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Evaluation the Effects of Hoof Trimming on Bovine Leg Score Improvement and its Distribution

Ahmadreza Mohamadnia[*1], DVSc
Fateme Naderi[2], DVM

[1]Department of Clinical Sciences, Faculty of Veterinary Medicine, Ferdowsi University of Mashhad, Mashhad, Iran.
[2]Private Practitioner

Abstract

Objective- Evaluation of leg scoring as a method for hoof trimming neccesity.
Design- Prospective randomised trial.
Animals- Hundred and sixty holstein dairy cows.
Procedure- One hundred and fifty cows selected in a dairy farm in dry period 2-3 weeks before calving (stage one), all cows were photographed, right, left and overall scores (A three point scoring system, in which score one is for normal cows and score three is for extremely outward rotated hindfeet) was given by 5 observers. Cows were photographed 30 days after parturition (Stage two), Days in Milk (DIM) 120 (Stage three) and DIM 150 (Stage four). Agreement of the observers in different stages, and leg score changes during time was evaluated using one way ANOVA. Distribution of leg scores in different stages compared using Chi-square test.
Results- No statistical difference was recorded between observers in each stages except stage two. The highest score was recorded in stage one (2.08±0.72) and the lowest recorded in stage two (1.56±0.64). After parturition overall score increased till 120 DIM (1.8±0.71) but no significant changes recorded by increasing DIM (1.85±0.74) and after hoof trimming. Distribution of score three cows were reduced significantly in stage two in comparison to stage one and increase significantly in stage three in comparison to stage two. No statistical difference recorded between stages three and four. The average number of cows in score three were 27.1, 5.3, 19.2, and 21.2 percent in stages one to four respectively that is higher than previously reported numbers.
Conclusion and Clinical Relevance- Leg scoring in cows with equal days in milk is useful. Hoof trimming cannot reduce leg scores but can prevent its growing trend.
Key words: Hoof trimming, Leg scoring, Dairy cows.

[*] **Corresponding author:**
Ahmadreza Mohamadnia, DVSc
Department of Clinical Sciences, Faculty of Veterinary Medicine, Ferdowsi University of Mashhad, Iran.
E-mail address: mohamadnia@um.ac.ir

Introduction

Hooves play an important role in digital protection and designed for making a good ground contact surface by decreasing possible contusions.[1] Walking and standing gait of a cow affected by hoof growth as normal cows got better gait and stride in comparison to long toed cows.[2] Hoof shape is a consequence of growth and wearing, walls growth faster than toes and toes growth faster than heels.[3] Hoof trimming result in reducing pain in overgrown hooves and trimming a thin layer of the horn stimulate production of more sound and elastic horn.
Overgrowing of the hooves, started in toe, resulted in reducing anterior hoof angle from 45 to 40 and less degrees. Higher blood pressure in outer area of the toe resulted in more horn production and more horn production besides hypertrophy and hyperplasia of the region make more imbalances between inner and outer claws.[4] In untrimmed cows 20% of the weight is on medial claw of the hind limb and 80% on the lateral claw, after hoof trimming this distribution can reduce to 30 and 70% in inner and outer claws that still show an imbalance between claws.[5] Back to sloping of the hooves and reducing toe angle weight pointed to ordinary place of sole ulcer in untrimmed and overgrown hooves. Hoof trimming resulted in changing this point forward or toward interdigital space.[6]
In order to compensate imbalance and shift the weight from outer to inner claw, claws rotate outward, hocks get closer and cow find a toe out conformation in her hindclaws.[7,8] Outward rotation measured by increasing degree between a line passing interdigital space and a line passing vertebrae. A leg-score system has primarily been developed by Jan van Amerongen within the Faculty of Veterinary Medicine, Utrecht University to assist decision-making of the optimal time of herd claw trimming.[9] In this leg or foot scoring system, If the exo-rotation is <17° the score is 1, between 17° and 24° the score is 2 and >24° the score is 3 (Fig.1). Under optimal circumstances the distribution of score 1 to 3 in a herd should be: score 1(good) > 60% of the cows, score 2 (moderately deviant) < 30%, and score 3 (poor) < 10%[9]. The leg score is considered a practical scoring tool by Dutch bovine practitioners in herd health management. Like other scoring systems e.g. the Body Condition Score (BCS) and locomotion score, the leg-score is preferably performed monthly, as a management tool for claw-health assessment by the herds bovine-practitioner.[10,11] A clear shift towards higher percentages for score 2 and 3 would be an indication of foot overgrowth or other problems.[9]
Back to literature the main reason for outward rotation of the claws is hoof imbalance and overgrowing. Hoof trimming normally done to reduce this imbalance and normally should reduce this rotation to normal level. This current study was done to evaluate effect of hoof trimming on improving leg scores.

