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Effectiveness of different regimens of a collective topical treatment using a solution of copper and zinc chelates in the cure of digital dermatitis in dairy farms under field conditions

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ABSTRACT

A controlled field trial was conducted to evaluate in dairy cattle the benefit provided by different regimens of a collective topical treatment using a solution of copper and zinc chelates to cure digital dermatitis (DD) compared with individual treatment alone, and further to investigate factors that could explain variations in the clinical cure of DD lesions over 6 mo. The study was conducted between November 2009 and October 2010 and involved 4,677 dairy cows from 52 French dairy farms on which DD was endemic. The farms were quasi-randomly allocated to 1 of 4 treatment regimens for 6 mo: no collective treatment (control), walk-through footbath during 4 consecutive milkings every 4 wk (FB/4W) or every 2 wk (FB/2W) and collective spraying during 2 milkings every 2 wk (CS/2W). For ethical and welfare reasons, all farmers also had to treat all detected active DD lesions with individual topical spraying of oxytetracycline. Digital dermatitis and leg hygiene were scored on all lactating cows during milking 7 times every 4 wk by 14 trained investigators. During these farm visits, data related to farm management were also collected. The curative effectiveness of collective treatments was assessed through a Cox survival frailty model as the probability of cure of an active DD lesion during at least 2 consecutive visits. The model was adjusted for farm and cow risk factors as well as initial DD prevalence. Monthly DD cure rates were 58, 55, 76, and 76% in the control, FB/4W, FB/2W, and CS/2W regimens, respectively. The spontaneous monthly cure rate for untreated active DD lesions was 61%. Hazard of cure of DD was increased by 1.28 and 1.41 when walk-through footbath and collective spraying, respectively, were applied over 2 d every 2 wk compared with the control regimen. Applying a walk-through footbath 2 d every 4 wk was not sufficient to improve the cure of DD compared with individual treatments alone. Three main factors were identified as speeding DD healing: cleanliness of the feet, initial small size of the DD lesion, and additional individual topical treatment. Grazing tended to speed DD healing. These results highlight the need of combining several control measures, including individual and collective topical treatments, and improving foot hygiene and the early detection of DD lesions to ensure a high cure rate and rapid curing of digital dermatitis on endemically affected farms.

Key words: dairy cow, digital dermatitis, topical treatment, field trial

INTRODUCTION

Digital dermatitis (**DD**) is a widespread, contagious foot disease of dairy cows currently reported as endemic in almost all countries where cows are housed (Berry et al., 2004; Logue, 2011). It is manifested by circumscribed lesions on the skin of the foot, mostly between the heels of the hind foot (Read and Walker, 1998; Laven, 1999). Once introduced into a herd, mainly through the purchase of an infected cow, the infection may spread to the entire herd if the environment of the feet weakens the digital skin (Rodriguez-Lainz et al., 1996; Wells et al., 1999). Digital dermatitis is a serious issue for many dairy farmers as it can be very painful and cause lameness for their cows, thereby negatively affecting welfare and production (Losinger, 2006; Bruijnis et al., 2010; Green et al., 2010). Moreover, the prevalence of the disease has increased, affecting between 5 and 30% of cows in most affected herds (Somers et al., 2003; Holzhauer et al., 2006) with only anecdotal reports of eradication (Yeruham and Perl, 1998).

Whereas collective topical treatments have been used widely to control DD, particularly in large herds and in herds with a high proportion of affected cows, none

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meet all of the following requirements: safe for the user, cow, and environment; proven effectiveness in controlling DD over the long-term; and easy to implement on farms with different housing systems.

