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EFFECT OF FLOOR ON WELFARE OF LACTATING COWS IN SMALL FARMS OF SIRAJGONJ DISTRICT, BANGLADESH

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ABSTRACT

Animal welfare is a relatively new topic and there is a dearth of the report regarding the welfare assessment of dairy cattle in Bangladesh. Therefore, the present study was carried out to assess the effect of floor surface of the dairy sheds on mastitis, skin lesions, cleanliness of body and lameness of lactating cow in smallholders' production system. To conduct this study, 5 soil type floor, 5 brick paved and 5 concrete floors of small holder dairy units were selected in Sirajgonj district. From each shed, 5 numbers of dairy cows were selected preferably in the first lactation stage. A total 75 milk samples from three different types of the shed were tested for subclinical mastitis using a California mastitis test. The results showed that 40%, 28%, and 32% cows were CMT positive for subclinical mastitis in soil, brick made and concrete type floor, respectively. The prevalence of SCM was not significantly differences among the different types of floor ($P > 0.05$). Cleanliness and hygienic status of the muddy soil type floor were found to be significantly poor in comparison to that of brick made and concrete type floor of dairy farms. The prevalence of skin lesions in different body parts was higher in brick made (62%) and concrete floor sheds (88%) compared to soil bedded (31%) floor. Hair loses in the concrete and brick made floor was significantly higher ($P \leq 0.01$) in comparison with the muddy soil floor. The overall prevalence of lameness of the brick made (72%) and concrete type floor was higher (65%) than that of soil bedded shed (48%). There was a significant difference of lameness between soil type and brick made floor of the shed ($P > 0.05$). The study recommends that in order to reduce the high prevalence of subclinical mastitis, skin lesions and lameness in smallholder farmers require to improve floor conditions through regular cleaning of the floor or upgrade to the concrete floor using rubber mat.

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INTRODUCTION

Animal welfare is a multidimensional concept combining several scientific disciplines. Animal welfare is a relatively new topic which is just beginning to attract attention in Asia including Bangladesh. The welfare of dairy cows encompass nowadays a major concern of public interest extending in most of the countries, due to its impact on health and productions of animals and, implicit, upon public health. Dairy cows are susceptible to a range of serious welfare issues. There are many different management practices that can impact dairy cow welfare including cleanliness and hygiene (Napolitano *et al.*, 2005), health indicators such as mastitis, skin lesion, lameness (Capdeville and Veissier, 2001; Lavan and Livesey, 2011; Webster, 2001). Presently concrete or brick paved floor are used for standing, walking and loafing area of dairy housing. Concrete floor is popular as it is impervious to water, can be easily cleaned, most sanitary and durable. Unfortunately concrete type floor is not the ideal walking and standing surface for cow (Phillips and Morris, 2000). It is because of its abrasive and hard nature. Another serious objection includes slipperiness as it doesn't provide enough friction for natural locomotion and standing. Similarly brick made floor also have some of these serious objections. Hard floor surface adversely affects hoof health and comfort, predisposes animal to pain and lameness and ultimately affect productivity. Being a developing country of Bangladesh, most of the small holder family based farms are made of muddy soil or mixed with sand due to their economic problem. Therefore, better care and management including comfortable housing and resting place is of utmost importance. Cleanliness does have a relationship with animal welfare, through links with mastitis, lameness and gastrointestinal problems. Dairy cow cleanliness is possibly an indicator of cow welfare (Bowell *et al.*, 2003).

Disease or injury is an important aspect of animal welfare, but the importance of animal health in relation to animal welfare is sometime underestimated. Lameness can be a cause of severe pain (Webster, 2001) and lameness is a multi-factorial disorder however; many cases may be avoided simply by paying greater attention to flooring condition. Flooring is a main feature of environment that affects occurrence of lameness. It has been found that floor surfaces which are very hard very smooth, rough, soft or too wet cause lameness (McDaniel and Wilk, 1991). The incidence of lameness was highest for concrete (32%) than other softer floor surface (Vockey *et al.*, 2001). Clinical lameness can manifest itself as soon as four months after the animals are housed on concrete floor (Leach *et al.*, 2005). In recent study, lameness score was found higher in cows housed in brick floor with combination of either concrete or rubber in covered area (Upadhyay *et al.*, 2017). Hard floor surface adversely affects hoof health and comfort, predisposes animal to pain and lameness and ultimately affect productivity. Providing soft rubber floor for covered area and sand bedding in open area of loose housing system will be favourable for cow comfort, health, hygiene and milk production. It may probably reduce occurrence of lameness and mastitis in organized dairy farm. With the increased awareness for animal welfare, provision of cushioned flooring in the resting and feeding area of animal house is gaining popularity.

