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Lameness and foot lesions in Swiss dairy cows: II. Risk factors

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Summary

The objective of this study was to evaluate risk factors associated with foot lesions and lameness in Swiss dairy cows. Potential risk factors were recorded by means of examination of 1'449 Swiss cows and the management systems of 78 farms during routine claw-trimming, and during personal interviews with the associated farmers. Statistical analysis of animal-based and herd level risk factors were performed using multivariate logistic regression models. The risk of being lame was increased in cows affected by digital dermatitis complex, heel-horn erosion, interdigital hyperplasia, Rusterholz' sole ulcer, deep laceration, double sole and severe hemorrhages. Cleanliness, BCS, affection with other foot lesions, breed, importance of claw health to the farmer, frequency of routine claw-trimming, producing according to the guidelines of the welfare label program RAUS, and silage feeding were shown to be associated with the occurrence of some of the evaluated foot lesions and lameness. The identified risk factors may help to improve management and the situation of lameness and claw health in dairy cows in Switzerland and other alpine areas with similar housing and pasturing systems.

Keywords: claw health, dairy cow, foot lesion, risk factor

Lahmheit und Klauenerkrankungen bei Schweizer Milchkühen: II. Risikofaktoren

Ziel dieser Arbeit war es, Risikofaktoren für Klauenerkrankungen und Lahmheit bei Schweizer Milchkühen zu ermitteln. Mögliche tier- und betriebsbezogene Risikofaktoren wurden während der routinemässigen Klauenpflege bei 1'449 Kühen auf 78 Betrieben sowie mittels persönlichen Interviews mit den entsprechenden Tierhaltern erfasst und mit Hilfe von multivariaten logistischen Regressionsmodellen statistisch ausgewertet. Kühe, die Dermatitis Digitalis, Ballenfäule, Zwischenklauenwarzen, Rusterholz'sche Sohlengeschwüre, tiefergehende Verletzungen, Doppelsohlen oder schwere Sohlenblutungen aufwiesen, gingen häufiger lahm als nicht betroffene Tiere. Folgende Faktoren waren mit dem Auftreten verschiedener Klauenerkrankungen sowie Lahmheit assoziiert: Sauberkeit, BCS, Vorhandensein weiterer Klauenerkrankungen, Rasse, Wichtigkeit der Klauengesundheit für den Tierhalter, Häufigkeit der routinemässigen Bestandesklauenpflege, Produktion gemäss Label RAUS und Silagefütterung. Um die Situation im Bereich Lahmheit und Klauengesundheit bei Milchkühen in der Schweiz und anderen alpinen Gegenden künftig zu verbessern, ist die Berücksichtigung dieser Risikofaktoren im Management der Klauengesundheit zu empfehlen.

Schlüsselwörter: Klauenerkrankung, Klauengesundheit, Milchkuh, Risikofaktor

Introduction

Lameness and foot lesions in dairy cows were shown to be important health problems in Switzerland (see part I of this paper). Beside the corrective claw-trimming routines and the consideration of claw health in breeding, it is necessary to take risk factors for specific foot lesions into account to maintain good claw health. Multifactorial conditions facilitating the development of lameness and foot lesions in dairy cows have been recognized by several studies. They revealed cow-related factors such as hereditary predisposition, age and stage of lactation as well as environmental and management parameters such as floor characteristics, bedding and feeding, herd size, claw-trimming routines and human-animal relationship (Hultgren and Bergsten, 2001; Green et al., 2002; Manske et al., 2002b; Borderas et al., 2004; Regula et al., 2004; Blowey, 2005; Somers et al., 2005; Holzhauer et al., 2006; Espejo and Endres, 2007; Kremer et al., 2007; Amory et al., 2008; Barker et al., 2009; Rouha-Mulleder

et al., 2009; Rutherford et al., 2009). As most of these studies examined cows from herds consisting of several hundreds to a thousand cows each, these results cannot be directly assigned to Swiss dairy cattle. In Switzerland and alpine areas of Germany, Austria, Italy, Slovenia and France, herd size, management, pastures and housing systems differ considerably from most parts of the rest of Europe and North America. The objectives of part II of this study were to evaluate risk factors associated with lameness and important foot lesions in Swiss dairy cows at both cow and herd level.

