Topical salicylic acid treatment of digital dermatitis in dairy cows: Drug resides in milk and clinical efficacy

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Introduction

Digital dermatitis (DD) causes skin lesions that commonly lead to lameness in cattle. Tetracyclines have been a treatment of choice, but Salicylic acid (SA) is a non-antibiotic alternative that has comparable efficacy. There is no regulatory tolerance for SA in food animals in the United States, and no published data about milk residues after use to treat DD in cattle. The primary objective of our study was to describe drug residues in milk after topical treatment of DD lesions with SA. We also compared the efficacy of SA to tetracycline when treating DD, and tested the use of thermographic imaging as a method for staging the severity of DD lesions.

Materials and methods

Lactating Holstein cows with at least one M2 stage (acute) DD lesion were enrolled in the study and randomly assigned to 3 treatment groups (n = 18 cows per group): 2 g tetracycline with 6 ml propylene glycol to form a paste, 5 g SA powder, or 6 ml of a commercially available SA paste. All treatments were applied topically to one lesion per cow. Lesions treated with tetracycline were left unbandaged, while SA-treated lesions had a gauze sponge and cohesive bandage applied for 48 hours. Milk samples were collected from all cows before treatment and 4, 8, 24, 36 and 48 hours after treatment. Digital and thermographic images of lesions were taken at 7 and 28 days after treatment. Drug concentrations in milk samples were measured using ultra high performance liquid chromatography-mass spectrometry. Lesion score data were analyzed using PROC GLIMMIX in SAS. Thermographic data were analyzed using PROC MIXED in SAS. Statistical significance was defined a priori as $P \leq 0.05$.

Results

Thirty-six cows never had any detectable drug residues in their milk (SA Paste = 11, SA Powder = 12, Tetracycline = 13). Of the 18 cows with drug residues in their milk, 13 had residues starting at 4 to 8 hours post-treatment, with no detectable drug amounts by 24 hours (SA Paste = 5, SA Powder = 3, Tetracycline = 5). Two cows had levels above the limit of qualification (LOQ) on the baseline sample (SA Paste = 1, SA Powder = 1). Two cows did not have a detectable amount of SA in their milk until 36 hours after treatment (SA Powder). One cow had a milk drug residue at 8 hours, no detectable residue at 24 hours, and then a detectable residue at 36 hours (SA Paste). A change from the baseline M2 lesions score to stage M3, M4, or M4.1 was considered "improvement". There were no lesions that resolved completely to M0. There was no difference among treatments in their effects on DD lesions, and there was lesion improvement on day 7 across all treatments. Cows that were treated with SA powder and tetracycline regressed similarly between days 7 and 28, while SA paste prevented worsening of lesions between day 7 and day 28. Acute M2 lesions had higher mean temperatures (28.9 ± 1.6°C) compared to M3 lesions (26.8 ± 1.9°C). Mean M2 lesion temperature was not different from mean M4 or M4.1 temperature (28.3 ± 1.7°C and 28.2 ± 1.7°C, respectively).

Significance

All treatments had similar effects on clinical outcomes, with improvement and no treatment differences on day 7. M2 lesions had higher mean temperatures than M3 lesions, but this difference is unlikely to be diagnostically useful. Tetracycline levels in milk of treated cows fell below the LOQ after 24 hours in all cows, in agreement with previous research. Most cows treated with SA (67%) never had quantifiable levels of SA in their milk at any time after treatment. Most cows with milk drug residues after treatment had levels below LOQ of SA by 24 hours post treatment. However, there were 3 cows that still had detectable SA in their milk for up to 36 hours. A milk withholding time of 36 hours should be observed following the treatment of DD with topical salicylic acid.

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