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Effect of hoof trimming intervention on behavior in dairy lame cows

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Abstract

Hoof lesions and lameness in cattle is currently a serious problem in the dairy industry and significantly affects the health and welfare of animals. High milk yield has been associated with lameness and claw lesions. It was found that 87.5% of lame animals were suffered from claw lesions and hoof lesions were present in all the cows having lameness. Hoof trimming (HT) is performed to prevent hoof lesions and improve gait by correction and maintenance of the hoof symmetry and shape. Lameness caused by hoof disorders can be treated by correct hoof trimming. The aim of this study was to know the behaviour of dairy cattle before and after hoof trimming. In this study twenty lame cows were selected and lameness index score was given to them (0-5 score). Care was taken to ensure that feed was provided at same levels throughout the study period and to nullify any effects of feed on lameness.

Different behaviour postures or patterns were recorded for a period of 3-5 hr per day for a period of 7 days to prior week of HT and after HT visually. Dairy cows showed 38 out of 46 total patterns, of which 11 were more commonly observed (MCO), 10 were commonly observed (CO), 8 were rarely observed (RO), 9 were very rarely observed (VRO) and 8 patterns were not observed (NO) before HT and after HT dairy cows showed 36 out of 46 total patterns, of which 13 were more commonly observed (MCO), 9 were commonly observed (CO), 6 were rarely observed (RO), 8 were very rarely observed (VRO) and 10 patterns were not observed (NO) at all. From this study it was concluded that the hoof trimming intervention has an immediate effect on production performance of dairy cows and lameness condition.

Keywords: Hoof trimming, ethogram, dairy cows

Introduction

India is the leading milk producing country in the world with 209.96 million tons during 2020-2021, which was contributed by crossbreed cows (28%), indigenous/non-descript cows (20%), indigenous/non-descript buffaloes (49%), exotic cows (1%) and goats (3%). In spite of this increased cattle population, lameness and hoof lesions in cattle are currently a serious problem in the dairy industry and significantly affects the health, welfare of animals and milk production (Westin *et al.*, 2016) [15]. Lameness is a painful and costly disease that affects the productivity of cows through its effects on milk production, culling and reproductive performance (Booth *et al.*, 2004) [3]. Lameness can be defined as the clinical manifestation of painful disorders, mainly related to the locomotors system, resulting in impaired movement or deviation from normal gait or posture. The severity of lameness can vary from stiffness or decreased symmetry of limb movement to an inability to bear weight on a limb, or even total recumbence. After udder health and fertility, hoof diseases were the third most important reason for culling (Landeskuratorium, 2015) [10]. Moreira *et al.* (2018) [11] found that (87.5%) of lame animals suffered from claw lesions and hoof lesions were present in all the cows having lameness. Various researches has shown that Holstein and crossbred dairy cattle are more vulnerable to lameness Some of the factors causing lameness are inherited factors (stance, weight, constitution, hoof characteristics), nutritional factors (proteins, minerals, vitamins, toxins), infectious causes (bacteria, virus, and rickettsia), environmental factors (climate, housing, road wear and tear) and managerial practices play a major role in its incidence. Many researchers have also reported that age, parity, stage of lactation and breed will also show significant effect on lameness in dairy cows (Bran *et al.*, 2018) [4]. Trimming is now a fundamental part of lameness management programme in any dairy farms because of its high preventive effects. Trimming of hooves significantly affects the milk fat and milk protein compositions.

HT is performed to prevent hoof lesions and improve gait by correction and maintenance of the hoof symmetry and shape, which ensures correct weight bearing. The therapeutic hoof trimming treats foot disorders and significantly effects the behaviour of animals. HT has positive effects on decreasing the lameness incidence, reducing the incidence of hoof lesions. The incidence of lameness was also related to standing behavior such that the number of new cases of lameness was higher among cows that spent >45% of the day standing (Chapinal *et al.*, 2010)^[6]. Lameness may be affected by behavior, but it can also modify the behavior of affected cows. In general, lame cows spent more time lying down and less time feeding, performed fewer aggressive interactions and were less active compared with non-lame cows. The higher incidences of lameness were reported in high yielding cross breed cows in Karnataka. Lameness can be reduced by proper hoof care management and hoof trimming. Thus, the present study was undertaken to know the effect of hoof trimming on behaviour of the dairy cows.

