Poster Presentation

Cancelled

Therapeutic Efficacy of Ozone Gel for Sole Ulcers in Cows

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Introduction

Sole ulcers are one of the problematic diseases related to economical loss via reduced milk productivity, decreased reproductive performance, and increased rate of culling. The removals of the pathological corneum of sole horns, heelless trimming method, and use of hoof block are the common treatments for sole ulcers. However, through treatments by these methods, it takes long time to be cured, and the prolonged inflammations in the sole corium can lead to bone developments within ventral surface of the distal phalanx, resulting in chronic formation of poor quality of the sole horn and the repeated affection of sole diseases. Some additional methods plus common therapy are required for achievement of the shortened cured period.

Ozone works as the bioactive stimulator inducing release of cell growth factors and proliferation of fibroblasts into the body (referred as ozone signal). In addition, ozone has a strong oxidation function contributing to bactericidal and virucidal actions. Ozone water is already utilized for disinfection in milking room and milking equipment in animal husbandry. However, the various functions in ozone water are lost in ultra-short period after use of ozone water. Ozone gel (ozone-containing glycerin ointment) enables more prolongation of efficacy of ozone than ozone water, and is the convenient material applied to the sole ulcers via the adhesiveness.

The aim of this study is to evaluate therapeutic efficacy of ozone gel when it was topically applied together with the common methods in treatments of sole ulcers in milking cows.

Materials and Methods

Animals were fourteen Holstein milking cows kept in Hiroshima prefecture, in which sole ulcers were found in 14 claws. Of 14 lesions, 7 lesions were treated with topical applications of ozone gel plus the common methods (O group); the common methods included removal of the pathological sole, and followed by heelless trimming method. Seven lesions were treated with topical applications of antibiotic ointments plus the common methods (C group). In the O or C groups, ozone gel or antibiotic ointment were topically applied to the lesions (which were antecedently exposed by trimming and cleaned), and followed by covering with absorbent cotton, and taping with elastic bandage.

The photos of the lesions were taken at first day (day1) and 1 week (day7) of each treatment. Using the photos, areas of lesions were measured using an image analyzer software Image J (US National Institutes of Health, Bethesda, MD; http://rsb.info.nih.gov/ij/). The reduction percentages of the lesion areas at day7 were calculated by dividing values at day7 by values at day1. In addition, severity of lesion was scored by 1 (good quality of keratinization of the sole horn), 2 (good quality of granulation), 3 (scabbing), 4 (erosion in the sole horn), and 5 (ulceration). Data were statistically compared between U and C groups using a t-test.

Results

The reduction percentage of the lesion areas at day7 was 40.2% in O group. This value was significantly (P = 0.02) lower than that in C group (72.5%). Severities of the lesions at day1 (scores 4.6 or 4.9) were improved at day7 (scores 1.3 or 3.7) by treatments with topical applications of ozone gel or antibiotic plus the common methods, respectively. Significantly difference (P = 0.03) was found in between severity scores in O and C groups.

Conclusions

Ozone gel is being recently utilized for wound healing in human skin diseases. In this study, the topical applications of ozone gel together with the common methods enabled significantly reduction of the lesion areas at 1 week after treatments than those obtained from the topical applications of antibiotic ointments.

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Ozone is believed to induce release of bioactive materials (such as epidermal growth factor and IL-8) via ozone signal, resulting in formation of keratin structures. In addition, oxidative action of ozone may allow reduction of bacteria into the lesions, resulting in advancing healing. This study indicates that ozone gel can be utilized as the curative material for sole ulcers in dairy cows.

The Corium Parallel Trimming Method is based on the Millefeuile Hypothesis that the sole horn of the claw grows one sheet at a time, similar to millefeuile

Hiroyuki Manabe

Introduction

When you trim a claw kept in a tied barn, specifically if it is a dry fore claw, you will see sole horn coming off like mica, or more like millefeuile. When you trim both medial and lateral claws one leaf at a time along the millefeuile-like-sole, sometimes you can make well balanced claw in size and height of the coronary band, and then it stands upright on the floor. Most of the time, the medial digit inclines axially. But, when you make cross cuts of a cadaver foot at one third from the toe, you can see the soles are parallel to the corium.