Walk-through footbaths containing antibiotics, formalin, or copper sulfate have been reported to successfully control digital dermatitis in clinical trials and anecdotal reports (Laven and Proven, 2000; Laven and Hunt, 2002a). Nevertheless these products have been abandoned progressively in European countries and are no longer recommended in footbaths for several reasons: antibiotics are not licensed for footbath use in the European Union, antibiotic resistance may develop (Shearer and Hernandez, 2000), formalin is carcinogenic (IARC, 2004), and the concentration of copper sulfate may reach a toxic threshold for plants and aquatic organisms when waste footbath solutions disposed into slurry are repeatedly spread over the soil (Stehouwer and Roth, 2004). Many alternative hoof-care products containing less toxic disinfectants have been developed over the past few years but science-based evidence regarding their effectiveness is scarce (Laven and Logue, 2006; Thomsen et al., 2008a; Speijers et al., 2010).

As walk-through footbaths are not always easy to implement in the field and some farmers are reluctant to use them (Auzanneau, 2009), a few alternative ways of applying collective treatments have been commercialised. However, again, few data are available on their effectiveness. Foam containing peracetic acid is available but field trial results showed inconsistent effectiveness in controlling DD (Journel and Carteron, 2001; Fiedler, 2004). Some hoof-care products are recommended not only for footbaths but also for collective spraying. However, to our knowledge, no investigation has tested the effectiveness of any of these products when applied through collective spraying to cure or prevent DD.

Finally, one of the major concerns when using a collective topical treatment to control DD is the lack of data on the best treatment strategy for a given farm regardless of the product used (Laven, 2003): it is not clear if collective topical treatments could be used to prevent DD, cure DD, or both, and consensus on the optimum frequency is lacking. For example, various frequencies for the application of copper sulfate have been tested, ranging from a daily application over 7 d (Laven and Hunt, 2002b) to 1 application every 2 wk (Speijers et al., 2010). Moreover, although several management practices are known to contribute to a higher risk of DD and may play a role in the cure of DD lesions (Rodriguez-Lainz et al., 1999; Somers et al., 2005; Holzhauer et al., 2006), clinical trials of hoof-care products rarely take management practices into account. These practices nevertheless may explain variations in effectiveness of similar treatment regimens assessed in different trials (Laven and Logue, 2006).

The purpose of our study was thus 2-fold: (1) to evaluate the potential benefit of using a collective treatment in addition to individual treatments in the cure of DD, varying the manner and frequency of applying a solution of copper and zinc chelates, and (2) to identify management practices that may affect the clinical cure of DD lesions.

MATERIALS AND METHODS

The trial was designed to be a quasi-randomized, multi-arm, multi-site, controlled but not blinded, field trial. All procedures were carried out under the agreement of the Ethics Committee for Animal Experimentation of Pays de la Loire (CEEA, France). This trial is reported following the REFLECT and CONSORT recommendations (Moher et al., 2010; O'Connor et al., 2010).

Animals and Management Practices

The trial was conducted on 52 dairy farms located in Brittany and Pays-de-la-Loire, France, from November 2009 to October 2010. The number of farms included was determined by convenience criteria as the maximum number that could be followed, to implement the trial on farms with management practices as varied as possible. The farms were recruited through professional hoof-trimmers, veterinarians, and technicians from the animal health service and milk recording scheme. Farms had to meet the following requirements: (1) have experienced DD for over 2 yr (endemic situation) and (2) milk their cows in a milking parlor (location for DD scoring and DD treatments). As far as possible, farmers had to participate in the national milk recording scheme. Of the 52 farms included in the trial, one did not have any milk records. All cows in lactation during the trial were included in the study.

Most animals were housed in cubicles with solid concrete floors that were automatically or tractor scraped. On 2 farms, the floor was cleaned by manure flushing and 4 farms had slatted floors. The cows were housed in straw yards on 7 farms, mostly with solid concrete floors, that were scraped by tractor (5 farms); 1 farm had a dirt floor. On most farms, cows had access to pasture in the spring. However, some farms (n = 6) housed their cows indoors year round. The farmers included in the study milked, on average, 70 cows (range from 29 to 129 cows) twice daily. More than 80% of the cows were Prim'Holstein. Three farms had only Normande and 2 farms had half Prim'Holstein and half Normande breeds. On average, the 305-d cow milk