

On farm evaluation of group treatment of digital dermatitis in dairy cows

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Abstract

The aim of this blind and longitudinal farm study was to evaluate the efficacy of Provita Hoofsure Endurance (PHE) foot wash solutions in reducing the prevalence of lameness due to digital dermatitis (DD) in dairy cows. Cows (n = 182) from three commercial dairy herds of closed type were diagnosed by lameness and pain scoring, with lesions consistent with DD in different stage of development. On the basis of locomotion scoring system (1-5), the prevalence of lameness was between 28.8% and 43.6%. Cows were considered for individual evaluation based on significant Kappa-value and restrained in a chute for lesion type (0-4), color (0-2) and size (0-2) scoring prior to application of PHE and at the end of trial in walk-through footbaths or group topical spray in milking parlor. Cows were allocated to one of two groups: cows in group 1 were treated with PHE 2.0% twice a day for 3 consecutive days in footbath, and treatment repeated again after 2 weeks with PHE 1.0% twice a day for 3 consecutive days. In group 2, 2.0% solution was sprayed on the palmar surface of the feet. Changes in each score between initial and final scoring were calculated and the comparison was made statistically using non-parametric U-test with 0.05 level of significance. From the results of this farm study, it is concluded that the application of PHE alleviates lameness significantly at the herd- or the cow-level as part of a control program of DD.

Key words: digital dermatitis, cow, lesion, footbaths, group topical spray

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Introduction

Digital dermatitis (DD) is an important cause of lameness in dairy cattle. The economic importance of DD is reportedly attributable to decreased milk yield, impaired reproductive performance, increased number of culled cows, and cost of treatment and control methods (Rebhur et al., 1980; Arguez-Rodriguez et al., 1997; Wells et al., 1999).

Digital dermatitis was first described in Italy in the early 1970's and since 1974 it has been reported in the United States, Europe, Japan, Canada, Mexico, and Chile (Rodriguez-Lainz et al., 1998; Read and Walker, 1999). In Iran, the disorder was first described as lameness outbreaks in Yaft Abad dairy herds in 1979 (Nowrouzian, 1990 and 1997). The cause of the disease is still debated; however, the marked susceptibility of DD lesions to parenteral or topical administration of antibiotics and detection of spirochetes invading the stratum spinosum and dermal papillae (Read et al., 1992; Blowey et al., 1994; Read and Walker, 1999) suggest that bacteria may play an important role in the pathogenesis. Many different systems have been used to treat the lesions in the form of footbaths, topical sprays, parenteral antibiotics, and bandages (Shearer and Elliott, 1994; Guterbock, 1995; Britt et al., 1996; Hemling et al., 1997). These recommendations were based on empirical evidence of efficacy. Subsequent studies on topical treatment supported these early observations (Guterbock, 1995; Britt and McClure, 1998; Nowrouzian and Zareii, 1998) and, as a result, antibiotic formulations have become a common method for treatment of DD.

Non-antibiotic formulations for treatment of DD may be desirable because they offer reduced risk of antibiotic residue in milk or meat from treated cows (Shearer and Hernandez, 2000). A variety of treatment products have been tested, but efforts have not been focused on establishing a standard protocol for studying various treatment products or procedures. Britt et al. (1996) topically applied four treatment products and used lameness to assess the rate of healing. In a later study by Britt and McClure (1998), the efficacy of topically applied products were evaluated using lameness, clinical observation for change in healing and evaluation of the lesion using standardized scoring system. However, the lameness score did not show good agreement with the clinical observation using clinical scoring system (Hemling and Lampe, 1997). Shearer and Elliott (1994) to evaluate hairy wart treatment products have also used lameness in combination with evaluation of lesion size and pain associated with the lesion. Berry et al. (1996) evaluated topically applied products using a scoring system that assessed pain and lesion size. The objective of this blinded longitudinal farm study was to evaluate the efficacy of Provita Hoofsure Endurance (PHE) foot wash solutions in reducing the prevalence of lameness due to DD in dairy cows.

Materials and Methods

Three commercial closed Holstein dairy herds in the vicinity of Tehran (Kordan, Eslam Shahr, and Fashfouye) with naturally occurring digital dermatitis were chosen for cow selection. Their total population

was 320, 950 and 750 cows, respectively. All herds had similar management. The prevalence of lameness was calculated on the basis of two locomotion scoring system. The locomotion scoring system one was based on scores 0 to 3 with 0 = no visible lameness; 1 = slight lameness; 2 = noticeably lame; and 3 = severe lameness (carrying the foot) when walking on a concrete surface. For majority of analyzes, the locomotion system two (scores 1-5) was used. Pre-treatment and post-treatment lesions were also evaluated by 3 veterinarians, working independently, using both locomotion scoring systems (Britt et al., 1996; Sprecher et al., 1997; Britt and McClure, 1998). The lameness and pain scores were followed by visual assessment of the condition of the interdigital space, and assessment of changes using lesion type-, color- and size- scores systems (Table 1; Figure 1) after using pressure spray of cold water on the affected area in the milking parlor. Pain score was evaluated by observation of evidence of pain and response to manual pressure of the affected area (Table 1).