Materials and Methods

This current study was done in a dairy farm consisting 2200 milking cows. Average milk production recorded as 37 lit/day. Hoof care programs including hoof trimming and hoof bathing were done regularly. Cows trimmed on days in milk (DIM) 120, immediately before drying off, Delayed pregnancy[12] and high score cows (on Monthly basis). Referred cows inspected for any possible injuries. Data recorded and transferred to herd data bank.
In order to evaluate the proposal of possible effect of hoof trimming on reduction of leg scores, 150 cows selected. All cows were photographed from back position in following four stages of lactation; Stage one: Close up cows that will deliver in next two to three weeks. Stage two: DIM 20, Stage Three: DIM 120 immediately before hoof trimming, Stage four: DIM 150, one month after hoof trimming.

Photos were recorded based on cow number and 5 individual observers scored right, left and overall score for the cows. Scoring system was taught to observers previously. Cows scored based on what was explained on introduction.

(a) **(b)** **(c)**

Figure 1. Different Leg scores, (a) Score one, less than 17% outward rotation, (b) Score two, 17-24% outward rotation and (c) Score three, more than 24% outward rotation

Data Analysis

Data was recorded on separate sheets for different observers and analyzed by Sigmastat software (Jandel Sci.). Results reported descriptively, in order to evaluate observers differences, findings were analyzed using one way ANOVA test. Effects of the time were evaluated in each observer and finally all data in each stage from observers put together and one way ANOVA revealed any possible effects of the time on recorded data, any possible significant result detected by Dunn's Method. Distribution of cows in each score compared in different stages by Chi square test. Data recorded and analyzed for right, left and overall separately. P values of 0.05 and less consider as significant.

Results

Table one show an agreement between observers except stage two of scoring. Highest scores recorded in stage one in pregnant cows and the lowest scores recorded in stage two.

Table 1. Overall score for each observer

Stages	Observer 1	Observer 2	Observer 3	Observer 4	Observer 5
1	2.02±0.73	2.16±0.68	2.18±0.69	2.02±0.73	**2.02±0.73**
2*	1.7±0.69	1.48±0.59	1.49±0.62	1.45±0.58	**1.68±0.65**
3	1.79±0.74	1.8±0.73	1.86±0.69	1.82±0.69	**1.74±0.7**
4	1.93±0.72	1.8±0.76	1.84±0.78	1.82±0.77	**1.88±0.68**

*: Significant difference between observers (P<0.05)

Data of based on right or left hind limb and an overall score presented in table 2. Left hind limb showed higher scores that right ones.

Table 2. Right, Left and overall leg scores (Mean ± SD)

Limb	Stage 1	Stage 2	Stage 3	Stage 4
Right Hindlimb*	1.67±0.71	1.79±0.78	1.48±0.67	**1.67±0.73****
Left Hindlimb*	1.8±0.81	1.4±0.6	1.94±0.82	**2.03±0.8****
Overall Score	2.08±0.72	1.56±0.64	1.8±0.71	**1.85±0.74****

*: Significant difference between different stages (P<0.05)
**: Non significant difference with the previous stage (P>0.05)

Distribution of overall scores (Rounded values) in different stages appeared in table 3, highest percentage of score three recorded in stage one (27.1%) and the lowest recorded in stage two (5.3%).

Table 3. Distribution of overall scores in different stages of scoring

Score	1		2		3	
	No	%	No	%	No	%
Stage 1	34	22.5	75	49.6	41	**27.1**
Stage2	102*	67.5	40*	26.5	8*	**5.3**
Stage 3	56*	37.1	65*	43	29*	**19.2**
Stage 4	62	41	56	37.1	32	**21.2**

*. Significant difference with previous stage

Since some changes were different in milking period, Overall scores in milking period (Stages 2, 3 and four) were reported separately (Fig. 2).

