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On farm welfare assessment of dairy cattle in small holders' production system in Assam

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Abstract

A study was carried out to assess the On-Farm welfare of dairy cattle in small holders' production system in Assam. The study was conducted in 5 nos. of soil bedded sheds and 5 nos. of concrete bedded sheds in Kamrup (Metro) District of Assam. From each shed 5 nos. of dairy cows were selected preferably in 1-2 months of lactation stage. Out of 10 shed observed, the average standing floor space provided per animal was recorded as 3.40 m² and 2.90 m² for soil bedded and concrete bedded shed respectively and the percentage of dry matter, crude protein, crude fibre, ether extract and total ash of concentrated mixture provided to the animals in both the sheds were found to be 89.60, 21.20, 10.67, 2.60 and 5.80% respectively. The cleanliness and hygienic status of the soil bedded shed were found to be poor in comparison to that of concrete bedded shed and the overall prevalence of mastitis was found to be 4.80% and 5.60% in soil bedded and concrete bedded shed respectively. The prevalence of skin lesion was higher (88.00%) in concrete bedded shed. The incidence of lameness was also recorded higher (72.00%) in concrete bedded shed than that of soil bedded shed (52.00%). The concrete bedded floor type of shed has advantages in regards to cleanliness and hygiene maintenance of the dairy cows, however skin lesion and lameness were found to be higher in concrete bedded shed than that of soil bedded shed. The welfare of dairy cows is significantly influenced by the floor type. The animal welfare issues have been compromised in the soil bedded floor type of housing in comparison to concrete bedded floor type of housing in Kamrup (Metro) District of Assam.

Keywords: Animal welfare, dairy cattle, floor type

Introduction

Animal welfare is a multidimensional concept combining several scientific disciplines. It is driven by ethical and societal concerns, as people are obligated towards animals in their care. Animal welfare is intrinsic for the animals and not something given to it by humans (Broom, 1996) ^[1]. Farm Animal Welfare Council (FAWC) designed guidelines known as "the Five Freedoms" to protect farm animals from unnecessary suffering and to promote good animal welfare and address both physical and mental suffering. This Five Freedoms define welfare as the freedom: 1) from hunger and thirst 2) from discomfort 3) from pain, injury or disease 4) from fear and distress and 5) to express normal behavior (FAWC, 2009) ^[2].

There are many different management practices that can impact dairy cow welfare. These practices include: floor space provided (Hurnik and Lewis, 1991) ^[3], quality and quantity of feed provided (Grant and Albright, 1995) ^[4], cleanliness and hygiene (Napolitano *et al.*, 2005) ^[5], health indicators such as mastitis, skin lesion, lameness (Capdeville and Veissier, 2001; Lavan and Livesey, 2011; Webster, 2001)^[6,7,8], reproductive indicator such as inter-calving period, number of service per conception and incidence of post parturition problem (Berglund, 2008) ^[9], behavioral indicators such as rumination, feeding, resting, sleeping, milking (Anna *et al.*, 2011) ^[10], and body condition scoring (Edmonson *et al.*, 1989, Wildman *et al.*, 1982) ^[11,12]. Space allowance generally determines the freedom of movement for confined animals. Stocking animals at increasingly higher densities successively decreases the opportunity for exercise and choice of micro-environment and social companionship. Quality and quantity of feed has an impact on production and welfare of cows. Maximum emphasis in feeding practices in dairy cows should be given on the physiological needs of the animal. 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) ^[13].

Disease or injury is an important aspect of animal welfare, but the importance of animal health in relation to animal welfare is sometime under-estimated. Lameness can be a cause of severe pain (Webster, 2001) [8] and the United Kingdom's Farm Animal Welfare Council recently stated that lameness was the most important animal welfare problem for the dairy cow. However, there is dearth of report regarding the welfare assessment of small holders' dairy cattle and the risk factors causing poor welfare in Assam particularly in Kamrup (Metro) District.