Materials and Methods

Experimental Design

An experiment was conducted in the Bengaluru area by selecting the animals based on the required criteria. In this study, twenty lame cows of mixed parity were selected for hoof trimming. The nutrient requirements of the animals were met as per ICAR (2013) through concentrated feed and *ad libitum* green fodder. Cows were offered 2-3 kg of concentrates during milking time at the rate of 400 g per litre of milk produced. Around 20 kg of green fodder consisting of Maize and Napier crops and 3-5 kg of dry fodder consisting of ragi straw as dry fodder was offered daily. The feed was offered twice daily. Care was taken to ensure that feed was provided at same levels throughout the study period and to nullify any effects of feed on lameness.

Lameness index score was allotted to the lame animals as mentioned by (Sprecher *et al.*, 1997)^[14] 1-5 score card. Behaviour ethogram was recorded for a period of 3-5 hr before hoof trimming prior to one week. After recording these parameters for one week, hoof trimming was performed on these animals.

Behaviour Ethogram

Various behavioural patterns were recorded without disturbing the day to day routine management activities. Observations were recorded at a distance from the animals. Human interference was avoided as far as possible. The definitions and recording of array of behaviour categories were based on observations made by Gouri *et al.* (2009)^[8] in Ramnad white sheep and Malabari goat breeds was adopted to the current experiment with modifications to suit the dairy cows. Further, most of the observations were made during cooler parts of the day.

Different behaviour postures or patterns were recorded for a period of 3- 5 hr per day for a period of 7 days to prior week of HT and after HT visually (Abdul *et al.*, 2017)^[11].

Following were the definitions of behaviour categories based on the observations made:

1. **Gaits:** The limb coordination's used in locomotion.
2. **Animal oriented movements:** Body movements towards or away from another animal, or in response to the motion of another animal.

3. Visual Patterns

- a) Animal oriented non-contact patterns: Distinctive motions or postures of the body or its visual patterns may or may not involve contact with, or be oriented in space towards, another animal.
- b) Animal oriented contact patterns: Movements in which a part of the body was brought into contact with the body of a con specific.

4. Object and Self oriented contact patterns

- a) Object oriented patterns: Movements in which a part of body was brought in contact with some inanimate part of the surrounding environment.
- b) Self-oriented contact patterns: Movements that bring an appendage or body region into contact with another part of the body.

5. Vocal and Non-vocal patterns

- a) Vocal patterns: Vocalizations-bellowing, bleating etc.
- b) Non-vocal auditory patterns: Producing non-vocal sounds. e.g., Tooth grinding, Rumination sounds, sneezing.

6. **Stretching patterns:** Short-term tonic postural adjustments.

7. **Stationary body positions and stances:** Postures of usually long duration associated with periods of rest and activity.

8. Feeding, digestive and elimination patterns

- a) Feeding and digestive patterns: Behaviour associated with the intake and initial processing of food.
- b) Elimination patterns: Voiding of solid and liquid wastes.

9. Common, rare and occasional occurrence of behaviour

- a) Common occurrence: Exhibition of behaviour patterns twice or more times in a given period.
- b) Rare occurrence: Exhibition of behaviour patterns once or more times in a given period.
- c) Occasional occurrence: Behaviour patterns were expressed very rarely; which may or may not be expressed in a given period.

Results and Discussion

The current study was conducted to formulate the standard detailed ethogram for lactating dairy cows. Table 1 shows the normal occurrences of behavioural patterns one week before and after HT. It also shows how each pattern is divided into one or more functional categories.