Animals, Material and Methods

Data management and statistical analysis

The data set described in part I of this paper was used for risk factor analyses. Herds were allocated to one of three breed classes (Holstein = Red and Friesian Holstein; Brown = Original Brown and Brown Swiss; Red = Simmentaler, Rotfleckvieh, and Montbéliard), according to the breed most frequently represented in a specific herd. Potential risk factors at cow level and herd level were analyzed for clinical lameness and the following foot lesions and definitions: Digital dermatitis complex (DD), heel-horn erosion (HE), Rusterholz' sole ulcer (RSU), white-line disease (WLD), severe hemorrhages (SH), interdigital hyperplasia (IH), double sole (DS), subclinical laminitis (SLAM), chronic laminitis (CLAM), and signalling foot lesion (SFL). Analyses of other foot lesions were not statistically evaluated, because either very high or very low prevalences resulted in groups of too few representatives for a risk factor analysis. Tables 1 and 2 provide information on potential cow and herd level risk factors.
Analyses at cow level were performed with R (R Foundation for Statistical Computing, Vienna, Austria), using mixed-effects logistic regression models fitted with penalized quasi likelihood and herd as random effect. Analyses at herd level were generated with NCSS (NCSS, LCC, Kaysville, USA) using logistic regression models. Categorical within-herd prevalence was used as the dependent variable for herd level risk factor analysis (Tab. 1 in part I of this paper). After assessing potential correlation between independent variables to avoid collinearity, in a first step, the association between each variable and the prevalence of the response variable was evaluated with a univariate model. In a second step, those variables with P-values < 0.25 were further investigated in a multivariate model. To build the final model, variables were eliminated using a backward stepwise procedure until all variables retained were significant ($P < 0.05$) or identified as being confounders that need to stay in the model according to Hosmer and Lemeshow (2000).

Results

Cow Level Associated Factors

No significant associations of any evaluated risk factors could be determined for the occurrence of SLAM and CLAM. Significant associations with clinical lameness and different foot lesions could be determined for BCS, general cleanliness, cleanliness of udder, and cleanliness of flank. Furthermore, associations between DD and HE on the one hand, and RSU and IH on the other hand could be demonstrated (precise information is given in Tab. 3).

Herd Level Associated Factors

No significant associations of risk factors could be determined for the within-herd prevalence of SLAM and SH. Farmer's opinion of the importance of claw health, claw-trimming frequency, consideration of claw health in breeding, regular outdoor exercise according to the label RAUS, breed class, silage feeding, standard deviation of BCS, and within-herd prevalence of DD and HE were sig-

Table 1: Description of the variables used in statistical analyses of cow level risk factors.

Variable	Description
BCS	Body condition score according to Edmonson et al. (1989), numerical variable
Cleanliness of udder	According to Faye and Barnouin (1985), slightly modified using half grades*, numerical variable
Cleanliness of flank	According to Faye and Barnouin (1985), slightly modified using half grades*, numerical variable
Cleanliness of hind limb	According to Faye and Barnouin (1985), slightly modified using half grades*, numerical variable
General cleanliness	According to Faye and Barnouin (1985), slightly modified to udder, flank, and hind limb only, using half grades* 1 = rather clean
	2 = mean score of udder, flank, and hind limb ≥ 0.5 or score of at least one region ≥ 1.5
HE (heel-horn erosion)	Effect of the affection with HE on the occurrence of DD (digital dermatitis complex)
DD	Effect of the affection with DD on the occurrence of HE
RSU (Rusterholz' sole ulcer)	Effect of the affection with RSU on the occurrence of IH (interdigital hyperplasia)
SLAM (subclinical laminitis)	Effect of the affection with SLAM on the occurrence of DS (double sole), RSU, and WLD (white line disease)

* Graduation of cleanliness: 0 = clean; 0.5 = slightly dirty; 1 = moderately dirty; 1.5 = very dirty; 2 = extremely dirty (more than 1 cm of thickness)

Table 2: Description of the variables used in statistical analyses of herd level risk factors.