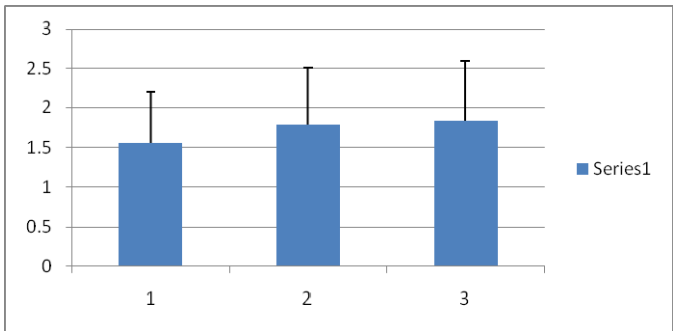

Figure 1. Overall leg scores in milking period

Discussion

Outward rotation scoring system was reported by Amerongen in Utrecht Vet College in order to estimate proper time of hoof trimming.[13] Hoof overgrown resulted in medial toe rotation and predispose to lameness and purulent conditions of the hooves.[14] Martin et al., 1986 study the growth and wearing of the hooves in concrete flooring and pasture, they didn't find any changes in dorsal wall growth but wearing of the hooves in toe and heels reduced by increasing days in milk (DIM). Growth and wearing recorded faster in forelimbs than hind limbs and hooves grows and wears faster in summer than winter months.[15] Boisot et al., didn't find repeatability between different observers in leg scoring.[16] Holzaer et al., didn't find any significant correlation between outward rotation of the hooves (Leg scores) and time of hoof trimming. The study was done on 52 animals with 11 observers and cows in three categories (Normal, Moderately and severely deviated).[17] Naderi et al. didn't find any difference between 48 trimmed and untrimmed cows.[18,19] In this current study observers increased to five persons in order to evaluate difference between observers. Difference between observes were not recorded in all stages except stage two (table 1), however Holzaer et al. and Boisot et al. studies showed significant difference between observers as just two observers between 11 observers agree with each other in finding proper cows for trimming.[16,17] This current study didn't follow the gold standard (needed hoof trimming) and just follow the repeatability between the observers. Maybe the main reason for the agreement in this study was photography evaluation. It seems that using this method based to its repeatability could be very useful in finding correct indices for leg scores. Observers just thought before scoring and were not skilled in this field.

Evaluation of the outward rotation (Leg score) on left and right hooves revealed a more rotation in left hoof in stages one, three and four (table 2). Theoretically this more rotation should be a result of more pressure on the hoof that make the animal to rotate her foot outward to compensate possible pressure on imbalance feet. This higher pressure may cause more lesions on the left foot,[20] however recent studies emphasis on more weight distribution on right part of the body in crossbred cows[21]. Higher pressure may be due to rumen position on left part of the body and its higher weight on the feet.

Because of recent hoof trimming and reasonable feeding and housing (low concentrate diet with good rest) cows have the best weight distribution pattern on their feet in stage one. In this situation outward rotation is not due to hoof imbalance and maybe udder size that occupies less places between hocks is the main reason.

Metabolic stress begins in stage two after parturition with prominent negative energy balance [22] that normally may affect hoof growth and wear.[23] On the other hand udder grow in this stage and because of its occupied space, push hocks laterally that reflect in decreasing outward rotation and leg score.[1] Negative energy balance normally reduce till the fourth month after parturition[23], so in stage three cows are in an equal or positive energy balance, and consequently hoof growth may return to its normal rate and weight bearing pattern start to change by changing growth/wearing patter. In fourth stage the only change in growth and wearing pattern is hoof trimming that was done after stage three.

