



Effect of therapeutic hoof trimming on haematological parameters in dairy cows with sole lesions[#]

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Abstract

A study was conducted among 18 lame cows from a herd of 114 cows in early lactation. Whole blood was collected from the lame cows on the first day of treatment and 20 days after therapeutic hoof trimming for analysis of haematological parameters. The number of red blood cells, haemoglobin concentration, platelet and volume of packed red cells increased ($p > 0.05$) on post trimming evaluation. The number of neutrophils and the percentage of neutrophils decreased with a concurrent increase in lymphocytes and monocytes which was not significant ($p > 0.05$) in lame cows post trimming. Neutrophil to lymphocyte ratio decreased in the affected animals in the post trimming period. Therapeutic hoof trimming and treatment improved the healing of painful sole lesions and reduction in pain sensitivity was also observed in all the affected animals.

Keywords: Haematological parameters, hoof trimming, dairy cattle

Lameness is a significant challenge for the dairy industry and this condition causes severe economic loss and apparent disruption of animal welfare. Sole ulcer and white line disease are predominant sole lesions associated with reduced milk production and fertility. Moreover, lameness alters feeding, standing and lying behaviour of cows and leads to reduced body condition. Functional hoof trimming is generally carried out to maintain optimum hoof dimensions (Philip, 2018) and to improve the balance between the medial and lateral claws (Bryan *et al.*, 2012). Therapeutic hoof trimming has the added advantage of reducing pain, promoting healing of sole lesions

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and improving the cow welfare. The effect of therapeutic hoof trimming on haematological parameters in cows affected with sole lesions has seldomly been reported previously and hence is discussed in this paper.

Materials and methods

The study was conducted at the University Livestock Farm and Fodder Research and Development Scheme, Mannuthy for a period of one year from July, 2020 to June, 2021. The lactating cows (n=114) were observed for lameness using a 5-point scale visual locomotion scoring method of Sprecher *et al.* (1997) and cows with a locomotion score of ≥ 3 were identified as clinically lame. Out of these, 18 clinically lame cows were subjected to detailed hoof examination in a conventional hoof trimming crush. The claws of both hind feet were subjected to functional hoof trimming using the 'Dutch five-step method' (Raven, 1985) and examined for laminitis related sole lesions. Severe sole lesions like sole ulcer and whiteline disease were managed with therapeutic hoof trimming, hoof block, antiseptic dressing and hoof bandaging. Clinical healing and pain sensitivity of sole lesions were recorded on day 20 following treatment.

Haematological studies were carried out in these lame cows on the day of treatment and 20 days after therapeutic hoof trimming. Venous blood samples were collected in EDTA vials for the estimation of haematological parameters including Red Blood Cell count (RBC), Haemoglobin concentration (Hb), Volume of Packed Red Cells (VPRC), Total Leucocyte Count ($10^9/\mu\text{L}$), differential leukocyte counts (absolute and per cent), platelet count and neutrophil to lymphocyte ratio (N:L) using an automatic haematology analyser. The haematological parameters in the two observation periods were statistically analysed by independent t test.

Results and discussion

There was a non-significant increase ($p>0.05$) in Red Blood Cell count (RBC), Haemoglobin concentration (Hb) and Volume of Packed Red Cells (VPRC) in lame cows on day 20 post-trimming when compared to pre-trimming evaluation on the first day of treatment. The number of neutrophils as well as the percentage of neutrophils decreased with a concurrent increase in lymphocyte and monocytes and were not significant ($p>0.05$) on post-trimming evaluation. Neutrophil to

Table 1. Haematological parameters (mean \pm SE) in lame cows on day one and day 20 of therapeutic hoof trimming (n=18)

