VETERINARSKI ARHIV 92 (1), 37-44, 2022 DOI: 10.24099/vet.arhiv.1048

Critical points assessment of hoof lesion manifestation in dairy cows: a preliminary study of a new scoring system

Luca Turini[1,2], Alessio Madrigali[1], Micaela Sgorbini[1,2], Chiara Orsetti[1]*, Awad Rizk[3], and Francesca Bonelli[1,2]

[1]Department of Veterinary Sciences, University of Pisa, Italy

[2]Centro di Ricerche Agro-Ambientali "E. Avanzi", University of Pisa, Italy

[3]Department of Surgery, Anesthesiology and Radiology, Faculty of Veterinary Medicine, Mansoura University, Egypt

TURINI, L., A. MADRIGALI, M. SGORBINI, C. ORSETTI, A. RIZK, F. BONELLI: Critical points assessment of hoof lesion manifestation in dairy cows: a preliminary study of a new scoring system. Vet. arhiv 92, 37-44, 2022.

ABSTRACT

Lameness is a serious animal welfare and production issue in the modern dairy herds. The development of a scoring system that is able to categorize the farm on the basis of its hazard risk level may help clinicians and farmers to identify potential issues and to reduce costs caused by lameness. The aim of this study was to develop an easy and fast score for evaluation of the structural and managerial factors potentially involved in the pathogenesis of foot lesions, and categorization of dairy farms. A total of six free-stall dairy farms were evaluated during a 3 month-period. The score developed in this study was composed of evaluation of the housing system, flooring, the farm design, the use of footbaths, the frequency of hoof trimming, and the continuing education of the employers. For each parameter, a score of 0 to 2 was assigned where the score 0 meant the least appropriate condition, the score 2 represented the best. The Farm Score showed a significant correlation with foot lesion prevalence (P = 0.0011, R2 0.94) and with the theoretical assessment of additional cost per animal (P = 0.001, R2 0.95). The significant correlation between the Farm Score, the foot lesion prevalence and the theoretical assessment of additional costs per animal may underline the potential usefulness of the score designed in this study. The Farm Score may be considered as a cheap and fast way to evaluate the hazard risk level for claw health on a dairy farm.

Key words: dairy cow; hoof lesion; lameness; scoring system; structural and managerial factors

Introduction

Lameness is a serious animal welfare and production issue in modern dairy herds. The literature shows that 4.5 to 30% of lactating dairy cows present with foot lesions and/or clinical lameness (OFFER et al., 2000). Lameness compromises the welfare of the affected animals (WHAY et al., 2003) and may result in reduced milk production (WARNICK et al., 2001) and body condition (COOK, 2004), decreased fertility, increased veterinary costs and the risk of premature culling (GARBARINO et al., 2004).

The interaction between lameness and herd-level risk factors is complex and few studies have investigated it. In particular, stall features (ESPEJO

*Corresponding author:
Chiara Orsetti, Viale delle piagge 2, Pisa, Italy, E-mail: chiara.orsetti@gmail.com

and ENDRES, 2007), lying surface (ITO et al., 2010), time spent away from the pen for milking (ESPEJO and ENDRES, 2007), the use of automatic alley scrapers (BARKER et al., 2007), and hoof trimming practices (ESPEJO and ENDRES, 2007) have been studied as factors associated with lameness in dairy cows. Most commonly, the hazard risk analysis concerning lameness at herd-level is based on observation of prolonged standing on hard surfaces, poor-quality standing and walking surfaces, concussive and shearing forces, foot conformation and claw function, poor-quality and/or less resilient claw horns, inadequate digital cushion function, environmental hygiene, routine foot trimming, penning times, cow flow at milking and other times, and walking surfaces (HUXLEY et al., 2012). The assessment of these items is time consuming and poorly manageable in field conditions. The development of a scoring system that is able to categorize the farm on the basis of its hazard risk level might help clinicians and farmers to identify potential issues, and to reduce costs caused by lameness.

The aim of this study was to develop an easy scoring system for evaluation of the structural and managerial factors potentially involved in the pathogenesis of foot lesions, and for the categorization of dairy farms.

Materials and methods

The dairy farms involved in the study were randomly selected from the farms managed by the same nutritionist in the north of Italy. A total of six free-stall dairy farms (A, B, C, D, E, F) under intensive management conditions were evaluated by two expert operators (TS, VR) over a 3 month-period.