Material and methods

The experiment was carried out at the commercial small holders' dairy farms in and around Guwahati under Kamrup (Metro) District of Assam, India. 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 nos. of soil bedded sheds and 5 nos. of concrete bedded sheds. From each shed 5 nos. of dairy cows were selected preferably in the first 1-2 months of lactation stage. Different parameters like standing floor space provided per animal, quantity and quality of feed provided to animals, cleanliness and hygiene management and incidence of mastitis, skin lesion and lameness were studied during the study. The quality of the food provided for animal was determined through proximate analysis of feed samples by the methods described in AOAC (2003) [14]. Experimental animals were scored for cleanliness and hygiene by using a modification of the system described by Napolitano *et al.* (2005) [5]. 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. The incidence of mastitis was determined through interview of households/cattle owners or attendants using structured questionnaire. The questionnaire was designed to collect the information on mastitis problem from last 5 years. A questionnaire was used undertaking face to face interview of the respondents to record the incidence of mastitis. 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) [15]. The lameness score was recorded after the afternoon milking using a scheme proposed

by Breuer *et al.* (2000) [16]. 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 mildly lame (slight limp – no head bob), 2 was attributed when the subject was lame (clearly limp – head bob) and 3 was recorded when the cow was very lame (head bob and held leg up for a period of seconds).

Result and discussion

Standing floor space provided per animal

The average standing floor space provided per animal was recorded as 3.40 m² and 2.90 m² for soil bedded and concrete bedded shed respectively. Moreover, the average width, depth and height of the manger were recorded as 0.51m, 0.46m and 0.55m for soil bedded and 0.59m, 0.40m and 0.54m for concrete bedded shed respectively.

The space allowances for the animals under concrete bedded shed were below against the recommendation of National Code of Practices for Management of Dairy Animals in India, (ICAR, 2014) [17]. However, the present findings are in agreement with Fregonesi and Leaver (2002) [18], who reported low space allowances in two experiments relating to welfare of dairy cows housed in straw-yards. The present study revealed that there is low welfare regarding floor space allowances in concrete bedded shed compared to soil bedded shed. It may due to the economic status of the farmers who kept only few animals on soil bedded shed for their livelihood. Hence animal gets more space than that of concrete bedded shed.

Moreover in the present study, the average width, depth and height of the manger were within the recommended value given by BIS, (2005) [19]. The manger should be designed and located where the animals cannot get into them so that the troughs are kept clean. Where feed and water troughs are provided in the loafing area, the access areas should be sufficiently wide to permit free movement of animals and prevent routes becoming wet and slippery and therefore increase the welfare of the animals (ICAR, 2014) [17].

Quality and quantity of feed provided to animals

The percentage of dry matter, crude protein, crude fibre, ether extract, total ash and nitrogen free extract of concentrate mixture provided to the animals were found to be 89.60, 21.20, 10.67, 2.60, 5.80 and 59.73 percent respectively which includes the grasses like Guinea, Napier, Para, Maize and Paddy straw. The nutrient composition of the concentrate mixture was at per the recommendation of ICAR, (2013a) [20].

Table 1: Proximate analysis of feed samples (% On DM basis)

Variables (%)	Concentrate mixture	Green fodder				Dry fodder
		Guinea	Napier	Para	Maize	Paddy straw
Dry Matter	89.60	22.40	19.20	32.10	26.20	88.23
Crude Protein	21.20	11.20	9.80	10.61	8.40	3.10
Crude Fibre	10.67	37.20	35.80	23.26	28.90	31.80
Ether Extract	2.60	1.60	1.90	1.80	1.90	1.80
Total Ash	5.80	10.60	12.50	9.90	8.20	13.20
NFE	59.73	39.40	40.00	54.43	52.60	50.10

The average quantity of concentrate feed mixture and green grass provided per animal were found to be 2.90kg & 3.40kg and 6.00kg & 6.50kg for soil bedded and concrete bedded shed respectively. However, the average dry fodder provided per animal was 7.50Kg for both type of shed. There was no significant difference in supplementation of dry fodder in soil

bedded and concrete bedded shed. But highly significant differences were observed in supplementation of concentrate feed mixture and green grasses in both the types of shed ($P \leq 0.01$).

Animals need to receive diet in adequate quantities of sufficient nutritional value to meet the requirements of good

health and welfare. Dairy cattle of all ages must receive sufficient quantities of feed/nutrients to enable each animal to maintain good health and meet their physiological requirements for production, reproduction and maintenance of health. Although, the dairy animals kept in both the floor type

of housing received sufficient amount of concentrate mixture and dry fodder, but lack of commitment had been observed to provide sufficient green fodder to keep the animals healthy and productive enabling low welfare.