Among the lame cows, a total of 182 cows were diagnosed with lesions consistent with DD in different stage of development using previously described methodology (Hemling and Lampe, 1997). Eighty-two milking cows were considered for individual evaluation based on significant Kappa-value. They were restrained in a chute for lesion type, color and size scoring (Hemling and Lampe, 1997; Britt and McClure, 1998; Shearer and Hernandez, 2000) prior to application of PHE and at the end of study. Cows were treated in walk-through footbaths (the first group) or topical spray in milking parlor (the second group).

Cows were allocated to one of two groups. At each site the cows were allocated to treatment (50% of lame cows demonstrating lesions consistent with DD) according to a randomization list. In both groups the application protocol required workers to wash the lesion with low pressure water hose while cows were being prepared for milking. Cows in group 1 (Eslam Shahr) were treated with PHE 2.0% twice a day for 3 consecutive days in footbath. Treatment was repeated after 2 weeks with PHE 1.0% twice a day for 3 consecutive days. In group 2 (Kordan and Fashfouye), 2.0% solution was sprayed on the palmar surface of the feet (with particular emphasis on DD lesions) in the interdigital cleft, dewclaw, and on the lateral medial heel.

Changes in each score (Lesion, Pain, Color, Size) within each cow between initial (before treatment) and final scoring (at the end of the trial) were analyzed, and comparison was made using non-parametric U-test at 0.05 level of significance (Shott, 1990). The differences between the two groups were not analyzed due to limited sample size.

Results

The prevalence of lameness is presented in Table 2. On the basis of locomotion scoring system, the prevalence of lameness varied between 28.8 % and 43.6 %. Two hundred thirty five cows showed lesions of the digital region. Among these lame cows, a total of 182 were diagnosed with lesions of DD in different

stage of development. Fifty three cows were diagnosed with claw capsule lesions. The prevalence of DD on farms varied between 75.0% and 81.0%.

The level of agreement between locomotion score and signs consistent with DD (the Kappa value) is presented in Table 3. The mean pain score of 1.28 ± 0.23 , 1.80 ± 0.11 , 1.65 ± 0.22 was detected in Kordan, Eslam Shahr and Fashfouye, respectively. The comparison of the pre- and post- treatment signs and scores consistent with DD, and changes in the prevalence in the three herds are presented in Table 4. The decrease in lameness-, pain-, color- and size- scores was significantly decreased after treatment with PHE solutions ($P < 0.05$).

Discussion

This study was conducted to evaluate the efficacy of PHE foot spray solutions in reducing the prevalence of lameness and severity due to DD in enrolled dairy cows. Results showed a significant difference in the severity (based on evaluated scores) of DD lesions from before to after treatment with apparent healing effects ($P < 0.05$). Reduction in the prevalence of DD on herd-level was also significant. The sample size was limited to assess the between group variations in treatment efficacy and obtain biologically sound results. However, this does not decrease the value of the study as such approaches (using the within cow comparison or in other word each cow serves as its own control) have been previously published.

The high level of agreement between the locomotion score and signs consistent with DD (Kappa value between 78 and 86) is indicative of the fact that infectious diseases of the lower limb, especially DD with a wide range of lesions, are important in developing lameness.

Application of the treatment protocols using PHE solutions periodically among the herd will result in minimizing effects of the disease. Dose and duration of application are important to a successful outcome-

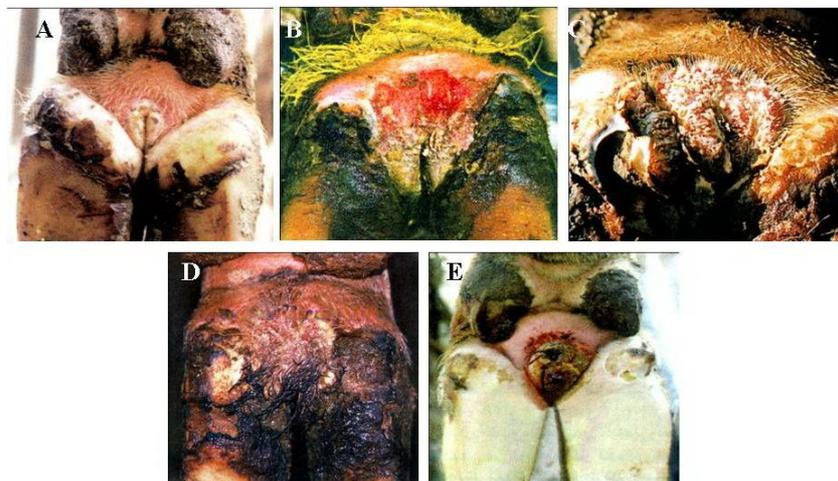


Figure 1. Lesion type of digital dermatitis in dairy cows: **A:** type 0, **B:** type 1, **C:** type 2, **D:** type 3, **E:** type 4

Table 1. Parameters of the scoring system used for the digital dermatitis lesions.

