Prevalence and associated risk factors of hoof deformities in selected areas of Chattogram, Bangladesh

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Abstract

A study was conducted to assess the occurrence and linked risk elements of diverse hoof abnormalities among dairy and beef cows in several chosen farms located in Chattogram, Bangladesh. The investigation took place from April 2023 to August 2023. A total of 22 cattle farms were investigated and it was discovered that 45% of farms had several deformities, including fissures, cracks, inflammatory lesions, broken hooves, sloughing, and ulcers. The prevalence was higher in cattle raised in intensive settings (70%) than in those raised under semi-intensive (20%) and free-range (10%) conditions. Additional others risk variables included the non-rubber mat floor, energy intake, sufficient space allowance, floor condition and exercise facilities. The study revealed the prevalence of hoof abnormalities in the survey regions as well as risk factors for dairy and beef cattle.

Keywords: Prevalence, risk factors, hoof deformities, dairy farms.

Chapter 1

Introduction

For an agricultural nation like Bangladesh, the health of the cattle hooves is a crucial concern. Animal productivity and bodily condition are badly harmed by it. Most hoof conditions result in lameness, which later leads to culling and significant financial losses (Hernandez *et al.*2005) Although the exact sum of causes of hoof disorders is unknown, there are a number of risk factors that can contribute to their development. These risk factors change from region to region and depend on the environment in each location.

The abnormalities of hooves can be caused by a variety of sources, including bacteria, viruses, fungi, accidental injuries, trauma, insects, and more. The most common hoof illnesses in Bangladesh are FMD, Foot Rot, and Myasis, which can lead to lesions like cracks, fissures (Axial, Horizontal, and Vertical), sloughing off of the hooves, ulcerative lesions, inflammatory pain in the hooves, interdigital dermatitis, bed sores, and more. In addition to excessive or insufficient hoof growth, other notable hoof irregularities that play a role in calf lameness encompass conditions such as sole hemorrhage, sole ulcer, white line disease, claw deformities, toe ulceration, and necrosis, as well as interdigital hyperplasia, among others (as outlined in the MSD manual). Foot and Mouth Disease (FMD), foot rot, injuries, arthritis, laminitis, pressure sores, abscesses, milk fever, downer's cow syndrome, and physical injuries are a selection of both localized and systemic disorders that make cows more susceptible to hoof abnormalities leading to lameness and restricted movement in the animals (Cook *et al.* 2005). Additionally, high-yielding dairy cows, overweight cows, and cows raised intensively on concrete floors are all regarded as risk factors (Sogstad *et al.* 2005).

Numerous animals experience hoof disorders each year as a result of its widespread prevalence. They suffer badly and especially the calves die. Affected animals cannot be used for agricultural purposes even if they are healthy, which disrupts agricultural production. Production of meat and milk declines. Cows may miscarry and lose their ability to reproduce. If the udder becomes inflamed, the cow's capacity to produce milk is permanently loss.

Hoof deformities have been observed even in non-ambulatory cattle during the preclinical phase (Tadich *et al.*, 2010) and they have been demonstrated to lead to reduced milk production in dairy

calves prior to the onset of evident lameness (Green et al., 2014). Typically, farmers tend to seek treatment only for severe cases of lameness (Horseman et al., 2014) often underestimating its overall prevalence and its impact on dairy cattle. As the severity of the problem escalates, it transforms into a welfare issue as the animals experience pain and discomfort. (Whay and Shearer, 2017) Consequently, it is imperative to proactively examine dairy herds for hoof problems and to pinpoint the various risk factors associated with these issues within practical farm settings.

Several studies have already been published on hoof disorders in diverse regions of Bangladesh, including areas like Chittagong, Patuakhali, (Rahman et al. 2014) Narshingdi, and more. The outcomes of this research have successfully identified multiple risk factors that potentially contribute to hoof irregularities. Nevertheless, there is a scarcity of information regarding foot problems in cross-bred cattle, and a comprehensive understanding of the underlying causes is still lacking. In light of this, the current study aimed to determine the prevalence of hoof problems in the specified study area and to identify a range of risk factors associated with these hoof disorders.

Chapter 2

Materials and method

Study area and period

The study was carried out in randomly selected 22 commercial dairy farms at Patenga, Raozan, Shitakund, Karnaphuli upazilla as well as at Chattogram metropolitan area of Chattogram district during internship period from April 2023 to August 2023.Most of the farmers of the study area were rearing Holstein Friesian cross breed,a few numbers of jersey and shahiwal dairy and beef cattle.