Incidence of hoof lesions in dairy cows

After hoof trimming, few claw diseases like sole haemorrhage, white line disease, sole ulcer, digital dermatitis, double hoof, and overgrown hoofs were detected in animals. Out of the total claw lesions in the herd, (5%) were affected with double hoof, (5%) were affected with digital dermatitis, (5%) with sole haemorrhages, (20%) with white line disease, (30%) with sole ulcers and (35%) were effected with overgrown hoof. Incidence of hoof lesions were depicted in Fig 1.

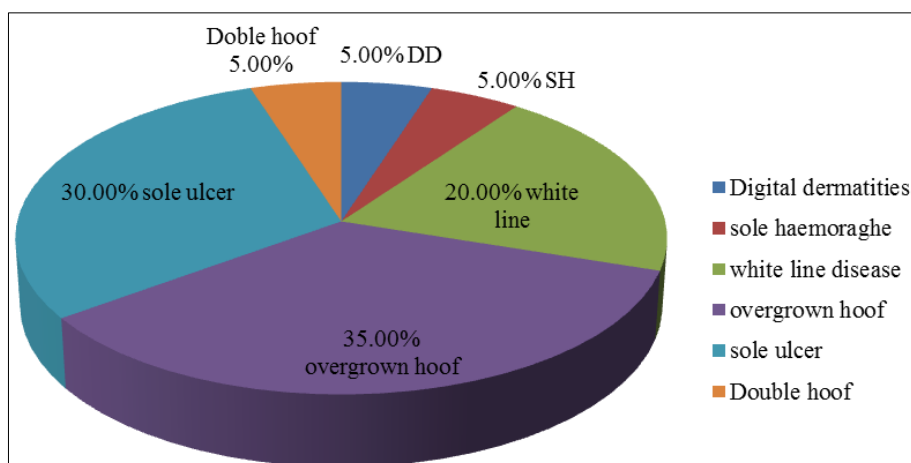


Fig 1: Incidence of hoof affections in dairy cows

Study of ethogram one week before and after hoof trimming in dairy cows

I. Gaits: Gait was a common behaviour shown by ruminants. They show walk, run and trot which are the parts of gait. This behaviour was commonly seen when they were left for grazing out of the shed.

1. **Stepping in Place:** This behaviour was shown to get rid of flies and mosquitoes from their legs. This behaviour was commonly seen when they were taken out for grazing and also during feeding in shed. This behaviour was observed as common occurrence one week before and more common occurrence after hoof trimming in this study.

II. Animal oriented movements

- Approaching:** It was a result of combination of gaits like- walking, running and trotting which, reduces the distance between two animals. This was commonly observed one week before and after hoof trimming.
- Low stretch:** Dairy cows occasionally exhibit this kind of behaviour during oestrus period. Where, it was placing head low and extending neck in uneven horizontal plane. In dairy cows it was rare occurrence one week before hoof trimming and very rare after hoof trimming.
- Departing:** Moving away from another animal by help of gait. Whenever the concentrate feed was offered, dominant animal made to eat that feed during which the lame animals get away from those to nearby place. It was noticed commonly one week before and after hoof trimming.
- Chasing:** This behaviour was observed usually during grazing in field. It was an indicative of playful or agonistic behaviour in them. But in dairy cows it was not observed during our study.
- Threat swagers:** When lame (prayer) animal was under the prone area of dominant (predator) animal, it showed nervous movements along with odd facial expressions. Where, those two animals were roaming side by side hierarchically. It was very rare occurrence one week before hoof trimming and rare occurrence after hoof trimming in dairy cows having agonistic function.

III. Visual patterns

a) Animal oriented non-contact patterns

1. **Flehman (Lip curl):** Commonly observed both in normal and estrus animal. Where ano-genital region of

the female animal which was estrus was sniffed by male animal. This behaviour shown by raised head upward through opening mouth with lip curled. It was very rare occurrence one week before hoof trimming and rare occurrence after hoof trimming.