Table 2: Floor space and feed allowance to the animals

Parameters	Soil bedded	Concrete bedded
1. Floor space provided per animal (m ²)	3.40	2.90
2. Dimension of manger (m)		
Width	0.64	0.59
Depth	0.46	0.40
Height	0.55	0.54
3. Quantity of feed provided per animal (kg)		
Concentrate mixture	2.90	3.40
Green fodder	6.00	6.50
Dry fodder	7.50	7.50

Scoring on cleanliness and hygiene

The average number of animals scored on cleanliness and hygiene were 4 (16%), 16(64%), 5(20%) and 12(48%), 10(40%), 3(12%) for soil bedded and concrete bedded shed respectively based on the score ranging from 0 to 2, where 0:clean to 2: very dirty. There was significant difference between both the floor types of shed ($P \leq 0.05$).

This study revealed that the cleanliness and hygienic status of the soil bedded shed were poor than concrete bedded shed. This may be attributed to the selection of flooring material by the farmer of respective sheds. 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)^[21] and Ward *et al.* (2002)^[22] stated that the dirtier cows positively correlated mastitis incidence.

Similar study was conducted by Hauge *et al.* (2012)^[23] 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 managerial condition. Iwanczuk (1997)^[24] also observed

that milk yield was shown to be significantly affected by mastitis intensity and hygienic condition in the shed. Bodman and Rice (1996)^[25] identified key areas like personal hygiene, cow environment, cow cleanliness, clipped udders, water use, udder wash, pre-dipping, udder drying etc. contributing to elevated bacteria counts and suggested practices which can inhibit bacterial growth.

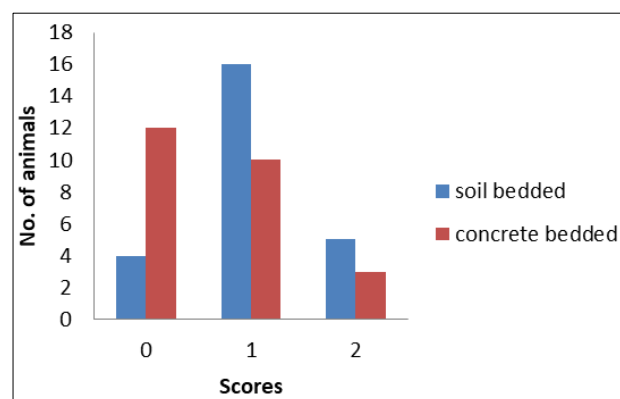
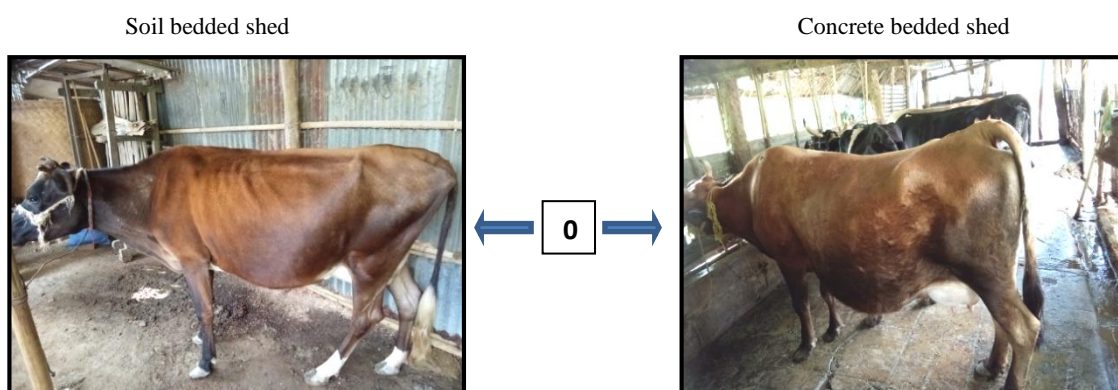