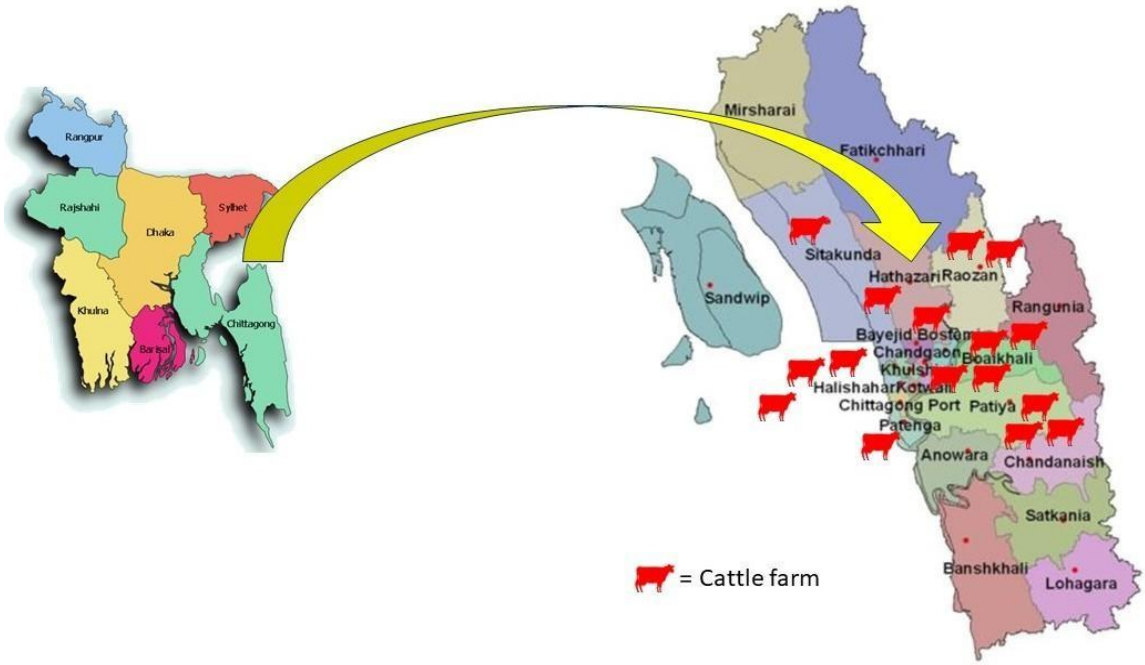

Figure 2.1: Study area

Data collection

A close-ended questionnaire was intended for the investigation. Farmers were repeatedly questioned, cows were observed, and register book entries were taken. Breed, body condition, posture, physical status, hoof-related illnesses, type of floor, washing system, housing pattern, floor (brick/concrete/rubber bedded/muddy), rearing system (intensive/semi-intensive/free-range), and grazing or zero-grazing were all recorded. The animals were examined to identify hoof problems and findings were recorded appropriately. Also, different inquiries addressing farmers' overall knowledge of hoof health were taken.

Figure2.2: Data collection from cattle farmer through face-to-face interview

Data Analysis

Data obtained were entered into Microsoft Excel Spread sheet 2007 and then data was analyzed in STATA 13.0 (StataCorp. 2013. Stata Statistical Software: Release 13. College Station, TX: StataCorp LP, USA) for analysis. Results were expressed as frequency, percentage and *p-value* against each category of variable and deformities. Significance was accepted at $p<0.05$.

Chapter 3

Results

General farm information

Table 1: General farm information (N=22)

Variable	Categories	Number	Percentage (%)
Farm type	Dairy	13	59.10
	Beef	3	13.60
	Mixed	5	22.70
Farm size	Small (1-10)	1	4.5
	Medium (10-20)	7	31.9
	Large (>20)	14	63.7
Rearing system	Intensive	17	77.2
	Semi-intensive	5	22.7
House type	Face-in	10	45.5
	Face-out	10	45.5
	Loose house	2	9.1
Mat use	Yes	9	40.9
	No	13	59.1
Space	<15 sq.ft	7	31.8
	15-20 sq.ft	12	54.5
	>20 sq.ft	3	13.6
Diet	Standard	9	40.9
	High concentrate	9	40.9
	High roughage	4	18.2
Floor condition	Dry	17	77.2
	Wet	5	22.7
Deformity	Yes	10	45.4
	No	12	54.5
Heel angle	Standard	6	27.24
	Low	7	31.8
	High	9	40.9

The information of selected farms is given in Table 1.