To our knowledge, studies concerned with prevalence of lameness, mastitis and skin lesions due to floor surface of dairy shed and welfare of cows are very scanty in Bangladesh. A very few research addressing animal welfare on assessment of dairy cattle welfare in Bangladesh reported by our group (Islam *et al.*, 2020 and Ahsan *et al.*, 2016). The hypothesis of the present study was that type of floors of the dairy shed would affects on-farm cows welfare variables. Therefore, a study was designed to evaluate how the floor types of the small holder farms affects the welfare of dairy cows in Sirajgonj district which is a high milk producing area of the country.

MATERIALS AND METHODS

Study site, farms and animals

The present study was conducted during the period from September 2017 to May 2018 in Sirajganj district. During the visit of farms, the farmer were informed of the purpose of the study and assured that their identity would be kept confidential. A preliminary survey was made prior to actual study for selecting apparently similar shed and animals for the proposed study. Recordings of the data were performed in 5 numbers of soil bedded sheds, 5 brick made sheds and 5 numbers of concrete bedded sheds. From each shed 5 numbers of dairy cows were selected preferably in the first 1-3 months of lactation stage.

Questionnaire

Face-to-face interviews with the farmers were carried out using a questionnaire with multiple-choice and semi-closed questions to collect data. Different parameters like standing floor space provided per animal, cleanliness and hygiene management and incidence of mastitis, skin lesion and lameness were studied during the study. At all times, farmers had the opportunity to clarify questions and add personal information and remarks. The on-farm assessment took an hour long interview and direct observation on the body injury and cleanliness of different body parts and lameness.

Cleanliness score

Animals were assessed by visual inspection and scored for cleanliness and hygiene by using a modification of the system described by Napolitano *et al.* (2005). A scoring chart divided the pelvis into five identifiable areas which were rated on a scale with anchor points at each end (0: clean and 2: very dirty) and half point increments. Scores were subsequently added to obtain a single value for each animal. The five regions were: ano-genital, udder rear view & lateral view, leg, hind underbelly and thigh.

Skin Lesions in body parts

During data collection on farm, cows were inspected for different lesions on different parts of animal body. Lesions on the skin were recorded on both the left and the right legs at the following locations: knee (carpal joint), front code (fetlock joint), hock (tarsal joint), stifle joint (articulation genus), and hip (tuber coxae). Lesions were classified as; 1: no noticeable changes, 2: hair loss, 3: swollen, 4: wound, as describe by Regula *et al.* (2004).

Lameness score

Lameness score was recorded after the afternoon milking using a scheme proposed by Breuer *et al.* (2000). Locomotion scoring is based on the observation of cows standing and walking (gait), with special emphasis on their back posture. Data were collected when cows were present in the shed. A score of 0 to 3 was used, where 0 was assigned when the animal was not lame (normal gait), 1 was given when the cow was mild lame, 2 was indicates, moderate lameness in cow and 3 was recorded when the cow was suffer from severely lame.

Detection of sub-clinical mastitis by CMT tester

For detection of sub-clinical mastitis, CMT was performed as the instructions of manufacturer (CHEIL BIO Co. Ltd.). In brief, 2 mL milk sample and 2 mL CMT solution were mixed together in test paddle. Rotate the paddle to mix, and changes in color and gel formation was observed within 10 to 15 Sec.

Data Analysis

Percentage (%) of values was calculated for different variable. To find out the significance difference, student's t test was used.

RESULTS

Prevalence of sub-clinical mastitis

Out of 25 lactating cows examined, 10 representing 40% were CMT positive (at least one CMT-positive quarter) for SCM in the muddy soil type floor dairy shed (Table 1). In addition, out of 25 cows, 28% (7) and 32% (8) were CMT positive for SCM in brick made and concrete type floors, respectively (Table 1). The prevalence of SCM was not significant differences among the types of floors ($P>0.05$) but the SCM tendency was higher in muddy soil type floor system shed.