Fig 1: Scores on cleanliness and hygiene of experimented animals



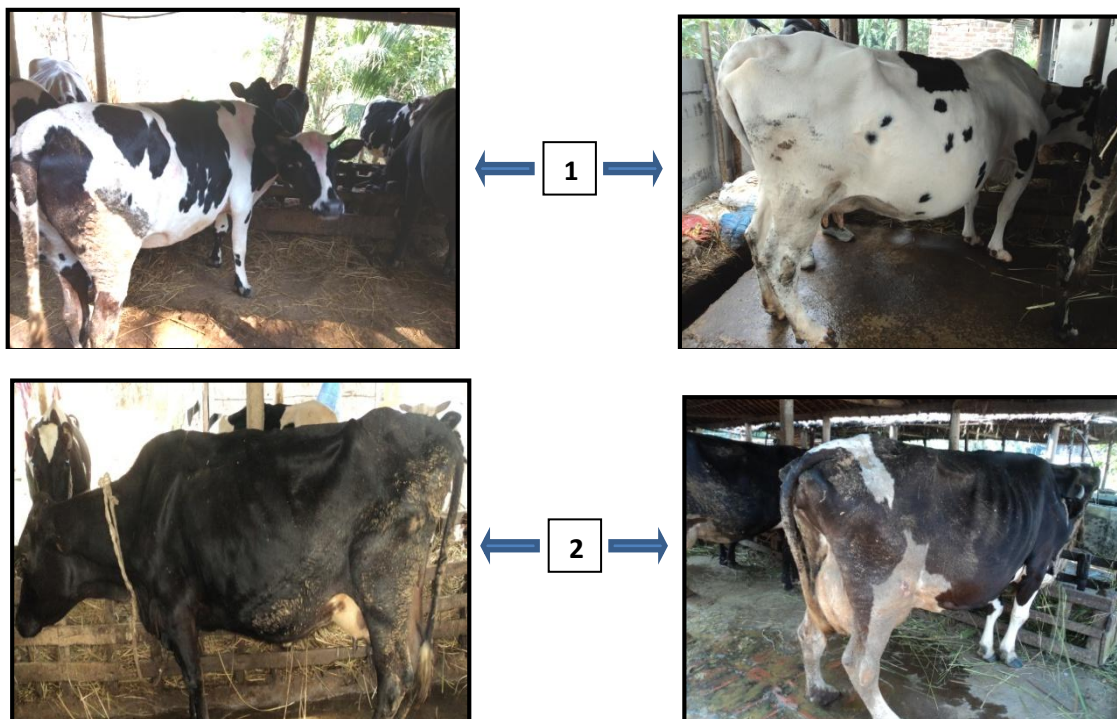


Fig 2: Scoring on cleanliness and hygiene of experimented animal

Incidence of mastitis, skin lesion and lameness score

The incidences of mastitis over the last 5 years were 1(4%), 2(12%), 1(4%), 0(0%), 2(8%) for soil bedded shed and 1(4%), 2(8%), 1(4%), 0(0%), 3(12%) for concrete bedded shed respectively. No significant differences were observed in both the types of sheds for incidence of mastitis among the experimented animals ($P > 0.05$). It indicates a gradual reduction of incidences of mastitis among the experimental animals which may be due to increase awareness among the dairy farmers for scientific health management of their animals. The present study is in close agreement with Bitew *et al.* (2010) [26] who reported that the overall prevalence of clinical mastitis ranged between 5.5% and 3% in crossbred cows.

Similarly, low incidence of mastitis was also reported by Sinha *et al.* (2014) [27] who found 9.88% of mastitis in Pune, India. Various risk factors like breed, parity, stage of lactation, level of milk production, teat tip to floor distance, housing, milking management udder and teat characteristics have been reported to be associated with the incidence of mastitis (Sharma and Singh, 2003) [28]. The trauma caused by milking machines to teat tissues (Sordillo, 2005) [29] and genetic selection for extremely high milk yields have been identified as predisposing factors for infection of mammary glands (Heringstad *et al.*, 2003; Tyler and Cullor, 2002) [30, 31]. Most cases of mastitis are caused by infections by pathogenic bacteria introduced through the teat opening (Tyler and Cullor, 2002) [31].



Fig 3: Incidences of mastitis of the experimented animals during the last five years

The number of animals observed with skin lesions were 3(12%), 4(16%), 2(8%) and 13(52%), 6(24%), 3(12%) which had been categorized as hair loss, swollen and wound for soil bedded and concrete bedded shed respectively. There was no significant difference between both the types of shed for swollen, wound and open wound. However, more cases of hair loss were observed in the concrete bedded shed which is significantly different at $P \leq 0.01$ in comparison with the

soil bedded shed. Result from this study indicates that there is high prevalence of skin lesion in concrete bedded shed than that of soil bedded shed, which may be due to the flooring condition of the concrete bed. Since the floor of concrete bedded shed is more slippery that aggravates the chances for skin lesion. The present study is well supported by the study conducted by Kielland *et al.* (2009) [32] 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) [33] 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 negative societal perception of the dairy sector. The present study revealed that the animals kept on the concrete bedded shed are more prone to the risk of poor welfare.