Prevalence of hoof deformities

In the present study, farm-based data of 22 farms were recorded. Among them, highest prevalence of deformity was ulcerative lesion of hooves (40%). Rest of the deformities like crack, fissure, fracture, sloughing off, and inflammation were prevalent at 10% each. Frequency of hoof deformities is shown in the pie chart (Figure1).

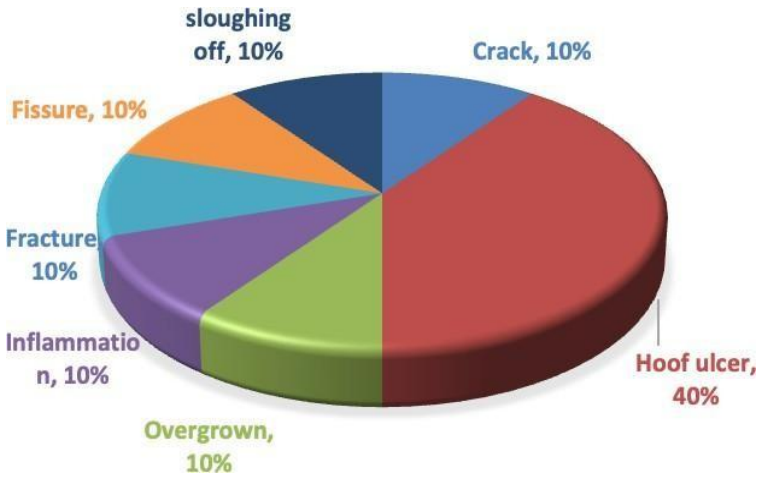

Figure 3.1: Frequency of hoof deformities

Association of different factors with hoof deformities

The analysis indicated that none of the variables showed a statistically significant association ($p<0.05$) with various hoof deformities. Detailed information about these associations, along with their respective p-values, is presented in Table 2. The current investigation unveiled that the incidence of hoof deformities was highest among cows raised in intensive housing conditions (70%), when compared to those in semi-intensive (20%) and free-range (10%) setups. Furthermore, ulcerated hooves were more common among cattle in intensive housing, whereas overgrown and sloughed hooves were predominantly observed in cows reared under semi-intensive conditions.

Although most farm floors are dry, concrete flooring (80%) are the leading cause of hoof issues as all the farms of study area covered here were made of concrete floor. Besides, this kind of floor is already harmful for hoof health of cow. However, it is also evident that face-in (70%) systems have more hoof issues than face-out (20%) systems, while loose housing (10%) has the fewest issues. Additionally, while considering the heel angle, it can be said that most issues (40%) have a decreased angle in hoof.

According to Table 2, dairy farms have a high deformity rate even though the p-value is

negligible*(p>0.05)*. Likewise, this is also brought on by intensive housing(*p>0.05*). Face-in system(*p>0.05*) has obvious hoof issues as well. Additionally, this study's biologically relevant variables that are associated with hoof deformities include less space allocation*(p>0.05)*, a high concentrate food*(p>0.05*), a dry (concrete) floor*(p>0.05*), exercise(*p>0.05*), and heel angle*(p>0.05*).

Table 2: Association of risk factors with hoof deformities

		Hoof deformities		
Variable	**Categories**	**Yes**	**No**	***P-value***
Farm type	Dairy	7	7	*0.83*
	Beef	1	2	
	Mixed	2	3	
Rearing system	Intensive	7	9	*0.52*
	Semi-intensive	2	3	
	Free-range	1	0	
House type	Face-in	6	4	*0.40*
	Face-out	3	7	
	Loose house	1	1	
Mat use	Yes	5	4	*0.42*
	No	5	8	
Spac e	<15 sq.ft	3	4	*0.72*
	15-20 sq.ft	5	7	
	>20 sq.ft	2	1	
Diet	Standard	5	4	*0.13*
	High concentrate	5	4	
	High roughage	0	4	
Floor condition	Dry	8	9	*0.78*
	Wet	2	3	
Exercise	Yes	3	1	*0.19*
	No	7	11	
Heel angle	Standard	3	3	*0.62*
	Low	4	3	
	High	3	6	

Chapter 4

Discussion

In this study, hoof deformities were found in 45.4% farms of study area. Compared to grazing cows, cows raised intensively exhibited an increased chance of developing several foot problems (Haskell *et al.* 2006; Hultgren and Bergsten, 2001). Among these farms some had more than one hoof problems. The differences in the results can be due to the research population's variable sizes, the study farms' climate effects, floor types, and genetic make-up of various breeds.

