

# Evaluating Efficiency of Footbaths for Prevention of Claw Disease and Lameness on an Israeli Dairy Farm

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## ABSTRACT

Footbaths containing various active compounds are commonly used on Israeli dairy farms to control infectious claw diseases. This study objective was to examine the efficiency of a split footbath containing copper-sulfate in preventing claw lesions and lameness. The split footbath contained: 5% copper sulfate solution on the right hand side and was empty on the left hand side (as a negative control). The footbath protocol was as follows: all the milking cows were walked through a footbath once a day, during three consecutive days, once a month. The solution was replaced with a fresh solution after every 100 cows. The study was conducted on a large commercial dairy farm experiencing claw lesions predominantly due to digital dermatitis and interdigital dermatitis. The prevalence of claw lesions due to infectious claw diseases was evaluated on four consecutive trimming sessions, 2-4 mounts apart. The results of the first trimming session at the beginning of the study, before the footbath treatment were; 10.2% lesion on the right claws, and 28.6% lesion on the left claws ( $p=0.06$ ). All others trimming were done during the footbath treatment period. From the data collected, we concluded that footbaths containing 5% copper sulfate solution used once a day during three consecutive days, once a month had no curative or preventive effect on the development of infectious claw lesions. We concluded that further research as well as the development of efficient protocols are necessary, using environmental-friendly solutions for use in footbath, for the treatment and prevention of claw lesions on Israeli dairy farms.

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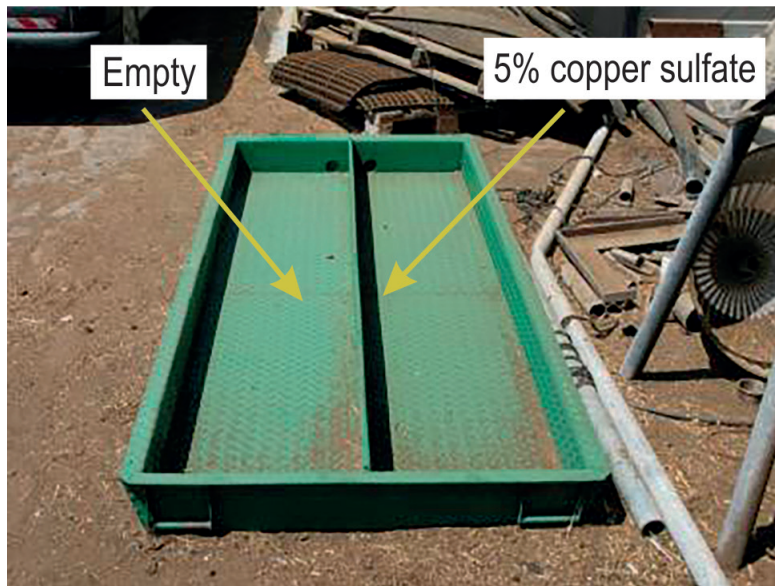
**Keywords:** Claw Disease; Lameness; Footbath; Trimming; Dermatitis Digitalis; Dermatitis Interdigitalis.

## INTRODUCTION

Lameness and claw disease in dairy cattle are a major concern of animal health and welfare and cause considerable economic loss due to reduced milk production, impaired reproduction, additional labor and treatment costs, as well as prevention program costs (1, 2, 3, 4). In a previous study the authors concluded that lameness caused a significant decrease in milk production as early as 15 days prior to the detection of the cow's lameness (4). The average milk loss due to a single event of lameness, regardless of its severity,

was 112Kg. These data substantiate the great importance of efficient prevention of claw disease in dairy cattle.

Footbaths containing various active ingredient solutions are commonly used worldwide as well as in Israel (5), for treatment and prevention of infectious claw disease. As consultants in the field of claw health in "Hachaklait" Veterinary Services, the authors of this paper have encountered many cases of improper and inappropriate use of footbaths on farms throughout Israel, often due to the use of unsuitable chemical compounds or improper application of the footbath



**Figure 1:** split footbath

treatment. Peer reviewed literature on the subject of footbaths is scarce, and is mostly limited to studies done on a small number of animals, often without or with an inadequate control group (5). Therefore, the efficacy of footbaths in preventing lameness and claw lesions is still a subject of controversy (6, 7, 8).

