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Universidade Estadual Paulista “Júlio de Mesquita Filho”
Faculdade de Medicina Veterinária e Zootecnia

**HOOF CARE® AS PREVENTION AND TREATMENT OF DIGITAL
DERMATITIS IN DAIRY COWS**

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Botucatu, SP
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Universidade Estadual Paulista “Júlio de Mesquita Filho”
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**HOOF CARE® AS PREVENTION AND TREATMENT OF DIGITAL
DERMATITIS IN DAIRY COWS**

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Program in Animal Biotechnology to
obtain the title of DOCTOR

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Dedictory

I dedicate this thesis to my parents José Paulo Mendonça and Sueli Souza Abreu Mendonça, to my brother Paulo Roberto Abreu Mendonça, and to my husband Rodrigo Augusto de Oliveira, who were with me throughout the journey.

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*“Whatever the human mind can conceive and believe, it
can achieve.”*

Napoleon Hill

ABSTRACT

MENDONÇA, A.P. **HOOF CARE® AS PREVENTION AND TREATMENT OF DIGITAL DERMATITIS IN DAIRY COWS.** Botucatu – SP. 2025. 89p. Defense (Doctorate) - Faculdade de Medicina Veterinária e Zootecnia, Campus Botucatu, Universidade Estadual Paulista.

Digital dermatitis (DD) is an infectious disease of polymicrobial origin that is considered endemic in dairy herds worldwide. Responsible for compromising animal welfare and productivity, it represents a significant obstacle for cattle farming. Treatment usually involves antibiotic therapy, and the main preventive measure is the use of footbaths. However, in Brazil, information on the effectiveness of footbath protocols under local climatic and management conditions is scarce. Therefore, this study aimed to determine the efficacy of a footbath protocol with the commercial product HoofCare®, alone or in combination with brushing, for the treatment, prevention, and control of DD lesions in dairy cows. The study was conducted in two phases on a commercial farm in Brazil. The first phase involved only the 360 most productive cows in the herd, while the second phase included the entire lactating herd, estimated at more than 2,200 Holstein cows. A pilot study was conducted to analyze the pH of the footbath solution, determine the appropriate number of cow passages and establish the frequency of solution replacement for each phase. In the first phase, the objective was to evaluate the potential of the solution to control, prevent, and treat DD lesions with the implementation of an intensive protocol: five times a week, once a day, for 60 consecutive days. Four periodic inspections were performed during morning milking to record hind limbs with and without lesions, as well as classify lesions according to the M-stage system. Given the partial success in controlling and preventing DD lesions with the persistence of active lesions, a maintenance protocol was applied in the second phase: three times a week, once daily, for 15 weeks, combined with brushing of active lesions with the same product on alternate days. Inspections and lesion classifications followed the same protocol as in the first phase. Preventive and curative efficacy was determined by comparing DD prevalence and final lesion outcomes in the herd before and after implementation of the protocol. Observing a considerable regression of active lesions 30 days after starting the protocol, it was decided to continue only with the footbath protocol, providing individual treatment in the hoof trimming chute only when necessary or during preventive hoof trimming. Comparison of DD prevalence and incidence throughout the experiment demonstrated a decrease in both. The 104-day protocol in phase 2 promoted a reduction in DD prevalence from 49.85% to 17.17% and incidence from 20.91% to 2.99%, with a significant reduction in active lesions (3.95%). It is concluded that the 10% HoofCare® footbath protocol, combined with brushing of active lesions, is an effective strategy for controlling, preventing, and treating DD in commercial dairy herds under Brazilian conditions.

Keywords: bovine digital dermatitis, footbath protocol, prevention of foot disease, lameness, animal welfare.

RESUMO

MENDONÇA, A.P.A. **HOOF CARE® COMO PREVENÇÃO E TRATAMENTO DA DERMATITE DIGITAL EM VACAS LEITEIRAS**. Botucatu – SP. 2025. 89p. Defesa (Doutorado) – Faculdade de Medicina Veterinária e Zootecnia, Campus Botucatu, Universidade Estadual Paulista.