Variable	Description and category if determined
Breed class	*Holstein* = Red and Friesian Holstein *Brown* = Original Brown and Brown Swiss *Red* = Simmentaler, Rotfleckvieh, and Montbéliard
General cleanliness	Within-herd prevalence of cows with cleanliness = 2 (less clean)
BCS average	Average of BCS of the cows of the herd
BCS standard deviation	Standard deviation of BCS of the cows of the herd
Herd size	Number of cows of at least 30 months on the farm 1 ≤ 20 cows 2 > 20 cows
Housing system	1 = tie-stall 2 = free-stall
Label RAUS	Regular outdoor exercise of at least 26 and 13 d per month in summer and winter seasons, respectively
Income	Income by dairy farming 1 = 100 % 2 = 50–90 % 3 < 50 %
Importance of claw health	Farmer's opinion of the importance of claw health 1 = absolutely important 2 = very and rather important
Claw-trimming frequency	Number of routine claw-trimmings per year 1 ≤ 1 2 ≥ 2
Consideration in rearing	Consideration of claw health in rearing
Portions of concentrate	Number of portions of concentrate per day 1 ≤ 2 2 > 2
Maximum amount concentrate	Maximum amount of concentrate per portion 1 ≤ 2kg 2 > 2kg
Minimal interval between portions	Minimal interval between 2 portions of concentrate 1 ≤ 6 hours 2 > 6 hours
TMR	Total mixed ration fed or not
Silage	Silage fed or not
Clinical acidosis	Farmer's estimation of treated cases of clinical acidosis during the last year, in % of affected cows (adapted to standard classification of the heard health service, Clinic for Ruminants, University of Berne) 1 = 0 % 2 > 0 %
Clinical ketosis	Farmer's estimation of treated cases of clinical ketosis during the last year, in % of affected cows (Mulligan et al., 2006) 1 ≤ 5 % 2 > 5 %
Clinical endometritis	Farmer's estimation of treated cases of clinical endometritis during the last year, in % of affected cows (adapted to standard classification of the heard health service, Clinic for Ruminants, University of Berne) 1 ≤ 10 % 2 > 10 %
Clinical mastitis	Farmer's estimation of treated cases of clinical mastitis during the last year, in % of affected cows (adapted to standard classification of the heard health service, Clinic for Ruminants, University of Berne) 1 ≤ 20 % 2 > 20 %
HE (heel-horn erosion)	Effect of within-herd prevalence of HE on DD (digital dermatitis complex)
DD	Effect of within-herd prevalence of DD on HE

Table 3: Foot lesions associated with clinical lameness and final linear regression models for clinical lameness and foot lesions on cow level.

Foot lesions associated with clinical lameness					
Lesion		**OR**	**Lower CL**	**Upper CL**	***P***
DD		1.890	1.320	2.706	< 0.001
HE		1.813	1.302	2.525	< 0.001
RSU		5.001	3.365	7.432	< 0.001
WLD		2.976	1.676	5.284	< 0.001
DS		5.043	2.434	10.445	< 0.001
IH		5.443	2.806	10.555	< 0.001
SH		1.520	1.079	2.141	0.017
DL		14.119	2.239	89.020	0.005
Final linear regression models – associations of risk factors with lesions/lameness					
Risk factor	**Dependent variable**	**OR**	**Lower CL**	**Upper CL**	***P***
HE	DD	4.272	3.177	5.745	< 0.001
DD	HE	4.177	3.088	5.649	< 0.001
RSU	IH	2.561	1.470	4.463	< 0.001
Cleanliness of udder	Clinical lameness	1.857	1.132	3.049	0.014
Cleanliness of flank	WLD	2.027	1.252	3.279	0.004
	IH	1.791	1.024	3.133	0.041
General cleanliness	HE	1.330	1.005	1.759	0.046
	DS	2.036	1.215	3.411	0.007
BCS	DD	1.419	1.017	1.981	0.04
	HE	0.742	0.551	0.999	0.049
	RSU	0.393	0.268	0.574	< 0.001
	SH	0.616	0.459	0.826	0.001
	DS	0.383	0.227	0.645	< 0.001
	SFL	0.609	0.453	0.819	0.001

DD = digital dermatitis complex; HE = heel-horn erosion; RSU = Rusterholz' sole ulcer; WLD = white line disease; DS = double sole; IH = interdigital hyperplasia; SH = severe hemorrhages; DL = deep laceration; SFL = signalling foot lesion.

nificantly associated with the occurrence of lameness and several different foot lesions at herd level (precise information is given in Tab. 4).