Table 1. Subclinical mastitis at individual cow of different type's floor dairy shed detected by CMT

Attribute	Floor types	No. of samples	CMT positive	Prevalence (%)
Cows	Soil type	25	10	40
	Brick made	25	7	28
	Concrete	25	8	32

Cleanliness and hygiene

Overall, a significant number of animals were showed dirty conditions in different parts of the body. Based on the scoring of cleanliness and hygiene, the average number of cows classified as clean, dirty and very dirty were 3(12%), 15(60%), 7(28%), respectively for soil bedded floor. In addition, the average number of animals scored on cleanliness and hygiene were 12(48%), 10(40%), 3(12%) and 13(52%), 10(40%), 2(8%), respectively for brick made floor and concrete bedded floor. There was a significant difference between soil type and brick made floor, and soil type and concrete type floor ($P\leq 0.05$) (Figure 1). The type of flooring had no significant ($p<0.05$) between the brick and concrete type floor (Figure 1).

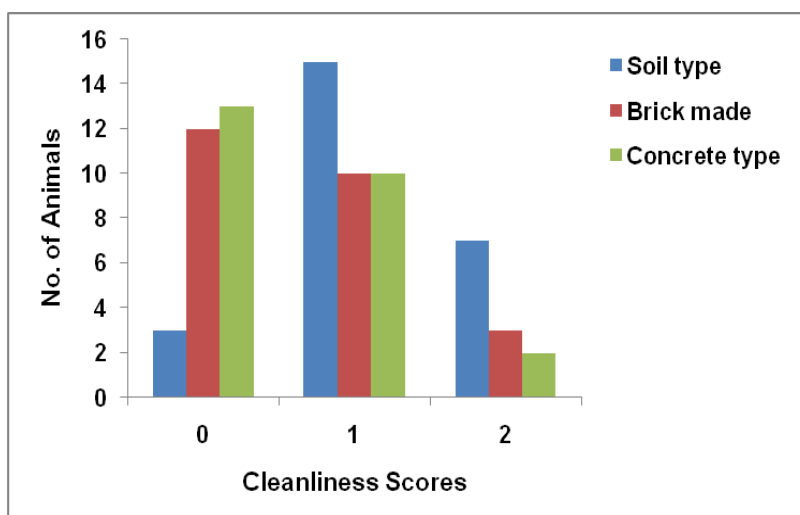


Figure 1. Scores on cleanliness and hygienic status of animals at different types of floor

Lameness

The present study revealed that the overall prevalence of lameness of the brick made (72%) and concrete type floor was higher (65%) than that of soil bedded shed (48%). Out of 25 observed animals, the number of animals exhibited the scores on lameness during milking were found to be 48% (8) mildly lame, 44% (2) moderately lame, 8% (1) very lame for soil bedded floor and 28% (10) mildly gait, 28% (3) moderately lame, 40% (3) very lame for brick made floor, respectively (Figure 2). The percentage of animals showed the lameness classified as mild, moderate and severe lame were % (8), % (4) and % (2), respectively for concrete type floor (Figure 2). There were significant differences of lameness of cows between soil type and brick made floor of the shed ($P>0.05$).

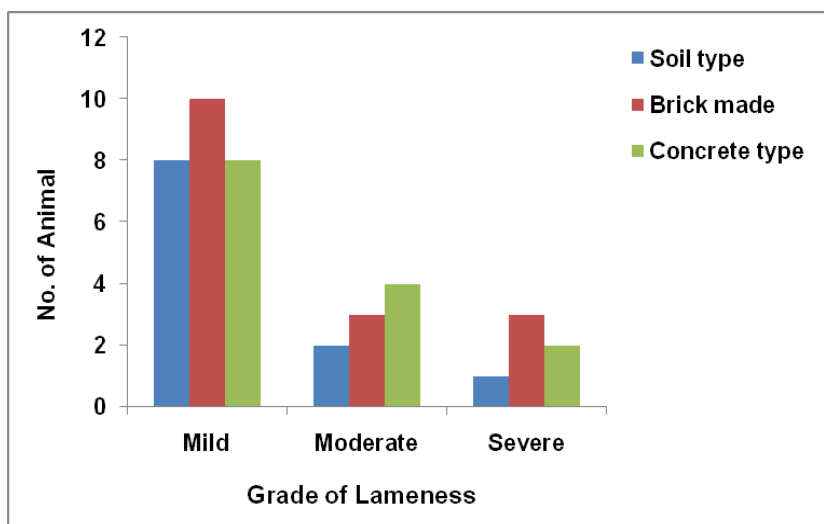


Figure 2. Animals showed different grades of lameness at different types of floor