Millefeuile Hypothesis

The sole horn consists of keratin sheets which grow from and parallel to the corium. The keratin sheets change from a wet ivory colored and dense substance into dried white colored and flaky substance. We call the former sole horn the SEIKAKU and latter the KOKAKU, which literally mean vivid horn and dried horn respectively in Japanese.

At a certain distance (about 5 mm from the corium), the sole horn denatures from the SEIKAKU to the KOKAKU. And then in appropriate circumstances KOKAKU partially turns into a flaky, flour like substance which is called pith or chalk. The pith appears at any point and any shape on the bottom of the KOKAKU and it grows bigger along the growth of the sole horn. When it occurs on the whole sole, the cow stands on the walls, white lines, and the remaining KOKAKU along the white lines. The wall reduce its height through exercise up to the KOKAKU sole that is parallel to the corium.

The MRI images give us an obvious feeling of the boundary between the SEIKAKU and the KOKAKU.

Materials and Methods

Frozen cadaver feet are used. After cross cutting, half of the claws are stored in a freezer for 24 hours. After cleaning up the surface of the KOKAKU with a wire brush, the claws are photographed. The thickness of the keratin sheet is measured with a caliper on the monitor of the PC.

Results

1 0.35 2 0.35 3 0.53 4 0.29 5 0.35 6 0.29 7 0.38 The average thickness of the keratin sheet was 0.36mm.

Conclusions

It's hard to show the fact that I can see the keratin sheet in the KOKAKU. 0.36mm is not a bad number. If the thickness of the keratin sheet is same in the SEIKAKU, about 14 sheets are piled to form 5mm. More than hundreds of trials have been needed to get 7 results. Next time, I'll try another way to measure the keratin sheets.

Acknowledge (if needed)

The author gratefully acknowledge the contribution Dr. Suzuki K, Dr. Miyoshi K, Dr. Hori A. School of Veterinary Medicine, Rakunou Gakuen University for the MRI images of the boundary between the SEIKAKU and KOKAKU

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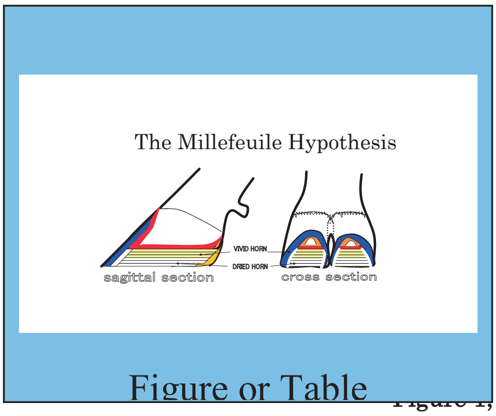

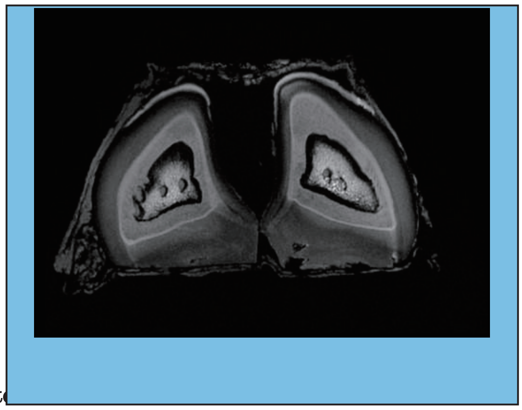

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Bovine claw grows from the coronary band as a claw-shape-cylinder

Hiroyuki Manabe

Introduction

Toussaint Raven advised in his book 'Cattle Footcare and Claw Trimming' to examine the claw in detail and draw it on paper. His remark suggests a great deal when we understand the form of the claw. He notes that the relationship between structure and function will be appreciated and a functional image will be formed. But unfortunately we sometimes think of the bovine claw like the equine hoof. Contrary to popular belief, the difference is more than the number of toes. The shape of the equine hoof is a trapezoid. But a bovine hoof is square or rectangular.

Materials and Methods

Twenty hind cadaver feet were used to record the shape of the wall. First, cadaver feet were cut at their pastern and then medal and lateral digits were separated. Two lines were drawn both sides of the ridge of the dorsal wall. One line started 1cm away from the coronary band to the toe and 1.5cm lower and parallel to the ridge. The midpoint of this 4 cm line was marked.

