3 years age group (61.02%) and lower in 0 to <1 year age group (52.7%). The incidence varied by Body Condition Score (BCS) and the observed highest incidence was in BCS-2 (68.96%) followed by BCS-3 (55.84%) and BCS-4 (13.04%) respectively. The non-vaccinated cattle (58.92%) showed a higher incidence compared to vaccinated cattle (53.33%). Pregnant cattle (59.45%) were more susceptible to FMD than non-pregnant cattle (6.98%). The observed case fatality rate was 10.38%, whereas the cured animal's percentage was 89.62%. This study reveals crucial insights into the incidence and case fatality rate of FMD in cattle at Jhenaidah Sadar Upazila. The findings support developing targeted interventions to control FMD and thus protecting cattle production. It is advised to prioritize mass vaccination program to reduce fatalities.

### INTRODUCTION

Foot and mouth disease (FMD) is the most widespread viral disease of cloven-hoofed animal and locally called as “Khura Rog” in Bangladesh (Ali et al., 2019) (Foot-and-mouth disease (FMD) in cloven-hoofed animals is considered a highly destructive disease in countries where the livestock sector plays a significant role in the economy, such as Bangladesh (Hossain et al., 2023). A substantial FMD-susceptible livestock population totaling 24.86 million cattle, 26.95 million goats, 3.83 million sheep, and 1.52 million buffaloes exists in Bangladesh (Livestock Economy at a Glance, DLS, 2022-23).

FMD is caused by the Foot and Mouth Disease virus (FMDV), which belongs to the Picornaviridae family and the genus is Aphthovirus (Hossain et al., 2023). The FMD virus has seven distinct serotypes: A, O, C, SAT-1, SAT-2, SAT-3, and Asia-1, with at least 65 identified subtypes (Rahman and Mozumder, 1991). It has been identified that four (4) serotypes (A, O, C, and Asia-1) and subtypes A-5 and A-22 are present in Bangladesh (Khan Sarah et al., 2002; Loth et al., 2011). The morbidity rate of Foot-and-Mouth Disease (FMD) was reported in cattle (27.04%), buffaloes (30.97%), sheep (8.88%), and goats (7.98%), respectively (Mahmud et al., 2016). A mortality rate of 71.46% in calves and a 66.6% reduction of milk yield has

been reported in some areas of the country (Ali et al., 2019 and Rahman et al., 2020).

FMD virus can be found in vesicular fluid, vesicular epithelium, respiratory aerosols, droplets, milk, urine, and semen of infected cattle. Susceptible animals can be infected through direct contact with respiratory aerosols and droplets from acutely infected animals, or indirectly through the environment or mechanically by persons, vehicles, wild animals, or birds (Alexandersen et al., 2003). It is believed that the FMD virus can be transmitted through aerosols over distances up to 30 miles under specific weather conditions (Iowa State University, College of Veterinary Medicine, 2024). It was observed that uncontrolled animal movement including both informal and formal cross-border animal movement within the country are important risk factors for the transmission of FMD in Bangladesh (Rahman et al., 2020).

The disease is characterized by high fever (104-106°F), epithelial erosions on the tongue and in the inner mouth leading to excessive salivation, and lesions on the feet causing lameness. In young calves, it can cause myocardial degeneration, known as “Tiger Heart disease” (Gleeson et al., 2003). The disease leads to significant economic losses including decreased milk production, loss of draft power, reduced body weight, lower meat production, and calf mortality. To prevent the FMD outbreak and to control the disease condition, vaccination program is necessary. Livestock Research Institute, Bangladesh produces vaccines including the monovalent (strain A), the bivalent (strains A and O), and the trivalent vaccines (strains A, O, and Asia-1). It is recommended to administer booster doses at 4-6 months intervals thereafter (Fraser, 1991). Immunity to one strain does not protect against other strains (Chowdhury et al., 1994). To effectively control the spread of FMD, it is important to implement strong bio-security measures, such as preventing uncontrolled animal movement in border area, isolating infected animals, and quarantining of newly arrived animals.

.In Jhenaidah, this type of study was not previously conducted. We conducted this study to comprehend the overall incidence of FMD in the

study area, and the results will assist in future research.

## MATERIALS AND METHODS

### Study area and duration

This study was conducted at Upazila Livestock Office and Veterinary Hospital, Jhenaidah Sadar Upazila, Bangladesh from November 2019 to April 2020.