Dairy farm "A" comprised 120 lactating cows, farm "B" 397 lactating cows, farm "C" 175 lactating cows, farm "D" 237 lactating animals, farm "E" 178 lactating cows, and farm "F" 1200 lactating animals. The cows were of the Italian Holstein Friesian breed. All the animals were fed with a total mixed ration (TMR) using a similar formulation.

All the visits were scheduled and performed on the basis of the hoof trimming plan on each farm. The evaluation was recorded on a printed chart. All the data were then digitalized into an Excel file. The score was composed of the evaluation of the housing system, flooring, farm design, use of footbaths, frequency of hoof trimming, and the continuing education of the employers. For each parameter, a score of 0 to 2 was assigned, where the score 0 meant the least appropriate conditions, and the score 2 represented the best, while score 1 identified conditions in between. Each item on the Farm Score is presented in Table 1.

At the end of each visit, the recorded data were used to calculate an overall score for each farm called the "Farm Score". Each farm was then classified as Low Hazard Level (LHL) if it reached a Farm Score higher than 8, Medium Hazard Level (MHL) with a score between 4 and 8, and High Hazard Level (HHL) if the farm had a total score less than 4.

In the context of the farm visit, the locomotion score (LS) was also evaluated in all the lactating animals as reported in the literature (SPREECHER et al., 1997). Briefly, the cows were observed standing and walking, paying close attention to their back posture. Observations were performed with the animal on a flat and non-slippery surface that provides good footing for cows.

Finally, theoretical assessment of economic losses and additional cost per animal were evaluated. The first index was calculated using the average monetary value from those reported in theliterature for each type of hoof lesion (SPREECHER et al., 1997). The theoretical assessment of economic losses was then estimated for each farm by adding the cost of all the foot lesions diagnosed during the hoof trimming visit. Finally, the theoretical assessment of additional costs per animal was calculated for each farm, by dividing the theoretical assessment of economic losses by the number of animals on the farm.

Table 1. Parameters evaluated by the operator on each dairy farm. The maximum score that could be reached by a farm is 12 and represents a Low Hazard Level (LHL) of the Farm Score regarding lameness risk assessment.

Item	0	2
Housing system	Wet and dirty bedding (MÜLLING et al., 2006); Wet and dirty floors (MÜLLING et al., 2006); Bad quality ventilation (MONDACA, 2019); Presence of puddles (SOMERS et al., 2005).	Dry and clean bedding (MÜLLING et al., 2006); Dry and clean floors (MÜLLING et al., 2006); Adequate ventilation (MONDACA, 2019); No puddles (SOMERS et al., 2005).
Flooring	Too smooth or too abrasive surfaces (MÜLLING et al., 2006); Bad flooring condition (SOMERS et al., 2005; MÜLLING et al., 2006).	Correct degree of surface abrasiveness (MÜLLING et al., 2006); Excellent flooring condition (SOMERS et al., 2005; MÜLLING et al., 2006).
Footbath	Absence of regular planning of footbath (HOLZHAUER et al., 2008); Absence of regular replacement of footbath content and chemicals (HOLZHAUER et al., 2008).	Constant use of footbaths (HOLZHAUER et al., 2008); Constant replacement of footbath content and chemicals (HOLZHAUER et al., 2008).
Farm design	Inadequate number of cubicles/cows (FREGONESI and LEAVER, 2002); Bad cubicle design (ESPEJO and ENDRES, 2007); Difficult access to food and/or water (MÜLLING et al., 2006); High animal density (ESPEJO and ENDRES, 2007); Presence of narrow and/or blind alleys (SOGSTAD and FJELDAAS, 2005); Presence of sharp turns (SOGSTAD and FJELDAAS, 2005).	Adequate number of cubicles (FREGONESI and LEAVER, 2002); Appropriate cubicle design and dimensions (ESPEJO and ENDRES, 2007); Wide access to food and water (MÜLLING et al., 2006); Absence of narrow and blind alleys (SOGSTAD and FJELDAAS, 2005); No sharp turns (SOGSTAD and FJELDAAS, 2005).
Continuing education	Absence of a continual education program (BERNARD, 2019); Poor quality of continual education program (BERNARD, 2019); Bad employee attitude (WAIBLINGER et al., 2002).	Qualified and alert employees (BERNARD, 2019); Presence of a continual education program for employees (BERNARD, 2019).
Hoof trimming	Absence of functional hoof trimming (ESPEJO and ENDRES, 2007).	Functional hoof trimming performed twice yearly (ESPEJO and ENDRES, 2007).