The second line was also parallel and about 3 or 4 cm away from the ridge; the second ridge which was formed at the abaxial end of the toe triangle at the tip of the pedal bone. And three points were put almost diametrically opposite to the first line.

Distances from the axial point to the dorsal point were measured. A is the distance between proximal points. B is the distance between midpoints. C is the distance between the distal points.

Results

The difference X between A and B, also Y between B and C ware calculated. 25% of medial claws had an XY difference of less than 1mm at both points. 65% of medial claws had an XY difference of less than 1mm at either point. 25% of lateral claws had an XY difference of less than 1mm at both points. 60% of lateral claws had an XY difference of less than 1mm at either point.

Conclusions

Significant difference was not found between the medial and the lateral claws. Only 10 % of the medial claws and 15 % of the lateral claws are not parallel. The bovine dorsal wall grows to make a claw-shape-cylinder unlike an equine hoof.

Normal feet were chosen, unlike industrial manufactured goods, living animals have variation, making it difficult to draw straight lines on the dorsal wall and axial wall. 40 digits were investigated altogether and the axial walls we can't see so often could tell the story of the claws. For example, if the proximal part of the axial wall is flat and the distal part is striated, it can be estimated that the cow has recovered from a hard situation, and vice versa. If the distal part is flat and the proximal part is striated, the cow has been suffering from some kinds of troubles.

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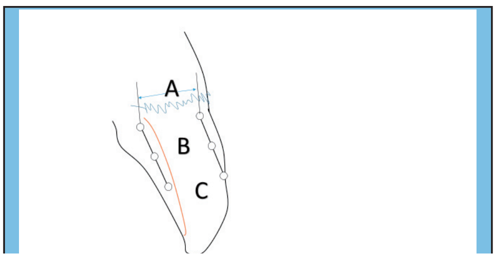
Roger Blowey: CATTLE LAENESS and HOOFCAE



Load Testing of hand-made “Sickle” Hoof Knife (Kamagata Teitō)

Masato Kuzuma[1*] and Noritsugu Abe[2]

Introduction

I become the 3rd generation farrier, which my grandfather began in Hokkaido, and currently we are performing cattle hoof trimming of around 18,000 animals per year by using Japanese traditional method. This method involves manually lifting a foot without aids and it is carried out using mainly a hatchet and a L shaped sickle type hoof knife (here after referred to as "sickle"). With this traditional method, the trimming needs to be performed quietly, quickly and with precision. Therefore, sharpness and durability of the sickle are indispensable. These sickles are a hoof trimming tool unique to Japan and initially manufactured by the old Japanese army for farrier in 1931. Due to its "L" shape and its effect of lever, even a relatively less strong Japanese person can use it, and furthermore, the edge of the sickle blade is made with good quality Hagane steel which contributes to being very sharp. We can obtain commercially mass-production sickles or a few hoof trimmers elect to make their own sickles. I also have learned from Master Hironobu Sato whom my grandfather knew, and I have made the sickles with the inherited method. Sickles need to be sharp and strong, however, some of the mass-produced sickles may break during the trimming, while my original sickles do not seem so. In pursuing why, sickles from different makers were tested for their strength.

Materials and Methods

Three sickles each from 3 different makers; (I) mass-produced, (S) Master Sato, and (K) myself were made available for testing. A cut was made on a square lumber to fix the blade of a sickle, and metal fittings were placed on the handle 170-mm from the base of blade. The metal fittings were pulled in a way that would mimic the load placed on the handle during the hoof trimming. A load measuring instrument was inserted between the sickle and the lever block, and load was applied by the lever block until failure when there was a clear sound of breakage at the peak load. The critical point was recorded. Statistical software R was used to make pairwise comparisons using t tests with pooled SD data.

Result

Average peak loads ± SD were (I) 23.7±3.1 Kg, (S) 45.3±4.0 Kg, and (K) 73.7±2.5 Kg. The statistically significant differences were observed between (I)-(S), (I)-(K), and (S)-(K). Sickles (K) were the strongest of the 3 makers.

