

The effect of hoof trimming on milk yield, rumination time, and activity in Holstein and Jersey cows

Mooyoung Jung, Seogjin Kang, Seungmin Ha*

Dairy Science Division, Department of Animal Resource Development, National Institute of Animal Science, Rural Development Administration, Cheonan 31000, Korea

Received January 17, 2024
Revised February 15, 2024
Accepted February 21, 2024

Corresponding author:
Seungmin Ha

E-mail: justusha@korea.kr
<https://orcid.org/0000-0002-5152-1979>

Hoof health management plays an important role in dairy farms because lameness can impact productivity via decreased milk yield, reproduction rate, and increased culling rate. Regular hoof trimming can help reduce the incidence of hoof diseases in dairy cows. However, its effects on healthy dairy cows remain unclear. This study investigated the effects of hoof trimming on milk yield, rumination time, and activity in healthy Holstein and Jersey cows. Fourteen cows (7 Holstein and 7 Jersey) without lameness were used in this study. We trimmed the cows and collected data from 3 days prior to 9 days after hoof trimming. Milk yield, rumination time, and activity were measured using automatic milking and health monitoring systems. Milk yield and rumination time decreased, whereas activity level increased on the trimming day compared to the previous days in both breeds, although the difference was not significant. On the days after hoof trimming, milk yield, rumination time, and activity recovered to normal. Especially in Holstein cows, a temporary increase in milk yield was observed compared to that in the pre-trimming period. Hoof trimming did not negatively affect the productivity of dairy cows of either breed. Furthermore, productivity can temporarily increase.

Key Words: Holstein cows, Jersey cows, Hoof trimming

INTRODUCTION

Hoof health is a major concern for the dairy industry. Lameness occurs in 28~46.4% of cows (Cramer et al, 2008; Ito et al, 2010). Additionally, a previous study demonstrated that 64% of cows housed in free-stall barns had at least one affected hind hoof (Sogstad et al, 2005). Hoof problems can worsen the income of dairy farms by decreasing milk yield and reproduction rates and increasing culling rates (Booth et al, 2004; Onyiro et al, 2008; Walker et al, 2010).

The locomotion score is commonly used to evaluate the health status of dairy cows (Sprecher et al, 1997). Automatic health-monitoring systems based on rumination time and activity have been used to reduce the time and labor required for the management of several dairy farms. Previous studies have reported an association

between automatic health-monitoring data and hoof health. Cows with hoof disorders have shorter rumination time and activities (Charlton et al, 2016; King et al, 2017).

Hoof trimming helps maintain hoof health in dairy cows (Manske et al, 2002). The effects of hoof trimming on milk yield, rumination time, and activity have been studied using automatic milking and health monitoring systems (Van Hertem et al, 2014). However, previous studies have been limited to the effect of hoof trimming on hoof diseases or lameness. The effect of hoof trimming on healthy claws, including those of Jersey cows, remains unclear. This study aimed to investigate the effects of hoof trimming on milk yield, rumination time, and activity in Holstein and Jersey cows without hoof disease or lameness.

MATERIALS AND METHODS

Animals

A total of 14 cows (7 Holstein and 7 Jersey) with healthy claws were used in this study. Cows were fed the same total mixed rations and raised in the same free-stall barns. The cows were milked using an automatic milking system (Lely Astronaut 4, Lely, Maassluis, Netherlands) at an interval of more than 8 hours.

Hoof trimming and locomotion scoring

Eight cows (4 Holstein and 4 Jersey) were trimmed on October 6, 2022, and the others (3 Holstein and 3 Jersey) were trimmed on September 21, 2021. Hoof trimming was conducted following the 5 Dutch steps by the same veterinarians with extensive experience in hoof trimming. Each cow was evaluated by veterinarians before and after hoof trimming according to the locomotion score (Sprecher et al, 1997). None of the cows had lesions in the claws or a locomotion score of 1, which means they were non-lame before and 9 days after hoof trimming.

Milk yield, rumination time, and activity

Milk yield was measured using an automatic milking system and was aggregated daily. An automatic health monitoring system using a neck collar-type biosensor (HR-Tag, SCR Engineers Ltd., Netanya, Israel) was used to detect rumination time and activity. The activity was measured every two hours and aggregated daily.

