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Assessment of lameness index score in dairy cows affected with foot lesions

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Abstract

Lameness in milking cows is a serious problem in the dairy enterprise which affects the health and well being of animals. The present study was aimed to know the effect of hoof trimming intervention on alleviation of lameness in dairy cattle before and after hoof trimming. Twenty lame cows were selected for the study and lameness index score was allotted to them (0-5 score). The nutrient requirements of the animals were met through concentrate feed and *ad libitum* green fodder. Lameness index score was recorded before week of hoof trimming (HT) and days after hoof trimming intervention it was recorded on 0th day, 3rd day, 6th day, 8th day, 11th day, 14th day. Lameness Index Score (LIS) was given before and after hoof trimming and severity of lameness was compared before and after hoof trimming. It was observed that significant improvement ($p>0.05$) in lameness index score was observed from 8th day post intervention when compared with before week of hoof trimming. Based on these observations, the intervention of hoof trimming demonstrated a favourable impact on both lameness and the enhancement of Lameness Index Score (LIS) in dairy cows. This innovative and improved approach involves the utilization of an angle cutter for hoof trimming, which is both safe and painless in comparison to the traditional hoof cutter method that often leads to bleeding hooves and involves Labor-intensive procedures.

Keywords: Lameness, lameness index score, hoof trimming, dairy cows

Introduction

Among the world India is the leading milk producing country with 221.1 million tons during 2021-2022, which was contributed by crossbreed cows (28%), indigenous/non-descript cows (20%), indigenous/non-descript buffaloes (49%), exotic cows (1%) and goats (3%). Lameness is thought to be the 3rd most economically important health problem in dairy herds after fertility and mastitis which significantly affects the milk production, health and welfare of animals ((Landeskuratorium, 2015; Westin *et al.*, 2016) [7, 17]). Lameness affects the productivity of cows by reduction in milk production, low reproductive performance and finally leading to culling of the animal (Booth *et al.*, 2004) [3]. In view of clinical manifestation lameness can be defined as of painful disorder, mainly related to the locomotors system, which results in impaired movement. The severity of lameness can vary from low to high like stiffness or decreased symmetry, inability to bear weight on a limb, or even total recumbence. Moreira *et al.* (2018) [8] reported that (87.5%) of lame animals were showing claw lesions and hoof lesions. 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. Bran *et al.*, (2018) [4] reported that age, parity, stage of lactation and breed will also show significant effect on lameness in dairy cows. Hoof trimming (HT) has now become a fundamental part of lameness management programme in almost all dairy farms. HT is performed to maintain hoof symmetry and shape, to prevent hoof lesions and improve gait. HT has positive effects on reducing the lameness incidence and incidence of hoof lesions. The most important thing in maintaining healthy claws in dairy cows is the structure and functionality of the claw horn. Therefore, anything that weakens the horn or changes its conformation is likely to make the animal more susceptible to ailments that cause lameness. High yielding cross breed cows were reported with lameness in Karnataka.

As lameness can be reduced by proper hoof care management and hoof trimming, the present study was undertaken to know the effect of hoof trimming on lameness in the dairy cows.

Materials and Methods

Experimental Design

Present study was conducted in Bengaluru area by selecting the animals based on the requirement of the study. Twenty lame cows of mixed parity were selected for hoof trimming in this study. Sprecher *et al.* (1997) [13] introduced a 5-point locomotion scoring system to quantify lameness, enabling the assessment of lameness prevalence within a dairy herd through visually evaluated locomotion scores. The Lameness Index Score, detailed in Table 1, was employed both before and after hoof trimming as per Sprecher *et al.* (1997) [13],

using a 1-5 scoring index card, facilitating a comparison of lameness before and after hoof trimming. The Lameness Index Scores were recorded on the 0th, 3rd, 6th, 8th, 11th, and 14th days following hoof trimming. A comparison was made between the recordings taken before and after the application of functional hoof trimming, known as the 'Dutch method' (AHDB, 2023) [1] as employed in this research (Illustrated in Plate 1). The primary tools employed included hoof knives, chisels, hammers, hoof cutters, hoof testers, long handle nippers, and electric hand grinders and cutters (Featured in Plate 2). For hoof trimming, a specially designed crate was utilized in dairy farms to secure the animals. The collected data underwent systematic categorization and were subjected to analysis using the Paired t-test statistical approach with the assistance of the SPSS 16.0 statistical software package.