In the investigated region, the study identified one type of infectious lesion and six types of non-infectious lesions. The infectious lesion noted was hoof inflammation (10%), while the non-infectious lesions encompassed crack (10%), fissure (10%), fracture (10%), ulcer (40%), overgrowth (10%), and sloughed-off hooves (10%), as depicted in Figure 1. Notably, non-infectious lesions were more prevalent (85.7%) than infectious lesions (14.3%) in the study area.

Our findings align closely with those of Correa-Valencia (2018), who also reported a higher occurrence of non-infectious lesions (94.4%) compared to infectious lesions (5.6%) in Colombia. However, it's worth noting that their study identified eleven distinct types of foot lesions, whereas our study focused on seven different types. This potential discrepancy could potentially be attributed to their comprehensive coverage of a significant number of animals (1120) across a broader geographical area.

In our investigation, we observed that 50% of the farms with deformities did not employ rubber mats on their floors, despite the notable influence of flooring systems on hoof health. Farmers from the UK and Ireland have reported a considerable decrease in lameness by as much as 70%. Cattle situated on flooring with rubber surfaces displayed notably fewer sole lesions and larger hooves, exhibited increased periods of standing in the walkways, and demonstrated higher activity levels. This implies that rubber flooring offers enhanced comfort to the hooves in contrast to concrete flooring. (Schütz, Karin E., *et al.*, 2015).

Increased lameness, mainly from laminitis has been linked to excessive calorie consumption. In our study, 50% of the farm using high concentrate ration showed hoof deformities.

F. J. Manson and J.D Leaver Manson *et al.* (1989) reported that, the high concentrate ratio significantly increases the duration of clinical cases of lameness (Manson *et al.*, 1989).

Our study also revealed that, farms which provide zero-grazing or no exercise are more prone to gain hoof deformities. Majority of the farm (70%) do not have exercise or grazing facility. Nevertheless, in contrast to cows that are permitted to graze, cows housed inside have a higher prevalence of claw problems and lameness (Smits *et al.*, 1992; Gitau *et al.*, 1996). Lameness is also said to occur less frequently during the grazing season (Leaver, 1988).

Another variable which is space allowance has also direct effect on hoof health. In our study, 80% farm showed hoof deformities which provide less space to animal compared to the healthy farms. The provision of adequate space is crucial to farm animals' welfare. If adequate space provided, their ability to access resources like food (DeVries and von Keyserlingk, 2006, 2009) and lying areas (Wierenga, 1983), as well as being connected to their ability to move around freely and engage in physical activity (Hurnik and Lewis, 1991).

In our research, the cows displaying hoof deformities were primarily of Holstein Friesian crossbreed, with a smaller proportion belonging to Jersey and local crossbreeds. In contrast, Sulayeman and Fromsa (2012) identified a frequency of 3.8% for hoof deformities in both local and Holstein Friesian cows, with crossbreeds accounting for 1.6%. From this, it can be inferred that Holstein Friesian crossbred dairy cattle are more prone to experiencing hoof disorders compared to Jersey crossbred dairy cattle.

Additionally, the new findings of the study suggest that a diminished heel angle (45°) and the utilization of a face-in system might potentially contribute to the occurrence of hoof abnormalities. To validate the existing condition of hooves and to delve into the specific underlying factors accountable for altering hoof health and the associated economic repercussions, a more comprehensive research effort is essential.

Chapter 5

Conclusion

The majority of the hoof issues were seen in cows kept commercially in intensive housing, and the most likely risk factors were the rubber mat using, concrete flooring, space allowance, diet and exercise. The study examines the prevalence and factors causing hoof deformities to assist farmers, assistants, and veterinarians in Bangladesh to take the appropriate activities for improved cow care and management as well as for their personal financial advantage.

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Biography

Sabrina Rahman Sabrinthe daughter of Md. Lutfur Rahman and Nurnahar Begum was born in 1997 at Cox's Bazar. She received a Secondary School Certificate (SSC) from Cox's Bazar Govt. Girls' High School in 2014 and the Higher Secondary Certificate (HSC) from Cox's Bazar Govt. College in 2016. Subsequently, she enrolled in the Doctor of Veterinary Medicine (DVM) course at the Faculty of Veterinary Medicine at Chattogram Veterinary and Animal Sciences University (CVASU) in Chattogram, Bangladesh, for the 2017–18 academic years. She is now an intern student at CVASU, which required for Doctor of Veterinary Medicine (DVM) degree. In the future, she will have the ambition to become a large and small animal general practitioner.