Conclusions

The way blades were made differ with (I) from (S, K). With (I), first a sheet of bare metal is laminated with steel, then the laminated sheet is punched out in the shape of the blade, and after that the blade and a separately made neck are welded together. On the other hand, with (S) and (K) a good Hagane steel is place on a soft steel then forged into blade and neck as one piece. Thus Hagane enters the neck part as well, making sickles (S) and (K) stronger than (I). Although the method of making sickles which I inherited from Master Sato requires more time and effort, it has been proved stronger. Furthermore, I made the neck 1.7mm thicker than Master Sato’s design, and strength improved. It is my hope to provide good sickles to as many hoof trimmers as possible, I will continue to produce sickles with my modification of Master Sato’s design with the best of my ability. Furthermore, I would like to hand down this Japanese traditional method of sickle forging with good confidence in the future. In addition, I would like to address improvement to the blade’s sharpness.

Acknowledgement

I thank heartily Imai Factory and my Master Hironobu Sato for their approval of load testing to some of the failure/destruction of their devotedly created sickles.

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Training Veterinary Students in Cattle Hoof Treatment using Wooden Foot Model

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Introduction
Hoof diseases are worsening in dairy practice and university education is in need of more practical approach. In our university, fourth-year veterinary students have been taking surgical practical laboratories utilizing cadaveric feet. Benefits of using cadavers are that they are more realistic and students can observe normal and abnormal variations. The disadvantages are multifold: their availability; complex and cumbersome processes of cleaning, freezing for storage, thawing, and sharpening and maintaining hoof knives; difficulty in teaching uniformly and consistently due to wide variation in clinical cases; and most of all the biosecurity. Participation in clinical cases alone is not enough to become a competent clinician and some efforts are made with surgical simulations, however, there has been no report of utilizing bovine foot models. In this effort we have made 9 sets of wooden bovine foot models from timber using angle grinder which also is used in treating clinical cases, and used in practical laboratories.

Materials and Methods
Foot models were made from commonly sold timbers and composed of claw parts and the rest of foot. Lateral claws were made longer, thicker and with dorsal curvature. Common lesion locations for sole ulcers and digital dermatitis (DD) were also marked for better simulations (Fig1). One hundred and forty students were divided into 2 classes of 8 groups and tasks were carried out twice. Each group was given one wooden foot model, an electric angle grinder, hoof nippers, a measure, bandage materials and instructions. Students were given 7 tasks and each were demonstrated first: the procedures of functional trimming (1-3); corrective hoof trimming (4); bandaging for DD (5); placing a block on medial claw (6); and cotton bandaging (7). One student from each group were asked to take video of the procedure with their smart phones when demonstrated, then shared with the group. An aassessment questionnaire was sent to each student on later date.

Results
All 7 tasks were completed within 3 hours. Response rate of the questionnaire was 87.9%. It consisted of 9 assessment criteria and each were graded from 1 to 5. Average grades were for: lectures, 3.8; bandaging A, 4.0; functional trimming 4.0; corrective trimming, 3.9; bandaging B, 4.2; bandaging C 4.1; value of taking video, 4.4; overall understanding, 4.0; overall satisfaction, 4.4; and well received generally. The students were also asked if they wished to further practice with cadavers and to which 66.0% answered yes. However, there was a marked difference in percentages of students with different future plans (87.0% of students wishing to get in to large animal practices and 45.0% of students wishing otherwise).

Conclusions
Student evaluation of the practical laboratory indicated that the foot model was helpful in learning. With consideration to students' future carrier choices, perhaps a stepwise progress in practical laboratories may contribute to better clinical education, initially with foot models, then cadavers and finally with clinical cases. Those foot model may also be useful in continuing education as it is relatively easy to apply in lecture and laboratory settings.