Table 1: The Lameness Index Score (LIS), accompanied by its clinical description and evaluation criteria, was utilized for assessing lameness in crossbred dairy cows before and after hoof trimming (HT)

LIS	Clinical description	Assessment criteria
1	Normal	The cow maintains a level-back posture while both standing and walking, and her gait appears normal.
2	Mildly lame	While standing, the cow maintains a level-back posture, but during walking, she adopts an arched-back stance, even though her gait remains unaffected.
3	Moderately lame	An arched-back posture is evident both while standing and walking. Her gait is affected and is best described as short striding with one or more limbs.
4	Lame	The presence of an arched-back posture is consistent, accompanied by a gait that can be characterized as deliberate, with the cow tending to favour one or more limbs/feet.
5	Severely lame	Furthermore, the cow displays an incapacity or significant hesitancy to support weight on one or more of her limbs/feet.



Plate 1: Hoof Trimming Procedure a) Guiding the animal into the enclosure. b) Employing a hoof knife to meticulously clear and cut the claws. c) Utilizing an angle grinder for precise paring and refinement of the claws. d) Preceding the Hoof Trimming process. e) Following the Hoof Trimming procedure



Plate 2: Animals exhibiting diverse hoof conditions, a) White line disease, b) Overgrown hoof, c) Sole ulcer, d) digital dermatitis, e) Double hoof, f) Sole hemorrhage.

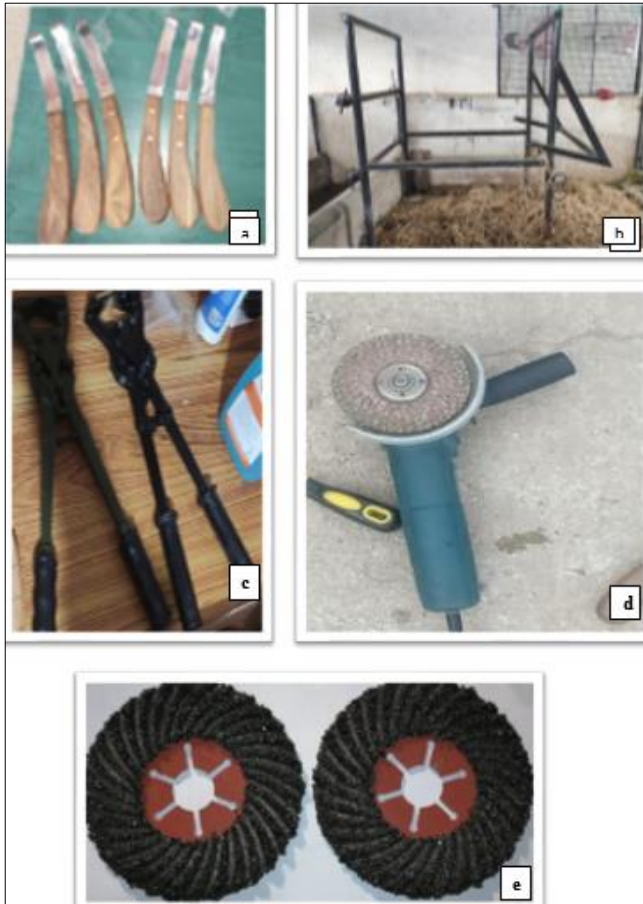


Plate 3: Visuals of tools employed in hoof trimming: a) Right and left hoof knives, b) Specially designed Travis for HT c) Hoof cutter d) Multipurpose Electric Angle d) Grinder, e) Multipurpose Cutter blade