Discussion

Risk factor analyses at the individual animal level

Associations with lameness

The risk of being lame was increased for cows affected by DD, HE, IH, RSU, WLD, DL, DS, and SH. Manske et al. (2002a) reported similar results for the associations between lameness and the occurrence of ulcers of the sole (independent of its region), as also Capion et al. (2008) revealed, and separations of the horn (DS and white line fissure), and dermatitis (erosive, verrucous dermatitis and HE) in Swedish cows. Another study reported increased risks for lameness in cows affected by severe digital dermatitis and interdigital dermatitis/HE (Frankena et al., 2009). Signalling foot lesions included several assessed lesions which might lead to lameness if not treated. In addition to this, not all of them were associated with lameness, which probably is the reason for no association of SFL with lameness.

Association between HE and DD

There was a strong association between HE and DD. A cow affected by HE was at 4.3 times higher risk of suffering from DD concurrently. Similar results have also been reported for Swedish, Dutch and Danish cows (Manske et al. 2002a; Holzhauer et al. 2006; Capion et al. 2008). This indicates that the 2 lesions might represent different clinical pictures of the same pathology (as proposed by Toussaint Raven (1985)) and, therefore, share common causative mechanisms and associations with risk factors at cow and herd levels. For an improved and earlier recognition of DD, it is therefore recommended that cows affected with HE be carefully investigated as they are also likely to be or get affected by DD.

Table 4: Final linear regression models for clinical lameness on herd level.

Risk factor	Dependent variable	OR	Lower CL	Upper CL	*P*
Importance of claw health = 2	Clinical lameness				
	Cat0	1	-	-	-
	Cat1	3.556	0.577	21.917	0.172
	Cat2	7.111	1.234	40.984	0.028
	DS				
	Cat0	1	-	-	-
	Cat1	3.701	1.326	10.331	0.013
Silage = no	RSU				
	Cat0	1	-	-	-
	Cat1	0.311	0.120	0.811	0.017
	CLAM				
	Cat0	1	-	-	-
	Cat1	0.217	0.057	0.823	0.025
BCS SD	WLD				
	Cat0	1	-	-	-
	Cat1	0.078	0.002	3.082	0.174
	Cat2	0.003	0.00001	0.852	0.044
Label RAUS = no	IH				
	Cat0	1	-	-	-
	Cat1	0.291	0.087	0.969	0.044
HE	DD				
	Cat0	1	-	-	-
	Cat1	1.090	0.934	1.272	0.275
	Cat2	1.185	1.030	1.364	0.018
	Cat3	1.134	0.968	1.329	0.119
DD	HE				
	Cat0	1	-	-	-
	Cat1	1.059	0.799	1.404	0.691
	Cat2	1.312	1.033	1.666	0.026
	Cat3	1.255	0.982	1.603	0.070
Consideration in rearing = yes	DD				
	Cat0	1	-	-	-
	Cat1	1.989	0.299	13.255	0.477
	Cat2	5.193	0.894	30.169	0.067
	Cat3	7.768	1.041	57.997	0.046
Claw-trimming frequency = 2	DD				
	Cat0	1	-	-	-
	Cat1	1.228	0.283	5.332	0.784
	Cat2	2.312	0.609	8.780	0.219
	Cat3	6.487	1.280	32.867	0.024
Breed class *Red*	DD				
	Cat0	1	-	-	-
	Cat1	0.137	0.008	2.361	0.171
	Cat2	0.059	0.004	0.761	0.030
	Cat3	0.071	0.005	1.061	0.055
Breed class *Brown*	DD				
	Cat0	1	-	-	-
	Cat1	0.375	0.017	8.159	0.532
	Cat2	0.039	0.002	0.771	0.033
	Cat3	0.019	0.001	0.619	0.026
	SFL				
	Cat0	1	-	-	-
	Cat1	0.107	0.017	0.662	0.016

DD = digital dermatitis complex; HE = heel-horn erosion; RSU = Rusterholz' sole ulcer; WLD = white line disease; IH = interdigital hyperplasia; DS = double sole; CLAM = chronic laminitis; SFL = signalling foot lesion. For description of categories, see Table 1, paper part I.