Milk yield, rumination time, and activity were dis-

tinguished by time (Fig. 1): 3 to 1 day prior to the hoof trimming day (D-3to-1), the hoof trimming day (Day 0), 1 to 3 days after hoof trimming (D1to3), 4 to 6 days after hoof trimming (D4to6), and 7 to 9 days after hoof trimming (D7to9). The average values of milk yield, rumination time, and activity yield for 3 days were used to calculate the milk yield, rumination time, and activity of D-3to-1, D1to3, D4to6, and D7to9.

Statistical analyses

Statistical evaluations were performed using SPSS software (SPSS 26.0; IBM-SPSS Corp., Armonk, NY, USA). The Mann-Whitney U test with Bonferroni's method was used to compare Holstein and Jersey cows. The Wilcoxon signed-rank test was used to compare changes in within-group categorical variables over time. Data are expressed as mean \pm standard deviation. Statistical significance was considered when the *P* value was lower than 0.05.

RESULTS

The age (6.0 ± 2.1 years), parity (2.6 ± 1.1 times), and postpartal days (275.6 ± 40.3 days) of Holstein cows were similar to those of the Jersey group (6.2 ± 2.1 years, 2.1 ± 1.1 times, 214.4 ± 95.3 days, respectively) (Table 1). Milk yield, rumination time, and activity differed according to hoof trimming in Holstein and Jersey cows (Fig. 2).

Milk yield was the lowest on the hoof trimming day (Day 0), but did not significantly decrease in Holstein and Jersey cows on the hoof trimming day compared to D-3to-1. In Holstein cows, the effect of hoof trimming on milk yield is considerable. The milk yield on

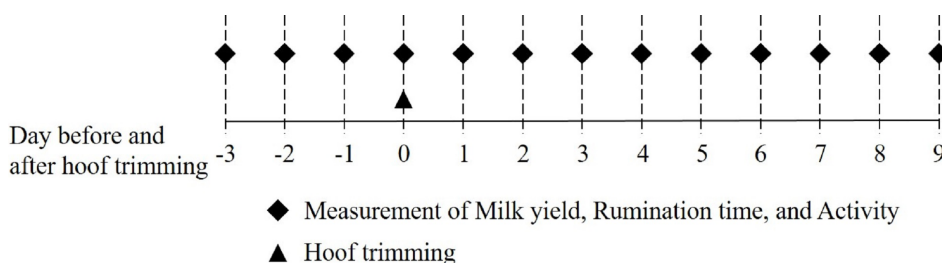


Fig. 1. Scheme of this study. Hoof trimming and data collecting on milk yield, rumination time, and activity.

Table 1. Descriptive statistics for cows according to the breed in the study

| Variable | Holstein cow | Jersey cow | P value |
|-----------------|--------------|------------|---------|
| Number | 7 | 7 | |
| Age, year | 6.0±2.1 | 6.2±2.1 | 1.000 |
| Parity | 2.6±1.1 | 2.1±0.9 | 0.535 |
| Postpartal days | 275.6±40.3 | 214.4±95.3 | 0.259 |

Data are expressed as the mean±standard deviation.

D4to6 increased compared to those on D-3to-1, Day 0, and D1to3 ($P<0.05$, respectively). Also the milk yield on D7to9 was higher than that of Day 0 ($P<0.05$). In Jersey cows, milk yields on D1to3 and D7to9 increased compared to that of Day 0 ($P<0.05$).

Rumination time decreased on the Day 0 compared to that of D-3to-1 in Holstein and Jersey cows; however, the difference was not significant (Fig. 2). In Holstein cows, rumination time on D-3to-1 did not differ from those of D1to3, D4to6 and D7to9. The rumination time on D7to9 was significantly higher than that on Day 0. In Jersey cows, no significant change of rumination time was observed in every time period.

