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On Farm Evaluation of Group Treatment of Papilamatous 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 rate of lameness due to Papillomatous Digital Dermatitis (PDD) in dairy cows. The 182 cows from three commercial dairy herds were diagnosed with lesions of PDD in different stage of development by lameness score and pain scoring. The prevalence rate of lameness was calculated between 28.8 and 43.6% on the basis of locomotion scoring system (1-5). The cows were considered for individual evaluation under significant of 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 in walk through footbaths or group topical spray in milking parlor and at the end of trials. The 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, solution 2.0% were sprayed on 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 when control program of PDD is monitored.

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

INTRODUCTION

Papillomatous Digital Dermatitis (PDD) is a major cause of lameness in dairy cattle. The economic importance of PDD 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; Argaez-Rodriguez *et al*., 1997; Wells *et al*., 1999).

PDD was first described in Italy in the early 1970's and since, 1974, PDD has been reported in the United States, Europe, Japan, Canada, Mexico and Chile (Rodriguez-Lainz *et al*., 1998; Read and Walker, 1998). In Iran, the disorder was first described as lameness outbreaks in Yaft Abad dairy herds in 1979 (Nowrouzian, 1990). The cause of the disease is still unknown however the marked susceptibility of PDD 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, 1998) 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 and Lampe, 1997). Many of these recommendations were based on empirical evidence of efficacy. Subsequent studies on topical treatment supported these early observations (Guterbock, 1995; Van Amstel *et al*., 1995; Britt *et al*., 1996; Reed *et al*., 1996; Blowey *et al*., 1998; Britt and McClure, 1998; Nowrouzian and Zareii, 1998; Shearer and Elliott, 1998; Shearer *et al*., 1998; Berry *et al*., 1999; Hernandez *et al*., 1999) and as a result, antibiotic formulations have become a common method for treatment of PDD.

Nonantibiotic formulations for treatment of PDD 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

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Britt, the efficacy of topically applied products were evaluated using lameness, clinical observation for change in healing and evaluation of the lesion using a scoring system. In this trial, the lameness score did not show good agreement with the clinical observation of the scoring system rating (Hemling and Lampe, 1997). Shearer has also used lameness in combination with evaluation of lesion size and pain associated with the lesion to evaluate hairy wart treatment products (Shearer and Elliott, 1994, 1998). Berry *et al.* (1996) evaluated topically treated products using a scoring system that assessed pain and lesion size. The objective of this blind and longitudinal farm study was to evaluate the efficacy of Provita Hoofsure Endurance foot wash solutions in reducing the prevalence rate of lameness due to papillomatous digital dermatitis 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 and cows were selected. Their total population was 320, 950 and 750 cows, respectively. All herds had similar management. The prevalence rate of lameness was calculated on the basis of locomotion scoring system (0 = No visible lameness; 1 = Slight lameness; 2 = Noticeably lame; 3 = Severe lameness (carrying the foot) when walking on concrete). Pre-treatment and post-treatment lesions were also evaluated by 3 veterinarians, working independently using two locomotion scoring systems (Britt *et al*., 1996; Sprecher *et al*., 1997; Britt and McClure, 1998). Among these lame cows a total of 182 cows were diagnosed with lesions of PDD in different stage of development by lameness score and pain scoring using pressure spray of cold water on the affected area in milking parlor and preceded manually touching the wound to response (Hemling and Lampe, 1997). Eighty two milking cows were considered for individual evaluation under significant of Kappa value and restrained in a chute for lesion type, color and size scoring (Hemling and Lampe, 1997; Britt and McClure, 1998; Hernandez and Shearer, 2000; Laven and Proven, 2000; Shearer and Hernandez, 2000; Moor *et al*., 2001) prior to application of PHE in walk through footbaths or group topical spray in milking parlor and at the end of trials (Table 1) (Fig. 1).

Table 1: Parameters of the scoring system used for the scoring of papilamatous 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 were round to oval, flat, raw, with erosive-like surfaces and visible margin	1
	Lesions were round to oval, raw, moist, with tufted or granular strawberry-like surfaces and primary hyperkeratinization around of margin	2
	Lesions were raised with surfaces covered by primary epidermal layer	3
	Mature lesions were raised with surfaces covered by small filiform pa-pillae	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