Association between RSU and IH

Cows suffering from RSU were evaluated to be at 2.56 times greater risk of developing IH. Prevalence of IH both includes symmetrical and asymmetrical hyperplasiae. The latter is described to be associated with propulsion of the corium caused by other foot lesions in the same claw as RSU (Weaver et al., 2005; Rusterholz, 1920), explaining our results.

Cleanliness

Cows with impaired cleanliness of the udder were at 1.86 times greater risk of being lame than cows with cleaner udders. This is probably due to longer lying bouts (Chapinal et al., 2010) and more time lying down (Walker et al., 2008; Ito et al., 2010), leading to more contact with manure and contamination of the udder. Furthermore, the detrimental effects of manure on horn can lead to a softening of the claw horn and an increase of the sensitivity to mechanical injuries (Borderas et al., 2004; Gregory, 2004; Gregory et al., 2006). The effects of impaired cleanliness of the flank on the occurrence of WLD and IH and of impaired general cleanliness on HE and DS can be explained similarly. Our results are supported by Rutherford et al. (2009) who found that the cleaner the cows were, the less prevalent was lameness. Several other studies observed reduced prevalence of DD, HE, sole lesions and hemorrhages in cows with good or passable cleanliness (Hultgren and Bergsten, 2001; Philipot et al., 1994; Manske et al., 2002b). No effect was seen for the cleanliness of hind limbs in the present study. This parameter might not have been sensitive enough to differentiate between clean and dirty cows.

Higher body condition score

Higher BCS was associated with less frequent occurrence of HE, DS, RSU, SH, and SFL, but more frequent occurrence of DD at cow level. Except for SFL, all of these foot lesions were associated with a higher risk of lameness. Our results confirmed the correlation between BCS and prevalence of lameness, reported by Espejo et al. (2006). They found higher prevalence of clinical lameness in under-conditioned cows than in normal or over-conditioned cows, as was also demonstrated in two other studies (Wells et al., 1993; Walker et al., 2008). Cows suffering from foot lesions probably have less activity and spend more time lying, leading to less food intake through reduced feeding time (Hassall et al., 1993; Juarez et al., 2003; Gomez and Cook, 2010, Ito et al., 2010). Consequently, they lose weight since they are not able to meet their nutritional requirements. Bicalho et al. (2009) found a positive association between BCS and digital cushion thickness; cows in the upper quartile of digital cushion thickness had a lower adjusted prevalence of lameness than the lower quartile. This supports the hypothesis that low BCS can not only be a consequence but also a risk factor for lameness as thinner digital fat-cushion probably has lesser capacity to dampen the pressure on the soft claw tissue, more frequently leading to foot lesions. Our results show significant associations of DD with lameness, possibly leading to the expectation of lower BCS in these cows, too. The more frequent occurrence of DD in cows with higher BCS found in the current study, however, might be explained by a negative impact of obesity on immune defense, which might be a risk factor for contagious infectious diseases like DD. As HE was associated with lower BCS, HE and DD obviously share many but not all risk factors with each other. Higher BCS prior to parturition was associated with high ketone concentrations in a study by Reist et al. (2003). The immunosuppressive function of ketones (Klucinski et al., 1988; Suriyasathaporn et al., 1999) might explain our results, although we did not assess the state of lactation at scoring of the body weight.

Risk factor analyses at herd level

Importance of claw health

Within-herd prevalences of lameness and DS were higher in herds of farmers to whom claw health was less important. Those farmers are likely to be less interested and less educated in the recognition, assessment and prevention of lameness. Poor animal care, farmers' attitudes, and herd health planning on farms were found to be important factors in cattle lameness (Mill and Ward, 1994; Bell et al., 2006; Dembele et al., 2006). Some of the DS assessed in our study were not of purulent character but had already drained. The affected cows had probably not been perceived as being lame by the farmers or they were not considered as having to be treated immediately. Barker et al. (2010) found increased lameness prevalence in herds where lame cows had not been treated within 48 hours of detecting them as lame. The reluctance in early treatment of lame cows is probably due to the attribution of less importance to and interest in lameness and claw health, leading to a higher prevalence of lameness.