Activity was the highest on Day 0 in Holstein and Jersey cows (Fig. 2). In Holstein cows, the activity levels on D1to3, D4to6, and D7to9 were significantly decreased compared to those on Day 0 ($P<0.05$). Similarly, in Jersey cows, the activity levels of D4to6 and D7to9 significantly decreased compared to those on Day 0 ($P<0.05$).

DISCUSSION

In this study, Holstein cows had a transiently increased milk yield after hoof trimming compared to those of Day 0 and D-3to-1. Jersey cows produced more milk after hoof trimming than Day 0. Both breeds showed transient changes in rumination time and activity on the hoof trimming day, but returned to a status similar to those of the days prior to hoof trimming. To our knowledge, this is the first study to investigate the effects of hoof trimming on milk yield, rumination time, and activity in Holstein and Jersey cows without lameness or hoof disease in Korea.

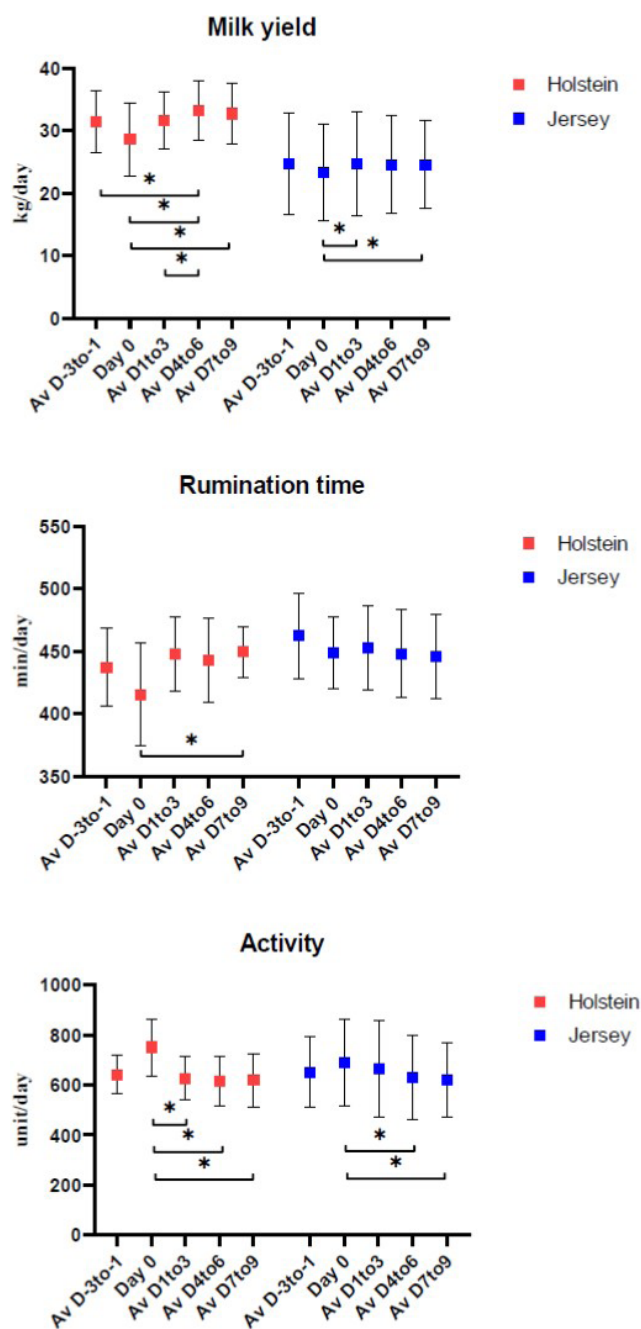


Fig. 2. Changes of milk yield, rumination time, activity according to hoof trimming. Av D-3to-1, the average from day -3 to day -1; Av D1to3, the average from day 1 to 3; Av D4to6, the average from day 4 to 6; Av D7to9, the average from day 7 to day 9. * $P<0.05$.

Milk yield and rumination time decreased, but activity increased on hoof trimming days in herds containing lame cows (Van Hertem et al, 2014; Erol et al, 2019). Although there was no statistical significance, the results

of Day 0 compared with D-3to-1 in both breeds in this study were similar to those in previous reports. Hoof trimming could increase the movement and reduce the resting time of cows. This could be the reason for increased activity and decreased rumination time on Day 0. Also, it has been known that hoof trimming could induce stress in cows (Pesenhofer et al, 2006). This could explain the reduced milk yield observed on Day 0, which was a temporary event that did not continue on the other days.