Results and Discussion

Incidence of hoof lesions in dairy cows

Following hoof trimming, a range of claw ailments including sole hemorrhage, white line disease, sole ulcer, digital dermatitis, double hoof, and overgrown hooves were identified in the animals. Among the overall claw lesions observed in the herd, (5%) exhibited double hoof, (5%) displayed digital dermatitis, (5%) showed signs of sole hemorrhages, (20%) presented with white line disease, (30%) indicated sole ulcers, and (35%) were afflicted with overgrown hooves. The incidence of hoof lesions is graphically represented in Figure 1 (See Plate 2).

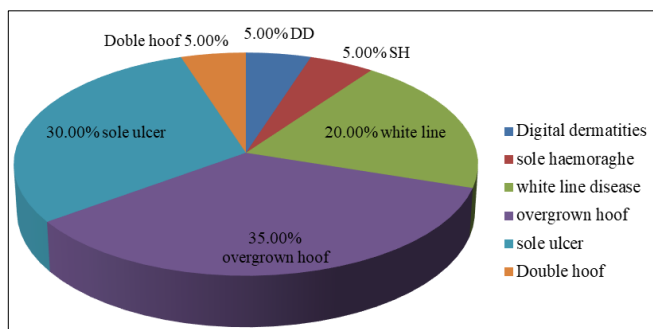


Fig 1: Incidence of hoof affections in dairy cows

Lameness Index Score (LIS)

The mean lameness index scores of the animals were documented one week before the hoof trimming intervention

and after its implementation as part of this study. These findings have been outlined in Table 2 and visually represented in Figure 2.

Table 2: Paired t-test analysis was conducted for the Lameness Index Scores (ranging from 1 to 5) in dairy cows, comparing their values one week before the hoof trimming intervention and after the intervention on days 0, 3, 6, 8, 11, and 14

Days	Mean ± SE	p-value
One week Before HT	2.90±0.12 ^a	
0 th day	2.95±0.14 ^a	0.330
3 rd day	2.90±0.12 ^a	0.330
6 th day	2.85±0.13 ^a	0.330
8 th day	2.55±0.15 ^b	0.005
11 th day	2.00±0.13 ^b	0.000
14 th day	1.95±0.14 ^b	0.000

Note: Means within a column bearing different superscripts differ significantly ($p \leq 0.05$)

The average lameness index score of the animals stood at 2.90±0.12 one week prior to the hoof trimming intervention. Following the hoof trimming, the mean score was 2.95±0.14 on the 0th day, 2.90±0.12 on the 3rd day, 2.85±0.13 on the 6th day, 2.55±0.15 on the 8th day, 2.00±0.13 on the 11th day, and 1.95±0.14 on the 14th day.

The findings indicated that there was no significant difference ($p > 0.05$) in the lameness index score on the 0th, 3rd, and 6th days ($P = 0.330$) when compared to the week before hoof trimming. However, on the 8th, 11th, and 14th days, a significant difference ($p \leq 0.05$) was observed when contrasted with the week preceding hoof trimming ($P = 0.005$, $P = 0.000$). Particularly, the 14th day displayed a notably more pronounced significance ($p \leq 0.05$) with a value of $P = 0.000$.

We noted an escalation in the lameness index score on the day of hoof trimming. This rise in the lameness index score was similarly noticeable on the 3rd and 6th days. However, starting from the 8th day, a progressive decline in the lameness index score became apparent, persisting through the 14th day and remaining lower than the level observed before the week of hoof trimming. When compared to the lameness index score from the week prior to hoof trimming, a reduction was observed on the 14th day following the hoof trimming intervention.