### Data collection

A total of 187 cattle were observed during the study period. Data were collected using a pre-tested structured questionnaire through face-to-face interviews with patient owners. Infected animals were brought for treatment to the Upazila Livestock Office and Veterinary Hospital, Jhenaidah Sadar. Patients were clinically examined, and all the required data (breed, age, sex, body weight, physiological status, vaccination status) were collected for the study. The owner of the FMD-infected cattle was kept in touch for follow-up until recovery or death. The number of infected dead animals was counted to estimate the case fatality rate in this study.

### Data analysis

After collecting all the necessary information, the data were sorted, coded, and recorded in an Excel spreadsheet (Microsoft Excel Version, 2019) and further analyzed.

The incidence was calculated by using this formula-

$$\text{Incidence} = \frac{\text{Number of new cases of disease during a given time period}}{\text{Total population at risk during the time period}} \times 100$$

## RESULTS AND DISCUSSION

### Incidence of Foot and Mouth Disease (FMD)

FMD is one of the most common diseases of cattle in Bangladesh. We observed 187 cattle during the study and found 106 cattle of different ages, sexes, and breed was infected with FMD. The overall incidence rate of FMD was 56.68% which

corresponds to earlier studies such as 17.3% in Mymensingh (Chowdhury et al., 1994), 19.2% in Gaibandha (Islam et al., 1985) and 21% in Manikganj (Rahman et al., 1989). This higher incidence of Foot and Mouth Disease (FMD) in cattle might be due to different regions, times, immunization status and breeds. According to Chowdhury and Islam, cross-breed animals were more frequently affected by FMD compared to indigenous breeds in 1993 and 2020, respectively. Notably, the outbreaks of FMD were more pronounced in December (37.14%) followed by November (35.59%), and decreased in January

(30.19%) followed by February (13.04%) (Sarker et al., 2011 and Mannan et al., 2009). In this study, non-vaccinated cattle were more affected than vaccinated cattle, similar to findings in Orsel et al. (2006), which stated that a single vaccination effectively reduces virus transmission among dairy cattle. It's important to note that border areas are particularly susceptible to the spread of FMD (Kabir et al., 2024). In the present study, we also observed a similar situation in Jhenaidah. As a border area, it allows cattle to move freely across borders, and farmers bring the cattle without any quarantine or isolation measures in place.

**Table 1:** Incidence of FMD according to sex, age, breed, season, body condition score, immunization status and pregnancy status

Category	Parameters	Animal observed	Affected	Percentage
<b>Sex</b>	Male	64	29	45.3
	Female	123	77	62.6
<b>Age</b>	Calf (0 to <1 year)	55	29	52.7
	Young (1-3 years)	59	36	61.02
	Older (>3 years)	73	41	56.16
<b>Breed</b>	Indigenous	50	25	50
	Cross	137	81	59.12
<b>Season</b>	Winter (Nov-Jan)	72	45	62.5
	Late winter (Feb)	66	36	54.55
	Early summer (Mar-Apr)	49	23	46.94
<b>Body Condition Score</b>	BCS-2	87	60	68.96
	BCS-3	77	43	55.84
	BCS-4	23	3	13.04
<b>Vaccination status</b>	Vaccinated	75	40	53.33
	Non-vaccinated	112	66	58.92
<b>Pregnancy status</b>	Pregnant	37	22	59.45
	Non-pregnant	86	6	6.98

**Sex**

The higher incidence rate of FMD in female cattle (62.6%) than in male cattle (45.3%) (Table 1) which is similar to a previous study (Mazengia et al., 2010). The higher rate of incidence in female cattle than in male cattle might be due to the physiological stressors which include estrus,

pregnancy, and lactation which are known to affect their resistance to infection (Aiello and Mays). In this study, it is also identified that female cattle were commonly affected by FMD, which is similar to a previous study (Fakhrul-Islam et al., 2016). This finding was in disagreement with that of another investigation (Chowdhury, 1993), it was stated that higher incidence of FMD

in beef cattle (bull/bullock) than in dairy cattle. In contrast, Belina stated that there were no significant differences in FMD prevalence rates between sexes in 2016.

### **Age**

The higher incidence rate in young cattle (61.02%) than in calves (52.7%) and older cattle (56.16%) (Table 1). This is in agreement with another study (Rufael et al., 2008), which stated that in Ethiopia the estimated mean incidence of acute FMD, varied from 18.5% in cattle less than two years of age to 14.0% in cattle three to four years of age. In this study, it is also identified that younger cattle were commonly affected by FMD, which is similar to a previous study (Fakhrul-Islam et al., 2016). This finding was in disagreement with another finding (Chowdhury et al., 2020) that found that the frequency of FMD cases in older cattle was higher than in younger cattle.