Skin lesions and injury

The number of animals observed with skin lesions were 3 (12%), 4 (16%), 3 (8%) and 10 (52%), 6 (24%), 4 (12%) which had been categorized as hair loss, swollen and wound for soil type and concrete type shed, respectively (Figure 3). In addition, the number of cows examined as hair loss, swollen and skin injuries were 14 (52%), 4 (24%), 7 (12%), respectively for concrete type floor shed. Hair losses in the concrete and brick made floor was highly significant ($P\leq 0.01$) in comparison with the muddy soil type floor.

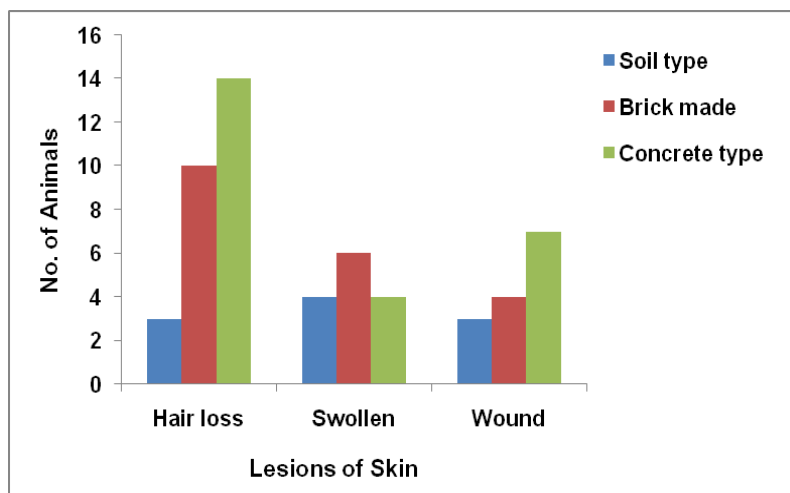


Figure 3. Total number of animals with different types of skin lesions on different body parts

DISCUSSION

This study revealed that the floor surface of the dairy shed is a potential risk factor that can affect the welfare of lactating cows in terms of causing mastitis, skin lesions and lameness. There was a complex correlation among the said factors in this study which indicated poor welfare exists in the studied area.

Mastitis

Mastitis is a disease of major economic importance in the dairy industry and a big welfare problem worldwide including Bangladesh. This study, the prevalence of SCM in examined cows was significantly influenced by floor type. Muddy soil floor type had a high prevalence of subclinical mastitis compared to brick made and good concrete floor. The finding agrees with the study by Mekibib *et al.* (2010), who also found a high prevalence of subclinical mastitis in soil floor and dirty udder. Poor hygiene and cleanliness of dairy cows has been consistently reported to be associated with the risk of subclinical udder infection (Schreiner and Ruegg, 2003). In the current study, the high prevalence in cows reared in soil type floor can be explained by the dirty floor would be a potential source of mastitis organism.

Cleanliness and hygiene

The present study revealed that the cleanliness and hygienic status of the soil floor type were poor than both bricks made and concrete type floor. This may be attributed to the selection of flooring material by the farmer of respective sheds through proper training on hygienic management of dairy units for better production. Moreover, the knowledge on scientific rearing of livestock is less among the farmers who kept their dairy animals on soil bedded shed than that of concrete bedded shed comprising the freedom of the animal to discomfort (Valde *et al.* 1997) and Ward *et al.* (2002) stated that the dirtier cows positively correlated with mastitis of cows. A similar study was conducted by Hauge *et al.* (2012) and concluded that cattle cleanliness affects hygienic milk production, thermoregulation, health and also confirmed the relationships between cleanliness of animals in dairy herds and factors associated with housing, feeding and management conditions. It has also been observed that the concrete and brick made floor type shed was better in management in comparison to soil type floor of shed indicating the animal welfare. Floor cleanliness showed a significant ($p < 0.05$) or close to significant ($p < 0.10$) relationship with lameness, hind limb cleanliness, udder cleanliness, body hair loss, respiratory problems, and mastitis (Islam *et al.*, 2020).