Parameters	Day of trimming	20 th day post trimming	P value	t value
RBC count ($\times 10^6/\mu\text{L}$)	5.661 \pm 0.25	5.88 \pm 0.23	0.174	-1.424
Hb concentration (g/dL)	7.04 \pm 0.20	7.20 \pm 0.22	0.308	-1.052
HCT (per cent)	26.56 \pm 1.21	27.34 \pm 4.14	0.310	-1.050
MCV (μm^3)	47.37 \pm 1.27	46.74 \pm 1.17	0.147	1.525
MCH (pg)	12.55 \pm 0.40	12.69 \pm 0.46	0.734	-0.346
MCHC (g/dL)	27.14 \pm 1.04	26.57 \pm 0.67	0.429	0.811
RDW (per cent)	21.91 \pm 0.42	22.35 \pm 0.47	0.175	-1.418
Platelet count ($\times 10^9/\mu\text{L}$)	280.23 \pm 27.33	334.47 \pm 29.28	0.141	-1.548
Mean platelet volume (μm^3)	6.21 \pm 0.14	6.37 \pm 0.11	0.135	-1.576
Platelet Distribution Width (per cent)	24.61 \pm 2.98	25.42 \pm 2.71	0.707	-0.383
Total leucocyte count ($\times 10^9/\mu\text{L}$)	8.238 \pm 0.52	8.40 \pm 0.72	0.805	-0.250
Lymphocyte ($\times 10^9/\mu\text{L}$)	4.66 \pm 0.34	4.93 \pm 0.50	0.479	-0.723
Lymphocyte (per cent)	51.28 \pm 1.98	52.18 \pm 2.01	0.597	-0.539
Monocyte ($\times 10^9/\mu\text{L}$)	0.55 \pm 0.07	0.56 \pm 0.04	0.834	0.212
Monocyte (per cent)	6.16 \pm 0.44	6.94 \pm 0.50	0.152	-1.499
Granulocyte ($\times 10^9/\mu\text{L}$)	3.75 \pm 0.30	3.57 \pm 0.33	0.287	1.099
Granulocyte (per cent)	41.21 \pm 2.60	40.20 \pm 2.05	0.673	0.429
N:L	0.83 \pm 0.05	0.78 \pm 0.06	0.406	0.851

lymphocyte ratio decreased markedly after therapeutic hoof trimming. There was no significant difference in the total leucocyte count but platelet count increased in the post-trimming period. The details of the results are shown in Table 1.

The haematological values were within the normal physiological limits in all the animals under study and these values showed no statistical difference between the first day and day 20 of therapeutic hoof trimming. The haematological parameters obtained in the present study were comparable with the observations of Parizi and Khalafizadeh (2006) who found that the number and percentage of neutrophils and monocytes were higher in the lame cattle; this could be related to inflammatory events. The authors also reported a significant decrease in RBC, Hb, VPRC in lame cows when compared to sound cows and attributed this to malnutrition in the affected animals consequent to pain.

Severity of lameness in dairy cattle was assessed subjectively by visual locomotion scoring methods in dairy cattle for adopting therapeutic measures. The most commonly used locomotion scoring method was the 5-point score proposed by Sprecher *et al.* (1997), which was reported as the gold standard test by Bicalho *et al.* (2007). Out of 114 animals screened for lameness, 18 cows that had a locomotion score of three or above were classified as clinically lame.

The claws were trimmed and examined thoroughly for the signs of laminitis related hoof lesions by hoof trimming. Green *et al.* (2002) observed that sole ulcer, white line disease, interdigital necrobacillosis, and digital dermatitis were the most common reasons for lameness. Sole ulcer (Fig. 1) and whiteline disease were identified as the laminitis-related lesions that caused clinical lameness in selected animals and this was in agreement with Zahid *et al.* (2014). The locomotion score of ≥ 3 and sole lesions in the selected animals are in agreement with observations of Winckler and Willen (2001) who reported that the possibility of sole disorder in cows with higher locomotion score. Winkler and Margerison (2012) observed that the locomotion score and sole lesions

increased during the postpartum period.

Therapeutic hoof trimming, hoof block, antiseptic wound dressing and hoof bandaging favoured the healing of painful sole lesions and the sole defects were almost covered with hoof by one month. All the sole lesions were healed and covered with hoof without any complications by 20th day of therapeutic trimming (Fig. 2).

Marked reduction in pain sensitivity was also observed on day 20 when compared to the first day of treatment. Functional recovery of the affected limb might have improved standing and feeding behaviour in affected animals and caused an increase in red blood cell count, haemoglobin concentration, volume of packed red cells and platelet count by 20th day of post trimming. Improvement in pain sensitivity might have indirectly affected the ruminating time of the cows (van Hertem *et al.*, 2014).



Fig. 1. Sole ulcer on the first day of treatment



Fig. 2. Healed sole ulcer on day 20

Conclusion

Therapeutic hoof trimming, fixing the hoof block and hoof bandaging had a beneficial effect on cow welfare by improving haematological parameters in post trimming period and markedly reducing pain sensitivity of sole lesions.

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Conflict of interest

The authors declare that they have no conflict of interest.

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