### **Breed**

The susceptibility of various breeds of cattle to FMD (Table 1). In this investigation, it was observed that cross-breed cattle are more susceptible (59.12%) than indigenous breeds (50%). Similar findings are found in different studies (Chowdhury et al., 1993; Islam et al., 2020) where cross-bred animals are more frequently affected than indigenous breeds. However, other researchers have observed that the occurrence of FMD was more found in local cattle (35.48%) than in cross-breed cattle (15.50%) (Alam et al., 2016).

### **Season**

The seasonal incidence of FMD outbreaks of FMD that is highest in Winter (Nov-Jan) (62.5%), Late winter (Feb) (54.59%), and then gradually declined in Early summer (Mar-Apr) (46.94%) (Table 1). This finding is supported by another study where the outbreaks of FMD were significantly higher in November (35.59%) and December (37.14%), and then declined in January (30.19%) and February (13.04%) (Sarker et al., 2011). Kahn Sarah, who suggested that higher prevalence of FMD in winter season in 2002. The maximum number of FMD outbreaks were reported from other countries during winter

seasons (Chowdhury et al., 1993). In another study, we found that an increase in the number of cases concerning an increase in temperature and humidity was due to the high interaction of animals at grazing and water spots with ascending animal-free movements (Khan et al., 2017). Outbreaks of this disease were the highest in November (34.69%) and December (36.20%) (Mannan et al., 2009). The highest number of FMD cases was reported in the winter season found in another study conducted by Khan in 2024.

### **Body condition score**

FMD varies according to body condition score. Table 1 shows that animals with BCS-2 were 68.96% which was the highest. Animals with BCS-3 and BCS-4 were 55.84% and 13.04%, respectively. Cattle with a poor body condition score had more FMD cases in this study, which was also observed in another study (Fraser et al., 1991). Cattle with a BCS of 3 were more likely to be infected than those with a BCS of 4-5 stated in another study conducted by Islam Fakrul in 2017.

### **Immunization status**

The incidence of FMD was higher in non-vaccinated animals (58.92%) than in vaccinated animals (53.33%) (Table 1). In another study, data shows that a single vaccination is effective in reducing virus transmission among dairy cattle (Orsel et al., 2006).

### **Pregnancy status**

The female animals which were pregnant (59.45%) was more susceptible to FMD than non-pregnant females (6.98%) (Table 1). This outcome is compatible with other studies (Rahman et al., 1989; Fakhrul-Islam et al., 2016) which stated that the pregnant animals were more susceptible to FMD than non-pregnant animals but incompatible with Al-Ajeeli in 2018, who mentioned that there was no significant difference between pregnant and non-pregnant cattle infected with FMD. The pregnant animals were more susceptible to FMD and the result coincided with the result of Rahman, 1989. On the other hand, the seroprevalence of FMD was considerably higher among pregnant

cattle than non-pregnant cattle (Salim et al., 2020), which may be surprising as pregnant cattle receive better management, but it may be attributed to stress, physiological and hormonal factors associated with pregnancy (Aiello and Mays, 1998).

**Case fatality rate of FMD**

**Table 2:** Case fatality rate of Foot and Mouth Disease (FMD)

Category	Parameters	Total affected	Number	Percentage
Prognosis	Dead	106	11	10.68
	Cured		95	89.32

**CONCLUSION**

Foot and mouth disease is a great threat to livestock population all over the world including Bangladesh due to wide host ranges and its rapid mutation. The disease causes high economic losses (Approximately 500 crores) annually in Bangladesh. As the disease is enzootic in our country, prevention of it through education is not practiced here. Therefore, vaccination is the only means of preventing the disease. To be more effective, general vaccination should be modified including ring vaccination to produce a buffer area along the border.

The contribution of the livestock sector to our national economy mostly depends on immediate action like appropriate preventive measures and control strategy in this respect for better prevention and control of FMD in Bangladesh.

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**Conflict of interest**

The authors declare no conflict of interest.

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The case fatality rate was calculated by the formula (No. of deaths due to the disease/ No. of cases). In Table 2, the case fatality rate was observed 10.68%. At least 50% of the case fatality rate was reported in mountain gazelles with few deaths in cattle in Israel with a recovery period of 8-15 days (Chakraborty et al., 2014).

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