Table 2. Farm Score composed of evaluation of the housing system, flooring, use of footbaths, farm design, continual education of employees, and the frequency of hoof trimming. Each item can be scored from 0 to 2. The Farm Score was composed of the sum of the scores of all the items evaluated. Legend: Score 0 - least appropriate condition; Score 1 - intermediate condition; Score 2 - optimum condition.

	Farm					
	A	B	C	D	E	F
Housing system	0	1	0	1	1	2
Flooring	1	1	1	1	0	1
Footbath	1	2	1	0	2	2
Farm design	0	2	1	1	1	2
Continuing education	1	1	1	1	1	2
Hoof trimming	0	2	0	2	2	2
FARM SCORE	3	9	4	6	7	11

Table 3. Results of the foot lesion prevalence, average locomotion score, overall Farm Score, and theoretical assessment of additional economic costs/animal on each farm. Legend: LS – Locomotion score (SPRECHER et al., 1997).

	Foot lesion prevalence (%)	Average LS	Farm Score	Theoretical assessment of additional cost/animal
Farm A	8.30	2.7	3	9.58€
Farm B	2.50	1.5	9	2.89€
Farm C	8.60	2.1	4	9.85€
Farm D	7.20	3.2	6	8.24€
Farm E	5.60	2.8	7	6.46€
Farm F	0.75	1.8	11	0.86€

Statistical analysis. Data concerning the Farm Score, the foot lesion prevalence, the average LS, the theoretical assessment of economic losses and the additional cost/animal were evaluated for distribution using the Shapiro-Wilk normality test.

A linear regression analysis was carried out in order to verify any possible correlation between the overall Farm Score, the foot lesion prevalence, the average LS, the theoretical assessment of economic losses, and the additional costs/animal.

The significance level was set at $P<0.05$. A commercial statistical software package was used (GraphPad Prism 8, USA).

Results

The Farm Score of each farm involved in the study is reported in Table 2. Farm A showed the lowest Farm Score, followed in ascending order by farms C, D, E, B and F. The Farm Score, the foot lesion prevalence, the average LS, and the theoretical assessment of additional costs/animal on each farm are reported in Table 3.

Farms A and C were classified as HHL, farms D and E were classified as MHL, while farms B and F were included in the LHL group.

The Farm Score showed a significant correlation with the foot lesion prevalence ($P = 0.0011$, R2 0.94) and with the theoretical assessment of additional costs/animal ($P = 0.001$, R2 0.95).

Discussion

Lameness represents a serious problem in the bovine dairy industry, leading to animal welfare and production issues (WHAY et al., 2003). The interaction between lameness and herd-level risk factors is complex, and few studies have been performed on this topic. Usually, hazard risk analysis is time consuming and poorly manageable in field conditions. The goal for a scoring system is for it to be easy and fast to perform, and to allow identification of the hazard risk level for clinicians and farmers. The faster and proper diagnosis of problems causing lameness might lead to a reduction in economic losses.

Farm B and F had a very low prevalence of foot lesions, associated with a high Farm Score, thus they were included in LHL. These farms managed the prevention of foot lesions with functional hoof trimming performed twice a year, constant and rational use of footbaths, appropriate farm design, clean and dry bedding, and qualified and alert employees (BRIZZI, 1990). Farms A and C showed a higher prevalence of foot lesions (8.3% and 8.6%, respectively) and were classified as HHL (Farm Score 3 and 4, respectively). The high prevalence of foot lesions in these farms could be due to the lack of functional hoof trimming as recommended by the literature. Hoof trimming was only performed in lame cows, whereas routine claw trimming has been reported to decrease the incidence of non-infectious foot lesions (MANSKE et al., 2002a). Functional hoof trimming improves animal welfare, as it has positive effects on claw health and lameness (MANSKE et al., 2002b).

Moreover, the farms suffered from an improper farm design and poor bedding hygiene. When the claws are maintained in wet conditions, the hoof horn and the barrier of the claw skin remain intact, reducing bacteria penetration and infection (BLOWEY, 2005). Poor farm design might have a negative influence on the health of claws. Prolonged standing by cows due, for example, to overcrowding, cow ranking and lack of cubicles, is usually one of the major concerns for bovine welfare because it may directly impair foot health (GALINDO and BROOM, 2000). Restricted access to feed or water can lead to poor cow flow and to prolonged standing (BOE and FAEREVIK, 2003).