- Lip flipping:** The animals were trying to avoid contact with other animals, and the fast raising of the upper lip was observed on several occasions. The majority of this was accompanied by a quick biting motion. As the animal turned away or quickly departed from the approaching individuals, the head was held forward and low. It was rare occurrence one week before hoof trimming and very rare occurrence after hoof trimming in dairy cows having agonistic and submissive functions.
- Yawning:** Dairy cows yawned during rest hours, especially when they were kept within the shed returning from grazing or feeding. Before the cud was regurgitated, the mouth parts assumed a yawn-like attitude. It was noticed commonly one week before and rarely after hoof trimming. This was seen commonly in dairy cows showing comfort function.
- Pawing the ground:** More often this was done while fighting, with a weird face and muzzle movement. It was noticed very rarely one week before and nil occurrence after hoof trimming. It was very rarely observed showing agonistic function.
- Ears back:** This was noted in response to strange noise, inside the shed or during grazing hours where in animals retracted their ears backwards, and dorsally. This behaviour was observed commonly one week before and more common occurrence after hoof trimming in this study showing agonistic function and excitation functions.
- Arched tail:** Where the animal assumed this posture especially during oestrus, defecation and urination. The animal held the proximal part of their tail extended. This behaviour was observed very rarely one week before and after hoof trimming in this study.

b) Animal oriented contact patterns:

- Sniffing (Nasal contact):** This was noticed in all the animals. One individual sniffed the anal region of the other individual. This was a common feature and was observed only when they were resting. It was most commonly observed one week before and after hoof trimming in this study showing comfort and variable

functions.

2. **Licking:** This behaviour was frequently seen, in which the animals licked their own bodies and occasionally those of other individuals. It was observed as a companion's act or as a means of relieving aggravation on their bodies. This behaviour was observed commonly one week before and after hoof trimming in this study.
3. **Biting:** This was caused by mosquitoes, insects, or flies bites, and was done to ease the uncomfortable irritation. Bite duration was short and bites were more common in these species. It was observed less frequently one week before and nil occurrence after hoof trimming in this study.
4. **Fore leg kicking:** This was a common occurrence. Animal lift their leg and drop their hoof on the bodies of the other animal. In dairy cows it was observed as rare occurrence one week before hoof trimming and common occurrence after hoof trimming.
5. **Head rubbing:** This behaviour was observed commonly one week before and after hoof trimming in this study.
6. **Head pressing:** During agonistic interactions, animals pressed their forehead and crown together. It was observed more frequently one week before and after hoof trimming in this study.
7. **Head butting:** Dairy cows with head butting were uncommon. It was exhibited less frequently one week before and after hoof trimming in this study.
8. **Muzzle tossing:** Repeated displacement (upward and inward) of the muzzle was noticed in persons involved in confrontations. It was very rarely observed before week and after hoof trimming in this study showing sexual and agonistic functions.
9. **Rearing and kicking:** Noticed particularly during agonistic interactions, when individuals rose up on their hind legs and stroked each other with their forelegs while maintaining an unusual head posture. It was observed rarely one week before and very rarely after hoof trimming in this study.
10. **Chin resting:** This was noticed when they were kept in a shed and slept next to each other, as well as during oestrous. It was observed more frequently one week before and after hoof trimming showing play, sexual and contact promoting functions.
11. **Mounting:** This is a common behaviour seen in oestrous period. This was also noticed in non-oestrous females. It was exhibited very rarely one week before and rarely after hoof trimming in this study.
12. **Fighting:** Animals uses their foreheads, horns, and forelegs in this act. It was mostly agonistic in nature. This was not observed during our study.
13. **Standing-on:** This pattern is shown as a fun behaviour in which they kept their forefeet on the back of their companion. It was very rarely observed one week before and after hoof trimming in this study showing agonistic and playful functions.