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Figure 1: Wooden Foot Model

Toe Ulcers and Osteitis of the Apex of the Distal Phalanx in 4 Cattle

Satoshi Nakamura [1,*]

Introduction

Osteitis is one of the deep infections of phalanxes within bovine claw [1-4]. This can contribute to severe necrosis in the phalanxes, resulting in difficulty of healing. Digit amputation is required for the severe affected claws with wide ranges of necrotic bony lesions [1-4]. Bone debridement in the necrotic regions within apex of the distal phalanx, and application of hoof block are the common therapeutic techniques [1,2]. Insufficient bone debridement may become the cause of delay in healing, through incomplete formation of granulation tissue covering the exposed bones [2]. Thus, good healing is associated with the accurate procedure of bone debridement based on preoperative detection of pathologic bone lesions such as application of radiography. There were a few acknowledge including the technical basis, therapeutic periods, and prognosis related to bone debridement for osteitis in apex of the distal phalanx due to TUs in cattle [5]. The purpose of this report is to show therapeutic efficacy of bone debridement, and to discuss technical basis related to range of removals of the pathologic bones via practical experiences of four cases with TU-associated osteitis,

Materials and Methods

Table 1 showed information of four Holstein milking cattle with TU-associated osteitis. Diagnosis of TU-associated osteitis was obtained by clinical exhibitions and radiographic examinations. The affected claws were tied with treatment stall in standing position, and were treated with intravenous local anesthesia. During therapeutic process, removals of the necrotic regions in apex of the distal phalanx toward the deeper site of the claws enabled grossly exposures of the normal bony surface in which oozed spotting hemorrhage were observed. After bone debridement, petroleum jelly was topically applied to the exposed bone regions, and followed covering with plastic wrap, and taping with elastic bandage. In addition, hoof block was applied to healthy claw of the same limb. Healing was determined by gross observation that the exposed regions of the distal phalanx were entirely covered with good quality of granulation tissue, and followed formation of new claw horns.

Results

The four claws with TU-associated osteitis were healed between 18 and 36 days after treatments. In changing bandage at 7 days after treatments, small debris of pathologic bones were present together with discharge of pus into the surgical wounds in cases 2, 3 and 4. At this time, good quality of granulation tissue was not filled-up into the surgical wounds of the claws in all four cases, despite poor quality of granulation tissue was found. The periods when the surgical wounds were entirely covered with good quality of granulation tissue ranged 10 to 21 days after treatments.

Conclusions

This study indicates that appearance of the oozed spotting hemorrhage in the exposed bone surface of the distal phalanx can be utilized as a basis to determine optimal degree of bone debridement to remove the necrotic regions of the distal phalanx within the claws with TU-associated osteitis. Therapeutic efficacy due to bone debridement may be enhanced by combinations of the applied hoof block and enclosed wet condition (due to wet wrap therapy).

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	Case			
	1	2	3	4
Age	4.5	5	1.6	2.5
Affected limb	Outer claw, right hind-limb	Outer claw, right hind-limb	Inner claw, left hind-limb	Outer claw, right hind-limb
Period when good quality of granulation tissues was proliferated	10	16	21	14
Period when when lameness was disappeared	5	7	14	3
Frequency of therapy	3	7	4	2
Period of therapy	21	21	36	18

Table 1: Case information

Association between hoof lesions and milk yield in lactating dairy cows

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Introduction

Lameness is a major challenge in the dairy industry worldwide and is detrimental to the wellbeing of lactating cows. Hoof lesions (HL) are responsible for over 90% of lameness and may be infectious or noninfectious. Due to the different underlying causes influence of specific HL on milk yield likely differs. The objective of this study was to evaluate the association between specific HL and milk yield in lactating dairy cows.

Materials and Methods

This study was conducted in a commercial dairy herd milking 3x with a total of 10,000 lactating Jersey cows in MN. Cows were enrolled in the study at 20 ± 3 DIM postpartum (d20) using convenience sampling as cows left the rotary parlor. After being sorted cows were examined for HL in a upright hoof trimming chute. No horn was removed from the sole to find HL. Cows diagnosed with HL were treated according to farm protocol. At 120 ± 3 DIM (d120), cows were reexamined for HL. Cows were scored for body condition (BCS). Test day milk yield data was retrieved for each cow. For lesion status at d20, cows were divided into healthy (cows without HL, n = 1,171) or lesion (cows with HL, n = 427). For lesion status category at d20, cows were grouped as healthy, hemorrhage (n = 278), noninfectious (sole ulcer, toe ulcer, and white line disease; n = 103), and infectious (digital dermatitis and foot rot; n = 34). To assess the relationship of HL development with milk production, cows without HL at d20 and d120 were defined as healthy (n = 308), cows with HL at d20 and no HL at d120 were defined as cured (n = 72), cows no HL at d20 but with a HL at d120 were defined as new (n = 587) and cows with HL at d20 and d120 were defined as chronic (n = 208). Separate models were built using test day milk yield as outcome. First test day milk yield was added as a covariate to account for the higher milk production in early lactation (Bicalho et al., 2008). Other variables of interest offered to the model included the fixed effects of lesion status, test number (1 – 10+), interaction between HL status and test number, parity (1, 2, >3), BCS and season of calving. Cow was included in the model as random effect.