Farms D and E showed an intermediate hazard level and foot lesion prevalence. In these cases, the major faults are the absence of continuous education of the employees and the lack of footbaths. Continuous education of employees is important in order to avoid a lack of awareness of the problem of lameness, ignoring the causes of lameness, or underestimation of the severity of the issue (BELL et al., 2009). It is reported in the literature that in the United States and the United Kingdom producers may underestimate the prevalence of lameness in their herds by up to 40% compared to trained assessors (WHAY et al., 2003). Footbaths are the most common herd-level approach to control lameness due to infectious causes in intensive dairy farming (SOLANO et al., 2017).

The significant correlation between the Farm Score, the foot lesion prevalence and the theoretical assessment of additional costs per animal may underline the potential usefulness of the Farm Score designed in the present study.

Lameness and foot lesions represent a huge concern for dairy farmers, as soon as they lead to a decrease in dairy cow performance and economic losses (WILLSHIRE and BELL, 2009). The prevalence of lameness in dairy cattle ranged from 5 % to 16.5 % in northern Europe (MANSKE et al., 2002a), and may rise up to 34% in Austria, Germany (AMORY et al., 2008; RUTHERFORD et al., 2009) and up to 48% in the US (BICALHO et al., 2009). This information indicates how important claw health is for the dairy cattle industry.

The correlation between our Farm Score and the theoretical assessment of additional costs per animal might imply the possible use of the score in the field.

The lack of correlation between our score and LS may be due to possible variations in measures. Despite the fact that LS is still considered a useful and cheap way to identify lameness in cows, the authors are still concerned about its objectivity (BECKER et al., 2014). Thus, the statistical model may be influenced by less precise evaluation. The theoretical assessment of economic losses did not

relate to our Farm Score. The results of both LS and theoretical assessment of additional costs per animal may be due to the low number of farms included. Further studies are needed for a better understanding of these items.

A limitation of the present study is the low number of farms included. Enrolling a higher number of dairy farms may make it possible to include the classification with different hazard levels in the statistical models.

In conclusion, the Farm Score developed in the present study may be considered a cheap and fast way to evaluate the hazard risk level for claw health on a dairy farm. Further studies will be useful to evaluate the agreement between different operators in filling out the Farm Score.

Acknowledgements

The authors thank Dr Stefano Tarantino and Dr Riccardo Vitali for providing the farms.

References

AMORY, J. R., Z. E. BARKER, J. L. WRIGHT, S. A. MASON, R. W. BLOWEY, L. E. GREEN (2008): Associations between sole ulcer, white line disease and digital dermatitis and the milk yield of 1824 dairy cows on 30 dairy cow farms in England and Wales from February 2003–November 2004. Prev. Vet. Med. 83, 381-391.

DOI: 10.1016/j.prevetmed.2007.09.007

BARKER, Z. E., J. R. AMORY, J. L. WRIGHT, R. W. BLOWEY, L. E. GREEN (2007): Management factors associated with impaired locomotion in dairy cows in England and Wales. J. Dairy Sci. 90, 3270-3277.

DOI: 10.3168/jds.2006-176

BECKER, J., A. STEINER, S. KOHLER, A. KOLLER-BAHLER, M. WUTHRICH, M. REIST (2014): Lameness and foot lesions in Swiss dairy cows: I. Prevalence. Schweiz. Arch. Tierh. 156, 71-78.

DOI: 10.1024/0036-7281/a000553

BELL, N. J., M. J. BELL, T. G. KNOWLES, H. R. WHAY, D. C. MAIN, A. J. WEBSTER (2009): The development, implementation and testing of a lameness control programme based on HACCP principles and designed for heifers on dairy farms. Vet. J. 180, 178-188.

DOI: 10.1016/j.tvjl.2008.05.020

BERNARD, J. K. (2019): Invited Review: Dairy extension program s in the southern region: Finding novel ways to meet the needs of our producers. Appl. Anim. Sci. 35, 1-7

DOI: 10.15232/aas.2018-01781

BICALHO, R. C., V. S. MACHADO, L. S. CAİXETA (2009): Lameness in dairy cattle: A debilitating disease or a disease of debilitated cattle? A cross-sectional study of lameness prevalence and thickness of the digital cushion. J. Dairy Sci. 92, 3175-3184.