IV. Object and Self-Oriented contact patterns

a) Object-oriented contact patterns:

1. **Face and neck rubbing:** When animals were resting outside, they cleaned the side of their faces and rubbed their throat region (to the manger walls supplied within the shed) and on the ground. It was most commonly seen one week before and after hoof trimming in this study

showing protective and comfort functions.

2. **Body scratching (rubbing):** When the animal got irritated by the flies or mosquitoes menace, they tend to scratch their body to get rid of the uneasiness. It was commonly seen one week before and after hoof trimming in this study showing grooming function.
3. **Head shaking:** The head was rotated once or more times, most likely to dislodge the materials from the various regions of the head. This was also observed in response to insects or flies being lodged on the head, causing significant irritation. It was most commonly seen one week before and after hoof trimming in this study showing grooming function.

b) Self-directed contact patterns

1. **Fore leg licking:** Licked areas included the lower forelegs, flanks, mid back, belly, hind legs, rump, tail, and ano-genital region of the body. It was frequently seen one week before and after hoof trimming in this study.
2. **Licking of hind limb:** The rear limbs were brought towards the head region during licking. By rising the hind leg licked the udder region. This was very rarely seen one week before and commonly after hoof trimming in this study showing grooming function.
3. **Head scratching with hind leg:** When the animal showed this kind of behaviour, it was extending its hind legs forward up to head region and scratching. The main cause for this behaviour was ectoparasitic infestation. In dairy cows it is not shown.
4. **Scratching with horns:** Dairy cows scratched their shoulders, backs, and flanks in response to irritation on their bodies. This was seen very rarely one week before and after hoof trimming in this study showing grooming function.
5. **Muzzle to body touching:** The muzzle or side of the face was used to touch, wipe, or rub the foreleg, flank, or back in response to flies and mosquitoes. This was observed more commonly one week before and commonly after hoof trimming in this study showing grooming and protective function.
6. **Tail swishing:** This was done to keep flies and mosquitoes away from the animals' hindquarters, especially when they were standing in a shed. Tail movements that were round or semi-circular were detected. Tail movements that were round or semi-circular were detected. This was observed more commonly one week before and after hoof trimming in this study which indicates protective function.

V. Vocal and non-vocal patterns

a) Vocal patterns: The one behavioural pattern was having most common occurrence.

Bellowing: It was noticeable right before concentrate feed was offered in the morning. It was most commonly noticed one week before and after hoof trimming. It indicates sexual, agonistic and discomfort functions.

b) Non-vocal auditory patterns: One of the behavioural patterns was having common occurrence, one pattern was having rare occurrence and the other pattern was having nil occurrence.

1. **Teeth grinding:** It has been reported, primarily during rest periods and while the animals are reclining. It was

discovered that the cheek teeth grinded in a rhythmic pattern. The ensuing sounds were higher in pitch and lasted only a few seconds: this was also noticed during ruminating. It was seen commonly one week before and after hoof trimming and it indicates sexual, agonistic and discomfort functions.

2. **Rumination and feeding sounds:** These sounds especially seen during group feeding and when concentrate feeds were given. Rumination sounds were not commonly shown; Feeding sounds were distinct and distinct from other sounds, and they were also heard while grazing/browsing. The sounds of grass and leaves being plucked were typical of nature. This behaviour was observed as common occurrence one week before HT and more common occurrence after hoof trimming in this study. It was observed in common which is shown as nutritive and contact functions.

VI. Stretching patterns: Both the behavioural patterns having nil occurrences.

1. **Walk stretch:** Because it was a part of gaits, the distance between two gaits might vary. This pattern was not shown in general.
2. **Standing stretch:** This was observed while they were motionless and frequently after rising from a reclining position. The animals' backs were reinforced, and their necks were extended forward and rarely downward. The muzzle was pointed backward, the upper lip was curled, the eyes were closed, and the upper lip was curled. This was not shown during our study.

VII. Stationary body positions and stances: one of the behavioural pattern showing common occurrence and other one had very rare occurrence.