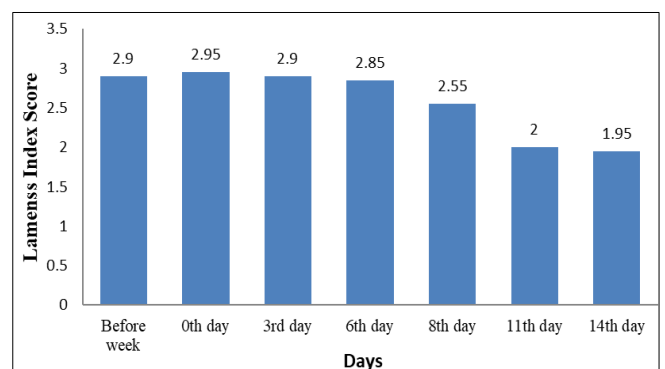


Fig 2: Comparison of Lameness Index Score (1-5) in dairy cows one week before HT and after HT on day 0, 3, 6, 8, 11 and 14

Prior to hoof trimming, (20%) of the animals exhibited a Lameness Index Score (LIS) of 2, while (70%) had an LIS of 3, and (10%) showed an LIS of 4. After hoof trimming, (20%) of the animals attained an LIS of 1, (65%) registered an LIS of 2, and (15%) maintained an LIS of 3.

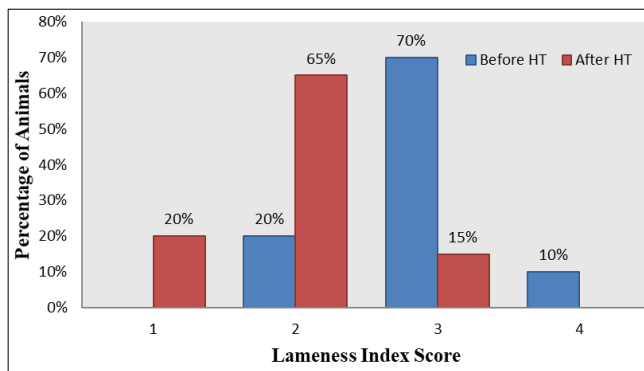


Fig 3: Percentage of animals in Lameness Index Score (1-5) one week before and after HT

Overall HT affected the locomotion of dairy cows in initial days and after a few days we noticed improvement in locomotion which shows that HT has almost positive effect on locomotion of dairy cows.

In the present study, cows were allotted lameness Index Score for lameness according to Sprecher *et al.* (1997) [13]. Before hoof trimming (20%) of the animals were in LIS 2, (70%) of the animals were in LIS 3 and (10%) of the animals were in LIS 4, and then after hoof trimming (20%) of the animals were in LIS 1, (65%) of the animals were in LIS 2, and (15%) of the animals were in LIS 3.

The outcomes indicated that no substantial difference ($p > 0.05$) existed in the lameness index score on the 0th, 3rd, and 6th days ($P = 0.330$) in comparison to the week preceding hoof trimming. However, discernible differences emerged on the 8th, 11th, and 14th days, displaying significance ($p \leq 0.05$) when contrasted with the week preceding hoof trimming ($P = 0.005$, $P = 0.000$). Particularly greater significance ($p \leq 0.05$) was observed on the 14th day ($P = 0.000$).

The findings were consistent with the research by Passos *et al.* (2017) [11], in which they investigated locomotion scores seven days post trimming and treatment. They noted that cows with infectious hoof diseases experienced a reduction of 1.5 units in their locomotion score (LS) ($p < 0.0001$), while cows affected by non-infectious hoof diseases showed a decrease of 1.7 units in their LS ($p < 0.0001$). This reduction signified a significant enhancement in gait. Similarly, in our study, a significant improvement in gait was observed on the 14th day following the hoof trimming intervention.

The outcomes of our study align with the research conducted by Novotna *et al.* (2019) [9], who observed that after preventive hoof trimming, there was an increase in the count of cows with a locomotion score of 1, coupled with a decrease in the count of cows with locomotion scores 2, 3, 4, and 5. Our study's results are consistent with these findings, as the number of cows with a locomotion score of 1 (i.e., 20%) increased following the hoof trimming intervention.

