

Report on foot bathing with an acidulated solution (DigiDerm) with 2% copper sulphate on the prevalence of digital dermatitis and heel horn erosion

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Introduction

Digital dermatitis is an emerging claw disease in dairy cattle in many countries around the world. The painful often bleeding lesions of the digital and interdigital skin cause lameness of different degree and milk production can be markedly affected. As a consequence of severe or mild dermatitis, heel horn erosion, interdigital hyperplasia and warts may develop (fig 1.). Digital dermatitis is caused by a bacterial infection although the precise course of the infection is not completely established. A spirochete of genus *Treponema phagedenis* is consistently found in the lesions although the bacterium alone could not provoke the disease (Pringle et al., 2008). Also other bacteria and chemical agents have been discussed as possible risk factors for dermatitis and heel horn erosion. Digital dermatitis can be rather successfully treated with local application of antibiotics (Manske et al. 2002). Antibiotics are also used in foot bath to control the disease but are very expensive and should be avoided because of development resistance bacteria. Thus, the utmost important aim is to prevent the disease by the use of sustainable methods. As digital dermatitis is proven to be related to poor hygiene and exposure of the feet to manure dry foot conditions must be promoted first of all. Secondary, foot bathing can be a complementary measure.

Earlier studies showed beneficial results in both preventing and treating digital dermatitis and heel horn erosion by foot bathing with a 7% copper sulphate solution twice daily six days a week (Bergsten et al., 2007). However, copper is a heavy metal, accumulates in the environment and could damage essential microbes in the soil. On the other hand some soils lack copper and copper sulphate is also a fertilizer that must be added to such soils. European Commission has a supervising programme to reduce the use of biocides and copper sulphate is not officially permitted to use in foot bath. It is urgent to find alternative foot bath solutions but no real alternative to copper sulphate other than antibiotics is not yet launched. There is however another possibility, to reduce the volume of copper used by increasing the efficacy of copper in the solution. By adding acids to the solution copper is more completely dissolved and sustained in solution. By using DigiDerm a reduction of copper up to 50 to 80% is claimed to give the same results in promoting healthy feet. In order to test the solution a trial was performed using the same methods and being in the same herd as previously described (Bergsten et al., 2007).

Material and methods

DigiDerm is a mixture of organic and inorganic buffered acids that sustains consistent active copper levels in a foot bath solution and reduces copper sulphate use 50 to 80%. With the beginning in September 2007 a two compartment longitudinally split foot bath was prepared. Hoof mat™ was used in the bottom in each side of the bath. DigiDerm concentrate was diluted with water 1:50 and copper sulphate was added to give a concentration of 2%. A 200 litres container was prepared and 15 litres of the solution was pumped and filled the left side of the Hoof mat™. The right side of the mat was filled with water. The 198 cows from two high producing groups, Swedish Holstein (SH) and Swedish Red (SB) respectively, were bathed once daily five days a week. With beginning on January 7th 2007 all the cows were trimmed by a professional foot trimmer in a hydraulic chute and feet were scored according to the national claw health report (fig 1). In addition, digital dermatitis and heel horn erosion were scored for each foot. All the feet were digitally imaged and the files were stored and used for later studying of lesions.

The proportions of having the certain type and score of lesion on both sides of the cow, right side alone or left side alone was compared and statistical analysis was made for the proportions of two independent groups with continuity correction (because the samples were relatively small).

Results

The results from the claw health scoring of digital dermatitis and heel horn erosion are presented in Table 1. The average prevalence of DD was 15,1 and DD found on the treated side was five times lower (2,0) than on the side treated with water (10,1, $P < 0,0020$). There was also significantly ($P < 0,02$) less mild dermatitis of the claws bathed with DigiDerm. However, no significant difference was found for heel horn erosion although there was a lower proportion on the treated side.

Table 1. Prevalence of digital dermatitis and heel horn erosion at foot trimming 2008-01 in feet that have been foot bathed with 2% acidoluted copper sulphate solution or water alone from 2007-09

	Dermatitis mild	Digital dermatitis severe	Heel horn erosion mild	Heel horn erosion severe
Total prevalence	41,9%	15,2%	48,5%	38,9%
Water alone	18,0%	10,1%	3,3%	7,1%
DigiDerm	7,8%	2,0%	0,8%	3,8%
P	0.015	0.002	NS	NS

Discussion

The beneficial effect of DigiDerm to reduce severe digital dermatitis was clearly shown in present study. Also mild dermatitis was significantly reduced although the majority of mild dermatitis occurred on both side's feet. Similar results was shown in an earlier study using copper sulphate alone in 7% water solution (Bergsten et al., 2007) where the risk of having DD was ten times and heel horn erosion four times less than compared to water. The two studies are not directly comparable because of many reasons. Firstly two different statistical models were used adapted to the present situations. Secondly, the epidemiology of the diseases in the herd is steadily changing over time, season and causative parameters. The generally very bad situation in the herd with prevalences up to 40% in certain groups during periods of time has now been reduced to an average of 15% in the studied high producing groups. In other lower producing groups the prevalence was lower during the same time as the study was performed. It is no doubt that foot bathing and individual treatments significantly reduced the infectious pressure in the herd. The effect on heel horn erosion was less marked and the majority of cows had both left and right side's feet affected. Severe heel horn erosion has been reduced in the herd and it is possible that without improving the general hygiene in the herd it may be impossible to reduce the heel horn erosion by means of foot bathing alone.

Summary

DigiDerm resulted in a prevalence of digital dermatitis of 2% while feet walked through water alone had a prevalence of 10%. Are the results of DigiDerm comparable to those by 7% copper sulphate solution alone? As discussed above the results can not be compared from one season to another because of many confounders. Also it is important to point out that the bath frequency was reduced to half and the number of treatment days were reduced from six to five in present study. With the aim to reduce copper as a possible biocide in the environment DigiDerm can give a contribution with satisfying results and significantly reducing severe digital dermatitis. Previously 7% solution with intensive foot bathing consumed 12,6 kg per week while DigiDerm with a less intensive bathing only used 1,5 kg copper sulphate, thus giving an eightfold reduction of copper.

Litterature

- Manske, T., Hultgren, J. and Bergsten, C., 2002. Topical treatment of digital dermatitis associated with severe heel- horn erosion in a Swedish dairy herd. *Prey Vet Med*, 53(3): 215-31.
- Bergsten, C., J. Hultgren, and A. Hillström. 2007. Using copper sulphate, peracetic acid or a combination of both in foot bath for the control of digital dermatitis and heel horn erosion in dairy cows. 13th International

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Pringle, M., C. Bergsten, L. Fernström, H. Höök, and K. Johansson. 2008. Genetic characterization and antimicrobial susceptibility of *treponema phagedenis-like* spirochetes isolated from digital dermatitis lesions in dairy cattle. Veterinary Research Communications. Submitted.