1. **Curled lateral recumbency:** The animals rested on one side of their rib cage at first, which was later supported by their flexed fore and hind legs. Many on the flank rested in lateral recumbency, stretching legs over the ground and pointing their ears backwards. This was observed commonly one week before and after hoof trimming in this study showing rest and sleep functions.
2. **Extended lateral recumbency:** In their reclining stance, the animals extended their legs while the torso was supported by the flanks and shoulders. The head was held extended and laid on the ground, or held over the ground or on their back. This was observed very rarely one week before and after hoof trimming.

VIII. Feeding, digestion, and elimination patterns

a) Feeding and digestive patterns: One of the behavioural patterns was having most common occurrence and the other two patterns were having nil occurrence.

1. **Grazing:** Plant pieces were taken into the mouth and sliced with a slight forward and backward movement of the mouth during this act. It was not seen because feed in offered in the shed itself.
2. **Browsing:** It was not seen because feed in offered in the shed itself.
3. **Rumination:** The animals are isolated from the rest of the pack and lie down to ruminate. Dawn and dusk were the busiest times for ruminating. It was observed in common. There was no difference before and after hoof trimming. This shows nutritive function.

b) Elimination patterns: Two of the behavioural patterns were having most common occurrence.

1. **Defecation patterns:** No difference in defecation patterns were observed before and after hoof trimming.
2. **Urination:** This pattern was assumed to be comparable to that of defecation posture. Urination was frequently observed when standing. This was observed more frequently one week before and after hoof trimming in this study.

Plate 1 illustrate a visual representation of some of the behavioural patterns displayed by dairy cows one week before and after HT. Dairy cows showed 38 out of 46 total patterns, of which 11 were more commonly observed (MCO), 10 were commonly observed (CO), 8 were rarely observed (RO), 9 were very rarely observed (VRO) and 8 patterns were not observed (NO) before HT, and after HT dairy cows showed 36 out of 46 total patterns, of which 13 were more commonly observed (MCO), 9 were commonly observed (CO), 6 were rarely observed (RO), 8 were very rarely observed (VRO) and 10 patterns were not observed (NO) at all.

One week before HT 38 behavioural patterns were showed, out of that 11 were more commonly observed (MCO), they are rumination, defecation, urination, muzzle to body touching, tail swishing, bellowing, face and neck rubbing, head shaking, sniffing/nasal contact, licking, head rubbing. 10 were commonly observed (CO); they are stepping in place, approaching, departing, yawning, ears back, chin resting, tooth grinding, feeding sounds, curled lateral recumbency, body scratching. 9 were rarely observed (RO), they are low stretch, lip flipping, arched tail, biting, fore leg kicking, rearing and kicking, body shaking, licking of hind limb. 8 were very rarely observed (VRO), they are threat swaggers, flehmen (lip curl), pawing the ground, head butting, muzzle tossing, mounting, standing on, scratching with horns, extended lateral recumbency. 8 patterns were not observed (NO) they are head scratching with hind leg, grazing, browsing, walk stretch, standing stretch, rumination sounds, fighting, chasing.

After HT 36 behavioural patterns were showed, out of that 13 were more commonly observed (MCO), they are stepping in place, ears back, feeding sounds, rumination, defecation, urination, tail swishing, bellowing, face and neck rubbing, head shaking, sniffing/nasal contact, licking, head rubbing. 9 were commonly observed (CO), they are, approaching, departing, muzzle to body touching, chin resting, tooth grinding, curled lateral recumbency, body scratching, fore leg kicking, licking of hind limb. 6 were rarely observed (RO), they are yawning, arched tail, threat swaggers, flehmen (lip curl), mounting, body shaking. 8 were very rarely observed (VRO), head butting, low stretch, lip flipping, rearing and kicking, muzzle tossing, standing on, scratching with horns, extended lateral recumbency and 10 patterns were not observed (NO), they are head scratching with hind leg, grazing, browsing, walk stretch, standing stretch, rumination sounds, fighting, chasing, pawing the ground, biting.