DOI: 10.3168/jds.2008-1827

BLACKIE, N., L. MACLAURIN (2019): Influence of Lameness on the Lying Behaviour of Zero-Grazed Lactating Jersey Dairy Cattle Housed in Straw Yards. Animals. 9, 829.

DOI: 10.3390/ani9100829

BLOWEY, R. (2005): Factors associated with lameness in dairy cattle. In Pract. 27, 154-162.

DOI:10.1136/inpract.27.3.154

BOE, K. E., G. FAEREVIK (2003): Grouping and social preferences in calves, heifers, and cows. Appl. Anim. Behav. Sci.; 80, 175-190.

DOI: 10.1016/s0168-1591(02)00217-4

BRIZZI, A. (1990): Il ruolo della mascalcia nel trattamento e nella prevenzione delle malattie digitali del bovino. Atti SIB 1990; X: 19. (In Italian)

COOK, N. B. (2004). Environmental and Nutritional Causes of Lameness. Proceedings of 8th Dairy Symposium of the Ontario Large Herd Operators. London, Ontario, pp. 139-144.

ESPEJO, L. A., M. I. ENDRES (2007): Herd-Level Risk Factors for Lameness in High-Producing Holstein Cows Housed in Freestall Barns. J. Dairy Sci. 90, 306-314.

DOI: 10.3168/jds.S0022-0302(07)72631-0

FREGONESI, J. A., J. D. LEAVER (2002): Influence of space allowance and milk yield level on behaviour, performance and health of dairy cows housed in strawyard and cubicle systems. Anim. Prod. Sci. 78, 245-257.

DOI: 10.1016/S0301-6226(02)00097-0

GALINDO, F., D. M. BROOM (2000) The relationships between social behaviour of dairy cows and the occurrence of lameness in three herds. Res. Vet. Sci. 69, 75-79.

DOI: 10.1053/rvsc.2000.0391

GARBARINO, E. J., J. A. HERNANDEZ, J. K. SHEARER, C. A. RISCO, W. W. THATCHER (2004): Effect of Lameness on Ovarian Activity in Postpartum Holstein Cows. J. Dairy Sci. 87, 4123-4131.

DOI: 10.3168/jds.S0022-0302(04)73555-9

HOLZHAUER, M., D. DÖPFER, J. DE BOER, G. VAN SCHAİK (2008): Effects of different intervention strategies on the incidence of papillomatous digital dermatitis in dairy cows. Vet. Rec. 162, 41–6.

DOI: 10.1136/vr.162.2.41

HUXLEY, J., S. ARCHER, N. BELL, M. BURNELL, L. GREEN, S. POTTERTON, J. READER (2012): Control of Lameness. In: Dairy Herd Health. (Green, M. ed), CABI, Oxfordshire, pp. 169-204.

ITO, K., M. A. G. VON KEYSERLINGK, S. J. LEBLANC, D. M. WEARY (2010): Lying behaviour as an indicator of lameness in dairy cows. J. Dairy Sci. 93, 3553-3560.

DOI: 10.3168/jds.2009-2951

MANSKE, T., J. HULTGREN, C. BERGSTEN (2002a): Prevalence and interrelationships of hoof lesions and lameness in Swedish dairy cows. Prev. Vet. Med. 54, 247-263.

DOI: 10.1016/s0167-5877(02)00018-1

MANSKE, T., J. HULTGREN, C. BERGSTEN (2002b): The effect of claw trimming on the hoof health of Swedish dairy cattle. Prev. Vet. Med. 54, 113-129.

DOI: 10.1016/s0167-5877

MONDACA, M. R. (2019): Ventilation systems for adult dairy cattle. Vet. Clin. North Am. Food Anim. Pract. 35, 139-156.

DOI: 10.1016/j.cvfa.2018.10.006

MÜLLİNG, C. K.W., L. GREEN, Z. BARKER, J. SCAİFE, J. AMORY, M. SPEİJERS (2006): Risk factors associated with foot lameness in dairy cattle and a suggested approach for lameness reduction. Proceedings of the 26th World Buiatric Congress, 15 October, Nice, France, vol. 24.

OFFER, J. E., D. MCNULTY, D. N. LOGUE (2000) : Observations of lameness, hoof conformation and development of lesions in dairy cattle over four lactations. Vet. Rec. 147, 105-109.