Skin lesions on different parts of the body

The result from this study indicates that there is high prevalence of skin lesion in concrete bedded shed and brick made floor than that of muddy soil type floor, which may be due to the flooring condition. Since the concrete type floor is more slippery that aggravates the chances for skin lesion and brick made floor is likely to be uneven that may affects skin lesions in different parts of the body. Though concrete and brick type floors are hygienically management is easy and good for cleaning rather than soil type floor but are more prone to the risk of poor welfare. The present study is well supported by the study conducted by Dutta *et al.* (2020) who found the prevalence of skin lesion was higher (88.00%) in concrete bedded shed than soil type floor. The present study is well supported by the study conducted by Kielland *et al.* (2009) who reported more risk factor related to prevalence of skin lesion of the Norwegian dairy cattle kept on harder free stall base in compare to the soft free stall base housing system. Similarly, Kumar *et al.* (2017) also reported that the prevalence of hock lesions in dairy farms was as high as 50 percent. Skin lesions, primarily the hock lesion are good indicator of poor welfare due to less comfort to the animals. As hock lesions are correlated to lameness, they are associated with economic losses and impaired welfare, as well as the negative societal perception of the dairy sector. In several studies, it has been found that concrete floor can adversely affect health, welfare, productivity and reproductive performance of cow (Enevoldsen *et al.*, 1994; Webster 2002).

Lameness of animals

Lameness is a major problem on dairy farms, both from the point of animal welfare and farm profits. Management factors have a significant influence on the number and severity of lameness cases. The design of facilities, including uneven concrete floor, uneven brick made floor and uncomfortable stalls with no bedding, are important risk factors for lameness, as is the structural integrity of the cow's hoof. In this study, the results revealed that the overall prevalence of lameness of the concrete type (65%) and brick made floor (72%) was high than that of soil bedded shed (48%). It may be due to the hardness, abrasiveness and slipperiness of the concrete floors, which can contribute to foot lesions and lameness. Brick made floor can be difficult for animals to get up and lie down or inducing injuries, and even making animals prone to lameness. Moreover on concrete floors dairy cows exhibit exceeded growth in claws, which leads to severe injuries of the sole (Bicalho and Oikonomou, 2013). Our study is well supported by the very recent study by Dutta *et al.* (2020) who reported the incidence of lameness was recorded higher (72.00%) in concrete bedded shed than that of soil bedded shed (52.00%). Findings from this study were in agreement with the study conducted by Vokey *et al.* (2001), who reported that the incidence of lameness was highest for concrete floor (32%) than other softer floor surfaces. In an another study, lameness score was found higher in cows housed in brick floor with combination of either concrete or rubber in covered area (Upadhyay *et al.*, 2017). In several studies, concrete floor and related hard floor has been found involved in the development of lameness (Vanegas *et al.* 2006, Cook and Nordland 2009). It has been found that floor surfaces that are very hard, very smooth, rough, soft or too wet cause lameness (McDaniel and Wilk, 1991). Therefore, ideally housing or management systems should consider the animals preference to improve welfare and to ensure that the animals are free from pain, injury, and disease.

CONCLUSION

From this study it can be concluded that the welfare of dairy cows is significantly influenced by the floor type in the studied area of Bangladesh. Thus, it can be said that worldwide due to increased animal welfare standards, flooring of the animal house will take an important position. The present study revealed that the concrete bedded and brick-paved floor type of shed has advantages in regards to cleanliness and hygiene. However, overall skin lesion and lameness were found to be higher in brick made and concrete type floor than that of soil type floor of dairy sheds. Prevalence of SCM was found to be higher in brick made floor type shed and the incidence of mastitis was found to be higher in concrete type floor. It has also been observed that the concrete and brick made floor type shed was better in management in comparison to soil type floor of shed indicating the animal welfare. Thus, the resting area could be covered with sand bed and concrete or brick type floor could be covered with rubber mat to improve the dairy cattle welfare in terms of decreasing mastitis, lameness and skin lesions.

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CONFLICT OF INTEREST

There is no conflict of interest for this study.

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