Since inappropriate use of footbaths can increase the prevalence and incidence of claw disease and lameness in a herd and since footbath applications are relatively expensive, well-designed studies with the aim of assessing the efficiency of footbaths in the prevention and treatment of claw disease are beneficial.

## MATERIALS AND METHODS

The study was designed as a negative-controlled clinical field trial model. On a large commercial dairy farm enduring claw lesions predominantly due to digital dermatitis and interdigital dermatitis, we used a split footbath (Figure 1). The dimensions of the footbath were: 2.5m long, 1m wide and 15cm deep, filled with 10cm deep solution. One side of the footbath (right) was filled with a 5% solution of copper sulfate while the other side remained empty. In this way, the cattle, while walking through the footbath, had the right claws submerged in a footbath solution while the left claws remained untreated (control). Copper-Sulfate is a disinfectant with bacteriostatic properties commonly used

in dairy farms. The  $\text{Cu}^{++}$  binds and inactivates the thiol groups in microorganisms (9). The herd was trimmed by a professional claw trimmer (trained by one of the authors, M.v.S) between the 13th to 20th December 2009. Thereafter, the herd was trimmed every 2 to 4 months by the same claw trimmer (specific dates: 4/2010, 6/2010, 9/2010). During these trimming sessions, all lesions and cow details were recorded. The trimmer was unaware of which side had been treated and which side served as control. Recorded data included the trimming date, cow identification number, leg with lesion and lesion type. The data was collected on a dataset using EpiData 3.1 (10). Treatment with footbaths was initiated approximately one week after the initial trimming.

**Footbath protocol:** All the milking cows on the farm were led through a footbath once a day during three consecutive days, once every month. The solution was replaced with fresh solution after every 100 cow passages. The footbath was located at the exit of the milking parlor. This protocol was repeated every month until the end of the year.

**Statistical Analysis:** The main outcome variable of this study was claw lesion prevalence at each trimming session. Lesions prevalence in the right claws were compared with that in left claws. The statistical analysis was performed using SAS 9.2 software (11). Differences in claw lesion prevalence between right and left claws were evaluated using the McNemar test for paired observations. The McNemar test is a chi-squared test based on the numbers discordant pairs in a two by two table. It is appropriate when the sample in question is non-independent. The statistic was calculated as follows:

$$\chi_{\text{paired}}^2 = \frac{(|b_1 - b_2| - 0.5)^2}{b_1 - b_2}$$

where  $b_1$  and  $b_2$  are the number of discordant pairs in a two by two table, respectively. The statistic has a  $\chi^2$  distribution with one degree of freedom.

## RESULTS

Lesions encountered during trimming are presented in table 1. The number represents the sum of cases of each lesion that

**Table 1:** Claw lesions by trimming:

Diagnosis	1 <sup>st</sup> trimming		2 <sup>nd</sup> trimming		3 <sup>rd</sup> trimming		4 <sup>th</sup> trimming	
<b>Front limb</b>								
	Left (n=11)	Right (n=7)	Left (n=31)	Right (n=29)	Left (n=6)	Right (n=3)	Left (n=35)	Right (n=32)
Digital dermatitis	3	2	3	5	0	1	1	4
Interdigital dermatitis	7	4	30	23	1	1	28	24
Double sole	3	3	0	1	5	1	9	4
Solar ulcer	0	1	0	0	2	1	1	0
Tyloma	0	0	0	0	0	0	0	1
<b>Total (lesions)</b>	<b>13</b>	<b>10</b>	<b>33</b>	<b>29</b>	<b>8</b>	<b>4</b>	<b>39</b>	<b>33</b>
<b>Hind limb</b>								
	Left (n=28)	Right (n=22)	Left (n=72)	Right (n=73)	Left (n=19)	Right (n=28)	Left (n=59)	Right (n=69)
Digital dermatitis	15	10	38	38	12	12	22	22
Interdigital dermatitis	6	6	35	36	2	3	35	34
Double sole	6	6	1	2	1	8	10	18
Solar ulcer	9	3	2	3	4	10	3	8
Tyloma	1	2	2	1	0	0	2	1
Solar hemorrhage	1	3	0	0	0	2	0	0
<b>Total (lesions)</b>	<b>37</b>	<b>30</b>	<b>78</b>	<b>80</b>	<b>19</b>	<b>35</b>	<b>72</b>	<b>83</b>