DOI: 10.1136/vr.147.4.105

RUTHERFORD, K. M. D., F. M. LANGFORD, M. C. JACK, L. SHERWOOD, A. B. LAWRENCE, M. J. HASKELL (2009): Lameness prevalence and risk factors in organic and non-organic dairy herds in the United Kingdom. Vet. J. 180, 95-105.

DOI: 10.1016/j.tvjl.2008.03.015

SOGSTAD, A. M., T. FJELDAAS (2002): Forfangenhet og forfangenhetsrelaterte klauvlidelser hos storfe. Norsk Vet. 114, 901-910.

SOLANO, L., H. W. BARKEMA, C. PİCKEL, K. ORSEL (2017): Effectiveness of a standardized footbath protocol for prevention of digital dermatitis. J. Dairy Sci. 100, 1295-1307.

DOI: 10.3168/jds.2016-11464

SOMERS, J. G. C. J., K. FRANKENA, E. N. NOORDHUİZEN-STASSEN, J. H. M. METZ (2005): Risk factors for digital dermatitis in dairy cows kept in cubicle houses in The Netherlands. Prev. Vet. Med. 71, 11-21.

DOI:10.1016/j.prevetmed.2005.05.002

SPREECHER, D. J., D. E. HOSTETLER, J. B. KANEENE (1997): A lameness scoring system that uses posture and gait to predict dairy cattle reproductive performance. Theriogenology 47, 1179-1187.

WAIBLINGER, S., C. MENKE, G. COLEMAN (2002): The relationship between attitudes, personal characteristics and behavior of stockpeople and subsequent behavior and production of dairy cows. Appl. Anim. Behav. Sci. 79, 195-219.

DOI: 10.1016/S0168-1591(02)00155-7

WARNICK, L. D., D. JANSSEN, C. L. GUARD, Y. T. GRÖHN (2001): The Effect of Lameness on Milk Production in Dairy Cows. J. Dairy Sci. 84, 1988-1997.

DOI: 10.3168/jds.S0022-0302(01)74642-5

WHAY, H. R., D. MAIN, L. GREEN, A. WEBSTER (2003): Assessment of the welfare of dairy cattle using animal-based measurements: direct observations and investigation of farm records. Vet. Rec. 153, 197-202.

DOI: 10.1136/vr.153.7.197

WILLSHIRE, J. A., N. J BELL (2009): An economic review of cattle lameness. Cattle Pract. 17, 136-141.

DOI: 10.1136/inp.c6672

Received: 15 April 2020
Accepted: 10 November 2020

TURINI, L., A. MADRIGALI, M. SGORBINI, C. ORSETTI, A. RIZK, F. BONELLI: Procjena kritičnih točaka lezija papaka u mliječnih krava: preliminarno istraživanje novog sustava bodovanja. Vet. arhiv 92, 37-44, 2022.

SAŽETAK

U mliječnim je stadima hromost danas važno pitanje dobrobiti i proizvodnje životinja. Razvoj sustava bodovanja za kategorizaciju farmi na temelju razine rizika od hromosti može pomoći kliničarima, odnosno stočarima, pri utvrđivanju potencijalnih problema i smanjenju troškova uzrokovanih tom bolešću. Cilj ovog istraživanja bio je razviti jednostavan i brz sustav za procjenu strukturnih i upravljačkih čimbenika u proizvodnji koji bi mogli biti uključeni u patogenezu lezija papaka i poslužiti za kategorizaciju mliječnih farmi. Tijekom tri mjeseca istraživano je ukupno šest mliječnih farmi sa slobodnim načinom držanja. Sustav bodovanja farmi uspostavljen u ovom istraživanju uključivao je nastambe za životinje, podove, organizaciju farme, upotrebu kupki za papke, učestalost obrade papaka i kontinuiranom edukaciju zaposlenika. Svakom je pokazatelju dodijeljen bod od 0 do 2, pri čemu 0 označuje najmanje prikladno stanje, a 2 najbolje stanje. Sustav bodovanja na farmi pokazao je znakovit odnos sa prevalencijom lezija papaka ($P = 0,0011$, R^2 0,94) kao i sa teoretskom procjenom dodatnih troškova po životinji ($P = 0,001$, R^2 0,95). Navedeno naglašava potencijalnu korist sustava bodovanja uspostavljenog u ovom istraživanju kao jeftinog i brzog načina procjene razine rizika za zdravlje papaka na mliječnim farmama.

Ključne riječi: mliječne krave; lezije papaka; hromost; sustav bodovanja; strukturni i upravljački faktori