Silage

Silage feeding was associated with the occurrence of CLAM and an increase in RSU within the herds. Faye and Lescourret (1989) observed the presence of laminitis and interdigital dermatitis to be associated with an increased period of feeding corn silage in French cows. Feeding silage might cause metabolic disorders because of rapid fermentation in the rumen and a subsequent increase in acidity (Abel et al., 2001) which is known to reduce the quality of claw horn development (Mulling et al., 1999). This hypothesis is supported by the association of more frequent occurrence of lameness with

feeding corn silage observed by Amory et al. (2006) and Barker et al. (2007).

Standard deviation of BCS

A greater variation of BCS within the herd was associated with a lower prevalence of WLD. We do not know how to interpret this result and rather consider it to be an artifact. As the confidence interval of this odds ratio was very large anyway, we interpret this finding with care and suggest larger studies to confirm it or – more likely – to rule it out.

Label RAUS

Label RAUS was associated with the occurrence of IH. Cows managed according to this label must have offered regular access to an outdoor yard of at least 26 and 13 days per months in summer and winter seasons, respectively. A possible explanation may be that outdoor exercise in large extent, if taken on impassable pastures, might enforce the development of IH by provoking the spreading of the claws, leading to more frequent propulsion of the corium. No negative correlation between label RAUS and any of the other foot lesions could be found. Positive effects of an outside run on the occurrence of lameness were also found by Rouha-Mulleder et al. (2009) and explained by improved blood circulation having positive effects on claw health (Gustafson, 1993).

Association between HE and DD

The positive correlation of HE and DD on each other could not only be revealed at cow level but also at herd level, and confirms results reported by Manske et al. (2002a).

Breeding and claw-trimming frequency

If the farmer considered good claw health in breeding, within-herd prevalence of DD increased. Claw-trimming frequency of at least twice per year was also shown to be a risk factor for DD. It is difficult to separate cause from effect, as possible reasons for this practice were not assessed. Possibly, high within-herd prevalence of DD led to the farmers' greater interest in good claw health. As a result, they may have changed their practice in rearing and prevention of foot lesions, considering claw health and claw-trimming frequency as more important than before. More frequent claw-trimming itself might be a risk factor for DD, as this was also reported in a study from the United States (Wells et al., 1999) and was in agreement with a Dutch study by Holzhauer et al. (2006), who revealed lower risk of digital dermatitis in cows trimmed more than 12 months before the study compared to cows that were trimmed at shorter intervals. On the other hand, Somers et al. (2005) reported long claw-trimming intervals of more than 7 months to be a risk factor for the occurrence of digital dermatitis in Dutch cows. In Switzerland, DD has not been very common during recent years (Bielfeldt et al., 2005). Due to this fact, farmers and claw-trimmers have probably not been used to a precise recognition of DD. Furthermore, the recognition of DD, especially the late chronic lesion M4, might be quite difficult for claw-trimmers and farmers because of their limited knowledge of this disease, little time invested in the claw-trimming procedure and high contamination with manure of some claws during claw-trimming. Claw-trimming tools, used for affected cows should be cleaned and disinfected before the next usage to prevent transmission of DD to other cows since it is a contagious disease (Döpfer et al., 1997; Read and Walker, 1998). Failure to wash claw-trimming equipment between cows has been revealed to be risk factor for a high incidence of digital dermatitis in the United States (Wells et al., 1999). It is reasonable that transmission of DD cannot be prevented if the affected cows are not recognized. Therefore, more frequent claw-trimming can certainly be considered as an actual risk factor for an increase of DD within herds.