**Table 2:** Infectious claw diseases from all four trimmings.

Diagnosis	1 <sup>st</sup> trimming		2 <sup>nd</sup> trimming		3 <sup>rd</sup> trimming		4 <sup>th</sup> trimming	
<b>Front limb</b>								
	Left	Right	Left	Right	Left	Right	Left	Right
Digital dermatitis	3	2	3	5	0	1	1	4
Interdigital dermatitis	7	4	30	23	1	1	28	24
<b>Total (lesions)</b>	<b>10</b>	<b>6</b>	<b>33</b>	<b>28</b>	<b>1</b>	<b>2</b>	<b>29</b>	<b>28</b>
<b>Hind limb</b>								
	Left	Right	Left	Right	Left	Right	Left	Right
Digital dermatitis	15	10	38	38	12	12	22	22
Interdigital dermatitis	6	6	35	36	2	3	35	34
<b>Total (lesions)</b>	<b>21</b>	<b>16</b>	<b>73</b>	<b>74</b>	<b>14</b>	<b>15</b>	<b>57</b>	<b>56</b>
<b>Prevalence (100 legs)</b>	<b>2.8</b>		<b>11.3</b>		<b>1.7</b>		<b>9.1</b>	

were detected. Among the claw lesions encountered during trimming sessions on this farm, lesions with an infectious background (dermatitis digitalis and dermatitis interdigitalis) were the most common. The most common infectious claw lesion on this farm was digital dermatitis. The most common non-infectious claw lesion was a double sole.

Since footbaths are predominantly designed to treat and prevent infectious claw diseases, in Table 2 only infectious diseases are represented for all four trimming sessions.

To determine whether there was a statistically significant difference between lesion prevalence in the right claws and

lesion prevalence in the left claws the data were edited to a 2X2 table (Table 3) appropriate for analysis using the McNemar test.

To examine whether the footbaths had any preventive effect on infectious claw disease, similar tables were designed for each trimming session (second, third, fourth).

## DISCUSSION AND CONCLUSIONS

Studies with footbaths have been carried in many countries, using different solutions and different protocols for the treat-

**Table 3:** McNemar test for infectious claw lesions at the first trimming (before using footbath):McNemar:  $P=0.06$ 

		Left		
Right	Yes	No	Sum	
No	14	26	04	
	28.57	53.06		
Yes	4	5	9	
	8.16	10.2		
Sum	18	31	09	

First trimming (December 2009) 464 cows were trimmed.

**Table 4:** McNemar test for infectious claw lesions at the second trimmingMcNemar:  $P=0.68$ 

		Left		
Right	Yes	No	Sum	
No	46	7	35	
	34.59	5.26		
Yes	39	41	04	
	29.32	30.83		
Sum	85	48	355	

Second trimming (April 2010) 460 cows were trimmed.

ment and prevention of infectious claw diseases (5, 6, 7, 8). Peer-reviewed literature on the subject of footbaths is scarce and is mostly limited to studies done on a small number of animals, often without, or with an inadequate, control group. For this reason, the investigators have tried to find effective protocols based on peer reviewed studies. The objective of this study was to examine the efficiency of the common used protocol in Israeli dairy farm, a monthly session of footbath containing 5% copper sulfate solution, used once daily during three consecutive days, for the treatment and prevention of infectious claw lesions.