Criteria	Description	Score assigned
Pain	no signs of pain	0
	signs of mild pain	1
	signs of severe pain	2
Lesion type	no lesion or hyperkeratosis	0
	Lesions round to oval, flat, raw, with erosive-like surfaces and visible margin	1
	Lesions round to oval, raw, moist, with tufted or granular strawberry-like surfaces and primary hyperkeratinization around of margin	2
	Lesions raised with surfaces covered by primary epidermal layer	3
	Mature lesions raised with surfaces covered by small filiform papillae	4
Color	Flesh and light, indicating a healed lesion	0
	Black or brown, indicating lesion regression	1
	Red or gray, indicating erythema	2
Size	No visible Lesion	0
	Lesion ≤ 2.5 cm in diameter	1
	Lesion > 2.5 cm in diameter	2

Table 2. The prevalence of lameness on the basis of the two locomotion scoring systems.

Dairy herds	No. of Dairy Cows	Lameness Mean	Prevalence (%)	Locomotion Scoring (1-5) (Max-Min)	Locomotion Scoring (0-3) (Max-Min)
Kordan	110	48	43/6	2-5	1-3
Eslam Shahr	350	115	32/8	3-5	2-3
Fashafouye	250	72	28/8	2-4	1-3
Total	710	235	-	-	-

Table 3. Number of cases with digital dermatitis and their locomotion scoring, pain scoring and sample selection on the basis of Kappa value in three commercial dairy herd.

Dairy herds	No. of DD (%)	Locomotion Scoring (Mean)	Kappa Value	No. of Cases on basis of 50 %	Pain Scoring Mean + SD (Max-Min)
Kordan	36 (75)	1-3 (2.5)	86	18	1.28 + 0.23 (0-2)
Eslam Shahr	88 (77)	2-3 (2.2)	83	44	1.80 + 0.11 (1-2)
Fashafouye	58 (81)	1-3 (1.9)	78	29	1.65 + 0.22 (1-2)

Table 4. Comparison of pre- and post-treatment criteria with Provita Hoofsure Endurance in three commercial closed dairy herds. (Mean + SD).

Dairy herds	Kordan	Eslam Shahr	Fashafouye	Statistical Significance
Treatment procedure	Spray	Footbath	Spray	-
No. of Cases	18	44	29	-
Pre-treatment Lesion	2.11 + 0.99 (0-4)	1.99 + 0.83 (0-4)	2.03 + 0.18 (0-4)	<i>P</i> < 0.05
Post-treatment Lesion	0.21 + 0.48 (0-2)	0.54 + 0.11 (0-1)	19.1 + 0.07 (0-2)	
Pre-treatment Pain	1.27 + 0.46 (0-2)	1.90 + 0.11 (0-2)	1.33 + 0.22 (0-2)	<i>P</i> < 0.05
Post-treatment Pain	0.6 + 0.23 (0-1)	0.23 + 0.04 (0-1)	0.44 + 0.18 (0-1)	
Pre-treatment Color	1.55 + 0.6 (0-2)	1.43 + 0.44 (0-2)	1.6 + 0.58 (0-2)	<i>P</i> < 0.05
Post-treatment Color	0.22 + 0.34 (0-1)	0.18 + 0.09 (0-1)	0.23 + 0.43 (0-1)	
Pre-treatment Size	1.17 + 0.3 (0-2)	1.24 + 0.2 (0-2)	1.26 + 0.19 (0-2)	<i>P</i> < 0.05
Post-treatment Size	0 + 0 (0)	0.5 + 0 (0)	0.3 + 0.1 (0)	
Pre-treatment Prevalence	75 %	77 %	81 %	<i>P</i> < 0.05
Post-treatment Prevalence	8 %	12 %	6 %	

with topical spray treatments. Failures to apply an effective concentration of drug for a sufficient period of time are believed to be major causes of reduced efficacy under field conditions (Shearer and Hernandez, 2000). The current study indicates a positive effect of PHE solution in reducing the effects of an outbreak of the disease. It also decreases recurrence, especially in cases of a high pre-treatment prevalence in the herd. Therefore, on such farms, application of PHE solution can be considered in biosecurity protocols (Mason et al., 2004).

It should be noted that the solution can be a suitable alternative for walk-through foot bathing which usually done through application of Formalin 5% and/or Copper Sulfate 3% in most of Iran's enterprises. Formalin threatens the health of the farm's personnel because of its toxic fumes. Copper Sulfate will bring irremediable losses to the environment (Kofler et al., 2004). The disinfectant power of PHE solution is estimated three times stronger than Copper Sulfate and twice as stronger as Formalin (Mason et al., 2004).

Application of PHE as spray is preferable to footbath because spray-application is cheaper in comparison with formalin. It also has less risk for drug inactivation by the presence of organic materials. Additionally, because of direct contact between drug and lesion, the topical spray application results in a sufficient concentration of drug reaching the lesion. Non-antibiotic formulations for treatment offer reduced risk of antibiotic residue in milk or meat from treated cows (Shearer and Elliott, 1994; Britt et al., 1996). Thus, the application of PHE solution is environmental friendly, relatively cheap and efficacious to use in herds that suffer from DD.

From the results of this farm study it is concluded that the application of PHE alleviates lameness significantly at the herd- or the cow-level when control program of digital dermatitis is monitored.

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