Breed

Breed was recognized as an important risk factor for DD. Herds mostly consisting of the breed classes Brown and Red had a lower prevalence of DD than those of the breed class Holstein. Holzhauer et al. (2006) found similar results for the occurrence of digital dermatitis in a study on 383 Dutch dairy herds. In our study, herds of breed class Brown not only had lower within-herd prevalence of DD but also lower ones of SFL, compared to those of the breed class Holstein. The generally high prevalence of SFL was mainly caused by frequent occurrence of HE, DD, SH, and RSU, which is comparable to other studies. Two studies (Kujala et al., 2009; Kujala et al., 2010) revealed higher risk for the occurrence of ulcers of the sole and WLD in cows of breed Holstein compared to those of breed Ayrshire. A possible explanation of the influence of breed on the occurrence of foot lesions may be the difference in the angles of the dorsal claw wall of cows of different breeds. Holstein cows often have more acute angles compared to those of other breeds. This results in lower height of the bulb, increasing the intensity of contact with manure. Good feet and leg conformation, however, were shown to have considerable genetic correlations with claw health traits (Koenig et al., 2005; Van der Waaij et al., 2005; Onyiro et al., 2008; van der Linde et al., 2010). A possible other explanation is the increased milk yield associated with the Holstein breed as Barker et al. (2010) hypothesized. Grohn et al. (2003) reported that high yielding cows were at a greater risk of metabolic disorders which might lead to a greater risk for horn-associated lameness as metabolic imbalance has negative impact on hoof horn quality, predisposing to lameness (Mulling et al., 1999). Green et al. (2002) and Rutherford et al. (2009) revealed that high yielding cows are more likely to become lame and another study by Amory et al.

(2008) reported higher risks for ulcers of the sole and white line lesions in higher yielding cows.

Conclusions

It can be stated from our results that regular corrective claw-trimming with clean instruments is of critical importance in Swiss dairy cattle in order to reduce foot lesions. More attention has to be paid to the occurrence of DD since its prevalence has increased considerably within the past years. Even though risk factors identified in the present study are only associations and might not be causal, knowledge of them by the veterinarian and consideration by the farmer might be important to improve claw health and reduce associated lameness in Swiss dairy cows.

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Boiteries et affections des onglons chez les vaches laitières suisses: II. Facteurs de risque

Le but de ce travail était de déterminer les facteurs de risque d'affections des onglons et de boiteries chez les vaches laitières suisses. On a relevé les facteurs de risques liés aux animaux et aux exploitations lors du parage de routine des onglons chez 1'449 vaches de 78 exploitations ainsi que par le biais d'interviews personnelles avec les détenteurs concernés et on les a interprétés statistiquement au moyen de modèles de régression logistique à plusieurs variables. Les vaches qui présentaient des dermatites interdigitales, de la pourriture des glomes, des verrues interdigitales, des ulcères de Rusterholz, des blessures profondes, des doubles soles ou des saignements solaires importants étaient plus souvent boiteuses que les animaux indemnes. Les facteurs suivants étaient associés à l'apparition de diverses affections des onglons et aux boiteries: propreté, BCS, présence d'autres affections des onglons, race, importance des soins aux onglons pour le propriétaire, fréquence des soins de routine aux onglons, production selon le label SRPA et affouragement avec de l'ensilage. A l'avenir, la prise en considération de ces facteurs de risque dans la gestion de la santé des onglons est recommandée pour les vaches laitières en Suisse ainsi que dans d'autres régions alpines.

Zoppia e malattie del piede delle mucche svizzere da latte: II. Fattori a rischio

Questo lavoro vuole rilevare i fattori a rischio per le malattie del piede e le zoppie nelle mucche da latte svizzere. Durante la cura di routine del piede di 1449 mucche da latte provenienti da 78 aziende e per mezzo di interviste personali con i proprietari degli animali, sono stati determinati e sono stati analizzati i possibili fattori a rischio sulla base di un modello di regressione logistica multivariato. Le mucche affette da: dermatite digitale, erosione dell'unghione, dermatite verrucosa, pododermatite circoscritta, ferite più profonde, doppie suole o gravi emorragie della suola, erano colpite più frequentemente da zoppia che le altre. I seguenti fattori sono stati associati con l'insorgenza di varie malattie del piede e di zoppia: pulizia, BCS, presenza di altre malattie del piede, razza, importanza della salute del piede per il proprietario dell'animale, frequenza delle azioni di routine per la cura dello zoccolo, produzione in base all'etichetta RAUS e agli insilati. Per migliorare la situazione in futuro in merito a zoppie e salute dello zoccolo nelle vacche da latte in Svizzera e in altre regioni alpine, si consiglia di prendere in considerazione i fattori a rischio citati per la gestione della salute del piede.

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