The changes in milk yield after hoof trimming remain controversial. Cows with hoof disorders increase milk yield after hoof trimming, while healthy cows show no difference in milk yield according to hoof trimming (Nishimori et al, 2006; Sogstad et al, 2007; Kibar and Çağlayan, 2016; Yakan, 2021). However, in our study, a temporary increase in milk yield was observed at D4to6 compared to D-3to-1 in Holstein cows. This could be due to the recovered level of cortisol, which increased on the trimming day and recovered to baseline four days later (Heinrich et al, 2020). This suggests that hoof trimming can temporarily affect milk yield in healthy cows. In addition, it is already known that the milk fat and protein compositions increased after hoof trimming in healthy cattle (Nishimori et al, 2006). Therefore, hoof trimming may positively affect dairy cow productivity.

As rumination time increases, milk yield also increases, whereas dairy cow activity decreases after hoof trimming (Van Hertem et al, 2014). Furthermore, rumination and feeding times increase after hoof trimming (Cruz et al, 2017; Yakan, 2021). The results regarding rumination time after hoof trimming in Holstein cows are consistent with those of previous reports. However, the results for the Jersey cattle differed. The rumination time during the post-hoof trimming period in Jersey cattle was slightly lower than that on D-3to-1 and differed from the previous reports. This may be because Jersey cows, which are smaller than Holstein cows, compete for feed with Holstein cows in the same barn. Further studies should elucidate why Jersey cows have decreased rumi-

nation time after hoof trimming, although the rumination time was not significant. The feeding time was also surveyed, and the cattle were divided into breeds. This is a limitation of this study.

In cows with hoof disorders, activity levels during post-hoof trimming period were lower than those of the previous level after hoof trimming (Van Hertem et al, 2014). In the present study, these patterns were similar in the Holstein and Jersey cattle, although the differences were not significant. However, the Holstein cows recovered sooner than the Jersey cows. In Holstein cows, the activity at D1to3 was slightly lower than that at D-3to-1 and significantly lower than that on Day 0. However, in Jersey cows, lower activity levels were shown on D4to6 and D7to9 compared on Day 0.

This study investigated the effects of hoof trimming on milk yield, rumination time, and activity in healthy Holstein and Jersey cows. On the day of trimming, Holstein and Jersey cows did not show any differences in milk yield, rumination time, or activity levels compared to the days prior to hoof trimming. After hoof trimming, milk yield temporarily increased compared to hoof trimming day in both breeds. In particular, Holstein cows showed increased milk yield compared to the days prior to hoof trimming. Additionally, rumination time and activity returned to the previous level during the post-hoof trimming period in both breeds. The results of our study support that hoof trimming in healthy cattle would not induce remarkable stress in dairy cattle and may temporarily increase productivity.

ACKNOWLEDGEMENTS

This work was conducted with the support of the “Study on the improvement of animal performance to establish the breeding base of the Jersey dairy cow” project (Project No. PJ01500605) of the National Institute of Animal Science, Rural Development Administration, Republic of Korea.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