Similar findings were observed by Van Hertem *et al.* (2014) [16], where they suggested that the after hoof trimming, locomotion score of the cows was significantly improved. They also mentioned that locomotion score was also affected by parity, the presence of lesions, activity level, and ruminating time.

The results obtained were also in accordance with Back (2010) [2], where they found that the locomotion scores were lower when compared with the locomotion scores before hoof trimming and indicates that the trimming have a positive effect on cow locomotion.

The outcomes observed in our study align with the findings of

Cruz *et al.* (2017) [5], who revealed that after seven days of trimming and treatment, the overall mean locomotion score (LS) decreased from 5 to 3.5 ($p < 0.0001$, $n = 34$), indicating an enhanced gait. Our study's results are in harmony with this research, as the overall mean LS dropped from 2.9 to 1.5. Thorup *et al.* (2014) [15] noted that the treatment of digital lesions and hoof trimming contributes to gait improvement by facilitating the healing of infections and inflammation in the affected digits, thus reducing discomfort and potential pain.

In contrast to our study, Ouweltjes *et al.* (2009) [10] proposed in their research that gait scores on day 0 (1.7 ± 0.6), 1 month (1.6 ± 0.6), 3 months (1.7 ± 0.6), and the overall gait scores adjusted for measurement (1.7 ± 0.4) were not significantly influenced by the type of flooring or trimming method. This suggests that gait scores remained consistent throughout the duration of the experiment. The reduced locomotion and slower recovery might stem from other factors affecting the joints, or the joints themselves could be impacted during the hoof trimming process.

The obtained results exhibited similarity and align with the discoveries made by Tanida *et al.* (2008) [14], who noted that gait showed a more fluid movement in the month following post-hoof trimming and 15 days after the trimming intervention.

Rinnovati *et al.* (2019) [12] conducted an investigation involving 236 lame cows affected by white line disease (WLD) lesions. They found that on days 30 and 40, none of the cows experienced a recurrence of the WLD pathology or lameness due to WLD or other factors. By day 60, the lesions had fully healed. In contrast to their findings, our study reached a locomotion score of 1. Their study indicated that cows were no longer lame due to the effective healing of hoof lesions. Similarly, Kimeli (2014) [6] explored the evaluation of locomotion scores and the association between claw disorders and locomotion scores in dairy cows. The presence of various claw disorders was significantly correlated ($p < 0.05$) with locomotion scores.

The outcomes derived from our study differed from the findings of Wilkes *et al.* (2008), who discovered that there was no distinction in locomotion scores among Holsteins and Jersey cows over the span of 12 weeks subsequent to relocating to a new free stall post hoof trimming. Locomotion scores increased across both breeds during the 86-day observation period, implying an exacerbation in lameness. Kimeli (2014) [6] also indicated, through his studies, that a strong correlation existed between certain animal-level factors and locomotion scores. The evaluated animal-level factors that exhibited significant associations with the cows' locomotion scores included breed, parity, and stage of lactation, among others that were examined.

Conclusion

The intervention of Hoof Trimming (HT) in lame animals revealed noteworthy distinctions ($p > 0.05$) in the lameness index scores on the 0th, 3rd, and 6th days ($P = 0.330$), as opposed to the week preceding the hoof trimming. Conversely, on the 8th, 11th, and 14th days, substantial differences were observed ($p \leq 0.05$) when compared with the week prior to hoof trimming ($P = 0.005$, $P = 0.000$). Particularly, the most pronounced disparity ($p \leq 0.05$) was identified on the 14th day ($P = 0.000$). This study concludes that the hoof trimming intervention yields a positive impact on dairy cow lameness. Moreover, this innovative and improved approach employs an angle cutter modification for hoof trimming,

ensuring safety and painlessness, unlike the conventional Hoof cutter notorious for causing excessive cutting and bleeding of hooves. HT emerges as an essential practice for ensuring robust claws, averting lameness, and augmenting the overall performance of dairy cows.

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