The best growth/ wearing pattern should be seen in stage one (Table 2) because of recent hoof trimming, lack of metabolic disturbances and more rest without walking toward milking parlor. In this stage udders are extremely small so the hocks got enough room to move toward each other and toes turn outward resulted in increasing leg score. In stage two by increasing udder size without any interference in hoof management, leg scores reduce significantly.[1]

By increasing DIM, leg scores increases without hoof trimming interference. Increasing leg scores based on growth and pattern of the hooves was expected in stage three. Since no changes in udder size expected between stages three and four, it can be accepted that with a fix size of udder, leg scores will affect by hoof growing. Non significant changes between stage three and four maybe a result of corrected weight bearing surfaces after stage three.
It seems that muscle mass in upper parts of the limbs, pregnancy status, udder size and some diseases like sole ulcer can affect normal weight bearing pattern in addition to hoof growth.[2,3]
The only stage that score three cows are less than 10% is stage two. Since this is a well managed herd with low incidence of claw lesions, it seems that previously reported distribution of leg scores[9] doesn't work in this area. Hoof trimming and correcting weight distribution (stage 1 and stage 4) should produce lowest distribution of score three cows, in contrast in these two stages (Table 3) over 20% of the cows show score three. However this distribution doesn't show changes between stages three and four that support possible weight bearing correction between these two stages.

Conclusion

Based on the results leg scoring should be done in cows with same days in milk. Results of this current study show different distribution of the leg scores among the cows in different stages. Hoof trimming at least cannot reduce leg scores but can prevent its growing trend.

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چکیده

ارزیابی اثر سم چینی بر بهبود اسکور سم و توزیع آن در گاو شیری

احمدرضا محمدنیا[1]، فاطمه نادری [2]

۱- گروه علوم درمانگاهی، دانشکده دامپزشکی، دانشگاه فردوسی مشهد، مشهد، ایران.
۲- دامپزشک بخش خصوصی

هدف- ارزیابی بهبود اسکور سم متعاقب سم چینی در گاو شیری

طرح مطالعه- مطالعه آینده نگر

حیوانات- یکصد و شصت راس گاو شیری

روش کار- یکصد و پنجاه راس گاو شیری در یک گله شیری در زمان خشکی دام و ۲-۳ هفته قبل از زایمان (مرحله ۱) انتخاب گردیدند. از تمامی گاوها عکس گرفته شد و اسکور چرخش (بر اساس سیستم سه نقطه ای) سم به بیرون توسط ۵ مشاهده گر از روی عکس ها داده شد. همین گاوها ۳۰ روز پس از زایمان (مرحله ۲)، روز شیردهی ۱۲۰ (مرحله سوم) بلافاصله قبل از سم چینی و روز شیردهی ۱۵۰ (مرحله چهارم) یک ماه پس از سم چینی اسکور داده شدند. میزان توافق بین مشاهده گرها و تغییرات میزان چرخش در طول زمان با استفاده از آزمون پراش یک طرفه ارزیابی گردید. توزیع اسکورهای سم در مراحل مختلف با استفاده از آزمون مربع کای مقایسه گردید.

نتایج- تنها در مرحله دوم اسکور دهی بین مشاهده گرهای مختلف اختلاف معنی دار دیده شد و در سایر مراحل مشاهده گرهای مختلف اختلافی نشان ندادند. بالاترین اسکور سم در مرحله اول (۰/۷۲ ± ۲/۰۸) و پایین ترین اسکور در مرحله دوم (۰/۶۴ ± ۱/۵۶) ثبت گردید. پس از زایش روند افزایشی در اسکور سم تا مرحله سوم (۰/۷۱ ± ۱/۸) ثبت گردید و لیکن اختلاف معنی داری بین مرحله سوم و چهارم اسکور دهی (۰/۷۴ ± ۱/۸۵) ثبت نگردید. توزیع اسکور سه به شکل معنی داری در مرحله دو نسبت به مرحله ۱ کاهش یافت که البته مجددا افزایش معنی داری در مرحله سه نسبت به مرحله ۲ ثبت گردید. اختلاف معنی داری در توزیع اسکور ۳ بین مراحل ۳ و ۴ ثبت نگردید. میزان متوسط فراوانی گاوها در اسکور ۳ ، مقادیر ۲۷/۱، ۵/۳، ۱۹/۲ و ۲۱/۲ در مراحل یک تا چهار ثبت شد که بالاتر از مقادیر گزارش شده در مطالعات قبلی است.

نتیجه گیری و کاربرد بالینی- اسکور سم باید در گاوهای با روز شیردهی مساوی داده شود. سم چینی قابلیت کاهش اسکور سم را ندارد و تنها می تواند جلوی افزایش آن را بگیرد.

کلمات کلیدی- سم چینی، اسکور سم، گاو شیری.