In this study it was observed that dairy cows were kept under intensive farming system mainly exhibited feeding, rumination, sleep and defecation patterns. Biting, fore leg kicking, head rubbing, head pressing, muzzle tossing, rearing and kicking and fighting were observed rarely during rest period. Similar findings were reported by Abdul *et al.* (2017) [1] and Gouri *et al.* (2009) [8] in Ramnad white sheep and

Bannur sheep respectively. Aoki *et al.* (2006) [2] also found increased stepping in rate after hoof trimming which is similar to our study.

Low stretch and yawning patterns were observed rarely during rest period. Similar findings were reported by Abdul *et al.* (2017) [1] and Gouri *et al.* (2009) [8]. Object and self-oriented contact patterns were mainly observed as to remove attached material from the body surface e.g. Head shaking, tail swishing, face and neck rubbing, licking, muzzle to body touching, scratching with the hind leg, body rubbing were observed most commonly while trying to get rid of the irritation on the body parts or for grooming the body. Similar such findings were reported by Abdul *et al.* (2017) [1] and Gouri *et al.* (2009) [8].

Bellowing pattern was most commonly observed during estrous period and may be due to any discomfort. The results of this experiment are in agreement with the findings of Abdul *et al.* (2017) [1], Gouri *et al.* (2009) [8] and Das *et al.* (1990) [7].

Tooth grinding was observed in dairy cows. Rumination sounds was not audible in and feeding sounds were commonly audible while eating, similar observations were

noticed by Abdul *et al.* (2017) [1] and Gouri *et al.* (2009) [8] in sheep.

Resting, Ruminating, and Grooming were commonly observed which are in agreement with Catrett *et al.* (2021) [5], and Ibrahim *et al.* (2018) [9] where they conducted a study to build an ethogram describing behavior in grazing cattle. Similar results were also reported by Platz *et al.* (2008) [12]. Silva *et al.* (2013) [13] observed that goats conduct their daily routine with sequences of behaviour that involve eating (food intake or selection) and resting or ruminating, with social interactions and other activities having happened more frequently which are similarly observed in our study also.

Feeding and digestive patterns were more evident and dairy cows spent more time while feeding and defecation. Similar findings were reported by Abdul *et al.* (2017) [1] and Gouri *et al.* (2009) [8] in sheep. Grazing and browsing not observed as the present study was carried out in intensive farming. Curled lateral recumbency was observed commonly and extended lateral recumbency observed rarely during rest period whereas Abdul *et al.* (2017) [1] and Gouri *et al.* (2009) [8] have not observed these behavioural patterns.

Table 1: Occurrence and probable functional categories of behaviour patterns in dairy cows one week before HT and after HT in this study

Sl. No	Behaviour patterns	Frequency of occurrence		Function
		Before HT	After HT	
I	Gait			
1	Stepping in place	+++	++++	Protective
II	Animal oriented movements			
2	Approaching	+++	+++	Variable, Social
3	Low stretch	++	+	Variable, Social
4	Departing	+++	+++	Variable, Social
5	Chasing	--	--	Play, Agonistic
6	Threat swaggers	+	++	Agonistic
III	Visual patterns			
a)	Animal oriented non-contact patterns			
7	Flehmen (Lip curl)	+	++	Sexual
8	Lip flipping	++	+	Agonistic, Submissive
9	Yawning	+++	++	Comfort
10	Pawing the ground	+	--	Agonistic
11	Ears back	+++	++++	Agonistic, Excitation
12	Arched tail	++	++	Sexual, Elimination
b)	Animal oriented contact patterns			
13	Sniffing/Nasal contact	++++	++++	Comfort, Variable
14	Licking	++++	++++	Comfort, Variable
15	Biting	++	--	Agonistic
16	Fore leg kicking	++	+++	Agonistic
17	Head rubbing	++++	++++	Contact promoting
18	Head butting	+	+	Agonistic
19	Muzzle tossing	+	+	Agonistic, Sexual
20	Rearing and kicking	++	+	Agonistic
21	Chin resting	+++	+++	Play, Sexual, Contact promoting
22	Mounting	+	++	Play, Sexual, Contact promoting
23	Fighting	--	--	Agonistic
24	Standing on	+	+	Agonistic, Play
IV	Object and Self-Oriented contact patterns			
a)	Object-oriented contact patterns			
25	Face and neck rubbing	++++	++++	Protective, Comfort
26	Head shaking	++++	++++	Grooming
27	Body shaking	++	++	Grooming
28	Body scratching (rubbing)	+++	+++	Grooming
b)	Self-directed contact patterns			
29	Scratching with horns	+	+	Grooming
30	Muzzle to body touching	++++	+++	Grooming, Protective
31	Tail swishing	++++	++++	Protective