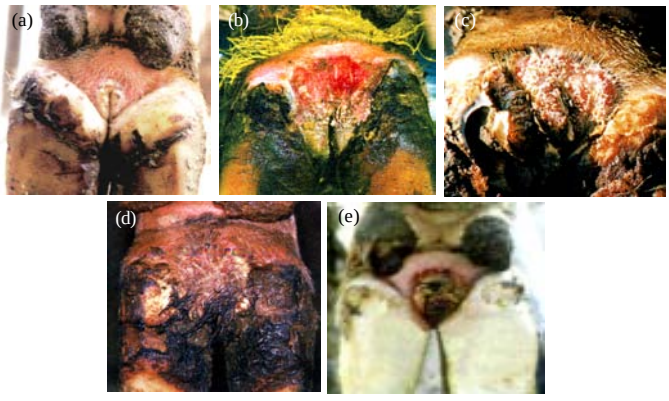

Fig. 1: Lesion type: a) Type 0; b) Type 1; c) Type 2; d) Type 3 and e) Type 4

The cows were allocated to one of two groups. In both groups the application protocol was required the 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 and treatment repeated again after 2 weeks with PHE 1.0% twice a day for 3 consecutive days; in group 2 (Kordan and Fashfouye), solution 2.0% were sprayed on palmar surface of the feet (with particular emphasis on PDD lesions) in the interdigital cleft, dewclaw and on the lateral medial heel. At each site the cows were allocated according to a randomization list. Changes in each score (lesion, pain, color and size) between initial and final scoring were calculated and the comparison was made statistically using non-parametric U-test with 0.05 level of significance (Shott, 1990).

RESULTS

The prevalence rate of lameness was calculated between 28.8 and 43.6% on the basis of locomotion scoring system. Two hundred thirty five showed lesions of digital region. Among these lame cows a total of 182 cows were diagnosed with lesions of PDD in different stage of development. Fifty three cows were diagnosed with claw capsule lesions. The prevalence rate of PDD was calculated between 75.0 and 81.0%. The prevalence rate of lameness is listed in Table 2.

The existence high Kappa value between 78-86 is indicative of the fact that digital infectious disease especially PDD which have a wide range of lesions are first priorities in developing lameness (Table 3). Screening test in a parallel-style milking is carried out through making pain. Its performed by spraying the digits of the both limbs with cold water and selecting 50.0% of the cases for tropical group evaluation of PHE solution with a high Kappa value and its created similar cases in three herds in a way that pain scoring with mean of 1.28±0.23, 1.80±0.11 and 1.65±0.22, respectively in three commercial closed Holstein dairy herds in Kordan, Eslam Shahr and Fashfouye was a conformation to this selection. Statistical analysis of pain, lesion, color and size in each commercial herd under study was carried out on 50.0% of the cases among the whole population of the cows suffering from PDD and its confirmation the significant effect of PHE on treating the lesions. Moreover, each approved significant decrease of disease up to 6.0-8.0% ($p<0.05$) (Fig. 1). Table 4 shows the results from one clinical observation conducted according to the method described earlier.

This study was conducted to evaluate the efficacy of PHE footwash solutions in reducing the prevalence rate

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

Dairy herds	No. of dairy cows	Lameness mean	Prevalence rate (%)	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 PDD and their locomotion scoring, pain scoring and sample selection on the basis of Kappa value in three commercial dairy herd

Dairy herds	No. of PDD (%)	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)	$p<0.05$
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)	$p<0.05$
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)	$p<0.05$
Post-treatment color	0.22+0.34 (0-1)	0.18+0.09 (0-2)	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)	$p<0.05$
Pre-treatment size	0+0 (0)	0.5+0 (0)	0.3+0.1 (0)	
Pre-treatment prevalence rate	75%	77%	81%	$p<0.05$
Post-treatment prevalence rate	8%	12%	6%	

of lameness due to PDD in dairy cows. Results showed a significant difference in evaluated scores between initial and final course of PDD lesion with apparent healing effects ($p<0.05$). Significant result also was achieved in the reduction of prevalence rate of PDD in herds by 6-8%.

Application of the presented treatment protocol periodically among the herd will display the effect of the PHE solution in thorough minimizing the disease. Dose and duration of application are important to a successful outcome with topical spray treatments. Failures to apply an effective concentration of drug and for a sufficient period of time are believed to be major causes of reduced efficacy under field conditions (Shearer and Hernandez, 2000). The studies performed was indicative of the positive effect of PHE solution in reducing the outbreak of the disease along with decrease of recurrence, especially when there exists a serious fight with the disease among the herd and it is generally controlled and its application can be considered in hygienic protocols (Mason *et al*., 2004).

It should be noted that the solution can be a suitable alternative for walk through foot bathing which is done through applying formalin 5% and copper sulfate 3% in most of Iran's husbandries. Formalin threatens the health of the farm's personnel in the long run since it is toxic and 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 that and in comparison with formalin twice stronger (Mason *et al*., 2004).

Application of PHE as spray is preferable to footbath application because spray application in comparison with formalin is cheaper and potentially has less risk for drug inactivation in confront with organic materials. On the other hand, at topical spray application sufficient concentration of drug reach to lesion because of direct contact between drug and lesion. Nonantibiotic formulations for treatment offer reduced risk of antibiotic residue in milk or meat from treated cows (Shearer and Elliott, 1994; Britt *et al*., 1996).

CONCLUSION

From the results of this farm study, it is concluded that the application of Provita Hoofsure Endurance alleviates lameness significantly at the herd or the cow level when control program of papillomatous digital dermatitis is monitored.

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