A dermatite digital (DD) é uma doença infecciosa de origem polimicrobiana e considerada endêmica em rebanhos leiteiros à nível mundial. Responsável por comprometer o bem-estar e a produtividade animal, representa um grande entrave para a bovinocultura. O tratamento da DD comumente envolve antibioticoterapia, e o uso de pedilúvio de passagem é a principal medida preventiva. No entanto, no Brasil, são escassas as informações sobre a eficácia de protocolos de pedilúvio sob condições climáticas e de manejo locais. Portanto, este estudo objetivou-se determinar a eficácia do protocolo de pedilúvio com o produto comercial HoofCare®, isoladamente ou associado ao pincelamento no tratamento, prevenção e controle de lesões de DD em vacas leiteiras. A pesquisa foi realizada em duas fases em uma fazenda comercial do Brasil, com a primeira fase envolvendo apenas as 360 vacas mais produtivas do rebanho, e a segunda fase abrangendo todo o rebanho lactante estimado em mais de 2.200 vacas da raça Holandesa. Realizou-se um estudo piloto para analisar o pH da solução do pedilúvio, definir o número adequado de passagens e a frequência de trocas de solução para cada fase. Na primeira fase, o objetivo foi avaliar o potencial da solução em controlar, prevenir e tratar as lesões de DD com a implementação de um protocolo intensivo: cinco vezes por semana, uma vez ao dia, por 60 dias consecutivos. Quatro inspeções periódicas foram realizadas durante a ordenha matinal para registrar os membros posteriores com lesões, bem como classificar as lesões de acordo com o sistema de pontuação M-stage. Dado o sucesso parcial em controlar e prevenir as lesões de DD com a persistência das lesões ativas, um protocolo de manutenção foi aplicado na segunda fase: três vezes por semana, uma vez ao dia, por 15 semanas, associado ao pincelamento das lesões ativas com o mesmo produto em dias alternados. As inspeções e classificações das lesões seguiram o mesmo protocolo da primeira fase. A eficácia preventiva e curativa foi determinada pela comparação da prevalência de DD, bem como o desfecho final das lesões no rebanho antes e após a implementação do protocolo. Ao observar uma regressão considerável das lesões ativas 30 dias após o início do protocolo, optou-se por continuar apenas com o protocolo de pedilúvio, realizando o tratamento individual no tronco de casqueamento somente quando necessário ou durante o casqueamento preventivo. A comparação da prevalência e incidência da DD ao longo do experimento demonstrou ambas reduziram. O protocolo de 104 dias da fase 2 promoveu uma redução na prevalência de DD de 49,85% para 17,17%, e na incidência de 20,91% para 2,99 %, com redução significativa de lesões ativas (3,95%). Conclui-se que o protocolo de pedilúvio com HoofCare® 10% associado ao pincelamento é uma estratégia eficaz para o controle, prevenção e tratamento da DD em rebanhos comerciais nas condições brasileiras.

Palavras-chave: dermatite digital bovina, protocolo de pedilúvio, prevenção de doença podal, claudicação, bem-estar animal.

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LIST OF ABBREVIATIONS AND SYMBOLS

ABBREVIATIONS

D. nodosus: *Dichelobacter nodosus*

DD: digital dermatitis

DIM: days in milk

e.g.: for example

IQR: interquartile range

OM: organic matter

ROS: reactive oxygen species

SCC: somatic cell count

TTO: Tea tree oil

W.: week

SYMBOLS

~: approximately

US\$: American dollar

%: percentage

SUMMARY

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CHAPTER 1

1. INTRODUCTION AND JUSTIFICATION

Cattle farming is responsible for a large part of the Brazilian economy, with an estimated herd of 238.63 million heads (IBGE, 2023), making Brazil the largest commercial cattle producer worldwide. Lameness is a major welfare issue in modern dairy production (THOMSEN; SHEARER; HOUE, 2023) with significant productive and economic impacts (NUFFEL et al., 2015; ZHANG et al., 2015). It is estimated that 98% of lameness cases in cattle originate from foot problems (NICOLETTI, 2004), with digital dermatitis being one of the main causes in dairy cows (PALMER; O'CONNELL, 2015; MOREIRA et al., 2018b), resulting in losses estimated at US\$ 132.96 per clinical case (CHA et al., 2010).

Digital dermatitis (DD) is highly contagious, painful, and widespread, ranking among the most prevalent foot diseases in dairy herds globally, with reports ranging from 3.32% at cow-level (AHMED; SHEKIDEF, 2012) to 83% (HOLZHAUER et al., 2006). It is considered endemic in confinement systems (WILSON-WELDER; ALT; NALLY, 2015; MOREIRA et al., 2018a) and is difficult to eradicate due to its multifactorial etiology (PALMER; O'CONNELL, 2015). Given its polybacterial origin (MOREIRA et al., 2018a), treatment generally involves antimicrobials. However, due to antibiotic use restrictions in cattle farming, the rise of antimicrobial resistance, and increasing concerns about organic production and animal welfare (SHEARER; HERNANDEZ, 2000; CRAMER; SOLANO; JOHSON, 2019), alternative antibiotic-free treatments are needed.

Several alternative substances are being investigated for DD treatment (KLAWITTER et al., 2019; BOMJARDIM et al., 2020; PAUDYAL et al., 2020). In addition, as an infectious disease of livestock, preventive measures are essential, with footbaths being the most widely used and effective strategy (EVANS; MURRAY; CARTER, 2016; JACOBS et al., 2019). Although copper sulfate and formaldehyde remain the most used footbaths compounds, both have limitations in efficacy and varying degrees of toxicity to the environment, animals, and handlers. Several commercial products are for use in footbaths in Brazil, among which HoofCare® stands out. This product, formulated with citric acid, tea tree essential oil, copper citrate and zinc chloride, has shown promising results for DD treatment when applied by brushing (MENDONÇA et al., 2024) and preventive

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Conflict of interest statement. - The authors declare that there are no conflicts of interest.

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