32	Licking of hind limb	++	+++	Agonistic
33	Head scratching with hind leg	-	-	Grooming
V.	V. Vocal and non-vocal patterns			
a)	Vocal			
34	Bellowing	++++	++++	Agonistic, Sexual, Discomfort
b)	Non-vocal patterns			
	Tooth grinding	+++	+++	
35				Agonistic, Sexual, Discomfort
36	Rumination sounds	--	--	Nutritive
37	Feeding sounds	+++	++++	Nutritive, Contact
VI.	Stretching pattern			
38	Walk stretch	--	--	Comfort
39	Standing stretch	--	--	Comfort
VII.	Stationary body positions and stances			
40	Curled lateral recumbency	+++	+++	Rest, Sleep
41	Extended lateral recumbency	+	+	Rest, Sleep
VIII.	Feeding, digestion, and elimination patterns			
a)	Feeding and digestive pattern			
42	Rumination	++++	++++	Nutritive
b)	Elimination patterns			
43	Defecation patterns	++++	++++	Elimination
44	Urination	++++	++++	Elimination

Key: ++++ more Common occurrence (>10times); +++ Common occurrence (5-10times); ++ rare occurrence (2-5times); +very rare occurrence (1-2times); --nil occurrence (0times).



A



B



C



D



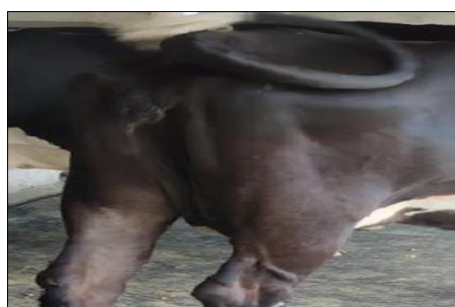
E



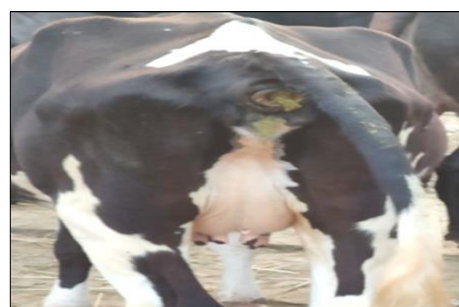
F



G



H



I



Plate 1: Animals showing different behavioural patterns, Idle (a), Licking other animal (b), Muzzle to body touching (c), Head rubbing (d), Licking body (e), Scratching with hind leg (f), Licking forelimb (g), Tail swishing (h), Tongue rolling (i), Defecation (j), Urination (k), Eating (l), Stepping in places (m)

Conclusion

The complete study of ethogram is a simple and easy tool for assessment of the health status of lame animals. HT didn't affect much of the behavioural patterns exhibited by the dairy cows. So HT can be recommended for farmers when the animals are identified as lame as it shows a positive effect towards gait improvement. In light of all this information, HT is necessary to ensure healthy claws and prevent lameness and it is, therefore, an integral part of improving the welfare of dairy cows.

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