ORCID

Mooyoung Jung, <https://orcid.org/0000-0001-7396-6787>

Seogjin Kang, <https://orcid.org/0000-0001-7838-9042>

Seungmin Ha, <https://orcid.org/0000-0002-5152-1979>

REFERENCES

- Booth C, Warnick L, Gröhn Y, Maizon D, Guard C, Janssen D. 2004. Effect of lameness on culling in dairy cows. *Journal of dairy science* 87: 4115-4122.
- Charlton GL, Bouffard V, Gibbons J, Vasseur E, Haley DB, Pellerin D, Rushen J, de Passillé AM. 2016. Can automated measures of lying time help assess lameness and leg lesions on tie-stall dairy farms? *Applied Animal Behaviour Science* 175: 14-22.
- Cramer G, Lissemore K, Guard C, Leslie K, Kelton D. 2008. Herd-and cow-level prevalence of foot lesions in Ontario dairy cattle. *Journal of dairy science* 91: 3888-3895.
- Cruz EAd, Fischer V, Passos LT, Porciuncula GCd, Stumpf MT, Werncke D, Santos CdSd. 2017. Effects of type of lesion and trimming on short-term behavior of grazing dairy cows. *Revista Brasileira de Zootecnia* 46: 280-285.
- Erol H, Atalan G, Yonez MK, Ozkocak TB, Veterinarian F. 2019. The Effect of hoof trimming on milk yield in dairy cattle. *Int J Sci Technol Res* 5: 10.7176.
- Heinrich M, Müller H, Fieseler H, Steiner A, Gottschalk J, Einspanier A, Spilke J, Mielenz N, Palme R, Baumgartner W. 2020. Cortisol concentration before, during and after sham foot trimming in German Holstein cows-the suitability of different matrices. *Tierärztliche Praxis Ausgabe G, Grosstiere/nutztiere* 48: 291-300.
- Ito K, Von Keyserlingk M, LeBlanc S, Weary D. 2010. Lying behavior as an indicator of lameness in dairy cows. *Journal of dairy science* 93: 3553-3560.
- Kibar M, Çağlayan T. 2016. Effect of hoof trimming on milk yield in dairy cows with foot disease. *Acta Scientiae Veterinariae* 44: 7-7.
- King M, Dancy K, LeBlanc S, Pajor E, DeVries T. 2017. Deviations in behavior and productivity data before diagnosis of health disorders in cows milked with an automated system. *Journal of Dairy Science* 100: 8358-8371.
- Manske T, Hultgren J, Bergsten C. 2002. The effect of claw trimming on the hoof health of Swedish dairy cattle. *Preventive veterinary medicine* 54: 113-129.
- Nishimori K, Okada K, Ikuta K, Aoki O, Sakai T, Yasuda J. 2006. The effects of one-time hoof trimming on blood biochemical composition, milk yield, and milk composition in dairy cows. *Journal of veterinary medical science* 68: 267-270.
- Onyiro O, Offer J, Brotherstone S. 2008. Risk factors and milk yield losses associated with lameness in Holstein-Friesian dairy cattle. *Animal* 2: 1230-1237.
- Pesenhofer G, Palme R, Pesenhofer R, Kofler J. 2006. Comparison of two methods of fixation during functional claw trimming-walk-in crush versus tilt table-in dairy cows using faecal cortisol metabolite concentrations and daily milk yield as parameters. *Wiener Tierärztliche Monatsschrift* 93: 288-294.
- Sogstad Å, Fjeldaas T, Østerås O, Forshell KP. 2005. Prevalence of claw lesions in Norwegian dairy cattle housed in tie stalls and free stalls. *Preventive Veterinary Medicine* 70: 191-209.
- Sogstad Å, Østerås O, Fjeldaas T, Refsdal A. 2007. Bovine claw and limb disorders at claw trimming related to milk yield. *Journal of dairy science* 90: 749-759.
- Sprecher D, et al, Hostetler DE, Kaneene J. 1997. A lameness scoring system that uses posture and gait to predict dairy cattle reproductive performance. *Theriogenology* 47: 1179-1187.
- Van Hertem T, Parmet Y, Steensels M, Maltz E, Antler A,

- Schlageter-Tello A, Lokhorst C, Romanini C, Viazzi S, Bahr C. 2014. The effect of routine hoof trimming on locomotion score, ruminating time, activity, and milk yield of dairy cows. *Journal of Dairy Science* 97: 4852-4863.
- Walker S, Smith R, Jones D, Routly J, Morris M, Dobson H. 2010. The effect of a chronic stressor, lameness, on detailed sexual behaviour and hormonal profiles in milk and plasma of dairy cattle. *Reproduction in domestic animals* 45: 109-117.
- Yakan S. 2021. Effects of hoof trimming on feed consumption, milk yield, oxidant and antioxidant system in dairy cows with hoof deformities. *Journal of Advances in VetBio Science and Techniques* 8: 47-58.