The difference in claw lesion prevalence between right and left claws found in the first trimming session (Table 3) was of borderline statistically significant:  $p=0.06$ . These results were dubious since we assumed that the distribution of lesion between left and right claws prior to the application of footbaths would be similar.

In all other trimming sessions, no difference was found in the prevalence of claw lesions in the right or left claws, indicating no association between foot bathing as used in this study and the likelihood to develop infectious claw le-

**Table 5:** McNemar test for infectious claw lesions at the third trimmingMcNemar:  $P=0.84$ 

		Left		
Right	Yes	No	Sum	
No	11	20	53	
		42.55		
Yes	3	13	31	
		27.66		
Sum	14	33	04	

Third trimming (June 2010) 475 cows were trimmed.

**Table 6:** McNemar test for infectious claw lesions at the fourth trimmingMcNemar:  $P=1.00$ 

		Left		
Right	Yes	No	Sum	
No	29	19	00	
	25.66	16.81		
Yes	37	28	13	
	32.74	24.78		
Sum	66	47	335	

Forth trimming (September 2010) 467 cows were trimmed.

sions. We concluded that footbaths containing 5% copper sulfate solution used once a day during three consecutive days, once every month had no preventive effect on the development of claw lesions. We assumed that these results were due to a low frequency of the footbath treatment sessions. It is possible that more frequent treatments with 5% copper sulfate, treated several days each week, may have improved the results. We do recommend carrying out additional studies of footbath with 5% copper sulfur solution with treatment protocol of two days per week, every week to examine whether the results will improve.

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#### REFERENCES

- Collick, D.W., Ward, W.R. and Dobson, H.: Associations between types of lameness and fertility. *Vet. Rec.* 125: 103-106, 1989.
- Hernandez, J., Shearer, J.K. and Webb, D.W.: Effect of lameness

- on the calving-to-conception interval in dairy cows. *JAVMA* 218: 1611-1614, 2001.
3. Green, L.E., Hedges, V.J., Schukken, Y.H., Blowey, R.W. and Packington, A.J.: The impact of clinical lameness on the milk yield of dairy cows. *J. Dairy Sci.* 85: 2250-2256, 2002.
  4. Van Straten, M. and Bruckstein, S.: Estimating the effect of lameness on production and reproduction parameters in four commercial dairy farms in Israel. XXIVth World Buiatrics Congress (WBC), October 15-19, Nice, 2006, France (Poster).
  5. Laven, R.A. and Logue, D.N.: Treatment strategies for digital dermatitis for the UK. *Vet. J.* 171 79-88, 2006.
  6. Arkins, S., Hannan, J. and Sherington, J.: Effects of formalin footbathing on foot disease and claw quality in dairy cows. *Vet. Rec.* 118: 580-583, 1986.
  7. Janowicz, P., Bathina, H., Hemling, T. and Blowey, R.: The effect of different footbath solutions on hoof health. 14<sup>th</sup> Int. Symposium and 16<sup>th</sup> Conference on lameness in ruminants. Uruguay, 8-11 Nov. 2006.
  8. Thomsen, P.T., Sørensen, J.T. and Ersbøll, A.K.: Evaluation of three commercial hoof-care products used in footbaths in Danish dairy herds. *J. Dairy Sci.* 91: 1361-1365, 2008.
  9. Epperson, B. and Midla, L.: Department of veterinary preventive medicine. The Ohio state university (2007). Copper sulfate for footbaths – Issues and alternatives. Tri-state dairy nutrition conference, April 24-25, 2007.
  10. Lauritsen, J.M. and Bruus, M.: EpiData (version 3). A comprehensive tool for validated entry and documentation of data. The EpiData Association, Odense Denmark, 2003-2004.
  11. SAS Institute. 2006. User's Guide Version 9.1: Statistics. SAS Institute, Cary, NC.