The number of animals exhibited the scores on lameness during milking were found to be 48% (12) normal gait, 44% (11) mildly lame, 8%(2) very lame for soil bedded shed and 28%(7) normal gait, 28% (7) mildly lame, 40%(10) lame, 4%(1) very lame for concrete bedded shed respectively. There was no significant difference between both the types of shed ($P > 0.05$) for lameness scores.

This study revealed that the overall prevalence of lameness of the concrete bedded shed was high (72%) than that of soil bedded shed (52%). It may be due to the hardness, abrasiveness and slipperiness of the concrete floors, which can contribute to foot lesions and lameness. Moreover on concrete floors dairy cows exhibit exceeded growth in claws, which leads to severe injuries of the sole (Bicalho and Oikonomou, 2013) [34]. Findings from this study was in

agreement with the study conducted by Vokey *et al.* (2001) [35], who reported that the incidence of lameness was highest for concrete floor (32%) than other softer floor surface. Similarly, Singh *et al.* (2012) [36], found quite higher incidence of lameness (65.54%) in crossbred cows maintained at NDRI, Karnal, where about 22.97% cows were afflicted with mild, and 14.19% with moderate, 21.62% with lame and 6.75% were afflicted with severe lameness. 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) [37].

Lameness result in discomfort, pain, injury and distress causing reduced mobility and feed intake, losses of body weight, productivity and reproduction. Lameness gives animal base indicator of welfare of dairy cattle (Whay *et al.*, 2003) [38] and affects cow's ability to interact with social and physical environment. Moreover lameness has been classified as the most representative animal-based indicator of compromised welfare in dairy cattle (Whay *et al.*, 2003) [38]. It has been found that floor surfaces which are very hard, very smooth, rough, soft or too wet cause lameness (McDaniel and Wilk, 1991) [39]. Therefore, ideally housing or management systems should consider animal's preference to improve welfare and to ensure that the animals are free from pain, injury and disease.

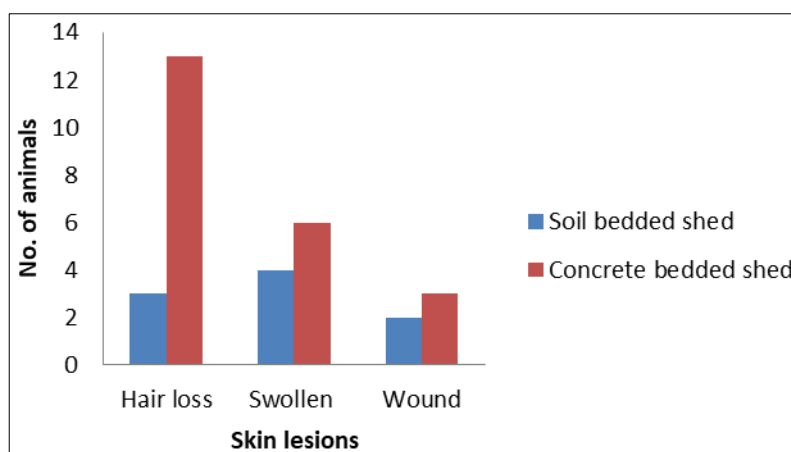


Fig 4: Number of animals with skin lesions on different body locations

Body Locations



Wound (Hock)



Hair loss (Hock)



Wound (Thigh)



Swollen (Knee)

Fig 5: Animals with skin lesions on different body locations

Conclusion

The present study showed that the concrete bedded floor type of shed has advantages in regards to cleanliness & hygiene. However skin lesion and lameness were found to be higher in concrete bedded shed than that of soil bedded shed. Incidence of mastitis was found to be higher in concrete bedded shed, however post-partum problems were found higher in soil bedded shed. It has also been observed that the concrete bedded shed were more improved in comparison to soil bedded floor type of shed indicating animal welfare. From this study it can be concluded that the welfare of dairy cows is significantly influenced by the floor type. The animal welfare issues have been compromised in the soil bedded floor type of housing in comparison to concrete bedded floor type of housing in Kamrup (Metro) District of Assam.

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