Results

A total of 1,598 cows comprising 13,768 test day milk yield records were used in the final analyses. Primiparous cows made up 60% of the enrolled cows with 14.3% in 2nd lactation and (25.7%) being in 3rd or greater lactation. Of all the HL diagnosed at d20, sole hemorrhage (69% of lesions) was the most common, followed by other noninfectious HL (24%) and infectious HL (7%). Similarly, sole hemorrhage was the most common new HL at d120. Overall, the average test day milk yield was 20.8 kg (95 % CI: 20.2 to 21.4 kg). On average, cows with HL at d20 had reduced test day milk yield from mid-lactation with the greatest losses of up to1.89 kg (95% Confidence Interval (CI): -2.75 to -0.9 kg) towards the end of lactation. More specifically, we found evidence that cows with noninfectious HL had reduced test day milk yield towards the end of lactation compared with healthy herdmates. Interestingly, there was evidence that cows that developed new HL produced on average more milk compared with healthy cows within the first 3 months of lactation with the greatest test day milk yield of 1.8 kg (95% CI: 0.9 to 2.8kg) at the fourth month of lactation.

Conclusions

We conclude that overall, cows with preexisting noninfectious HL produce less milk compared with healthy cows later in lactation. We found evidence for increased milk production in early lactation for cows that developed new HL compared with cows that remained healthy. This supports the theory that HL are diseases related to higher milk production.

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Routine herd health data as cow-based risk factors associated with lameness in pasture-based, spring calving Irish dairy cows

Joris R. Somers[1*], Jon N. Huxley[2], Michael L. Doherty[1] and Luke E. O'Grady[1]

Introduction

Cow-based risk factors for lameness are not as clearly defined as herd level risk factors. Untangling the cause-and-effect association is often difficult but it has been shown that high yielding cattle are more prone to develop lameness (Alawneh et al., 2014; Archer et al., 2010). Cows in low body condition, lighter in live body weight and cows losing excessive body condition are also at a higher risk of becoming lame (Alawneh et al., 2014; Green et al., 2014; Lim et al., 2015). Age of cattle is also mentioned as a risk factor for lameness in a dual capacity. Both lower age at first calving and increasing lactation number are associated with increased locomotion scores (Haskell et al., 2006; Rutherford et al., 2009).

The objective of the present study was to use information gathered through routine herd health monitoring to identify cow-based risk factors for lameness previously unreported in pasture-based, seasonally breeding dairy herds and utilize this information to indicate cows at risk of developing lameness in the first 150 days of lactation.

Materials and Methods

This prospective observational study was carried out on 10 commercial Irish dairy farms during the spring and summer of 2013 and 2014. These 10 farms were part of an on-going herd health management programme conducted by University College Dublin (UCD).

Data recorded as part of the herd health programme were monthly milk recording, including yield to date, predicted 305 day energy corrected milk (ECM) yield, somatic cell count and milk constituents; Economic breeding index (EBI); Calving date, calving difficulty and peri-parturient disease events; Body condition score (BCS) at calving, pre-breeding, services, pregnancy diagnoses and drying off; Ultrasound-based pre-breeding examination, pregnancy diagnosis at 30 and 60 days after insemination and anoestrous examination.

The predominant breed on these farms was Holstein-Friesian. All the farms used seasonal breeding and only cows calved between 1st January and 30th June 2013 or 2014 and declared for breeding in the spring breeding herd were included in the study. Lameness data were gathered by means of serial locomotion scoring of all the animals in the breeding herd. Between 25th February 2013 and 1st September 2014, all 10 farms were visited 3 times each year by the same UCD veterinarian. Visits were scheduled in order to facilitate cows being locomotion scored once within 60 days in milk (DIM), once between 60 and 120 DIM and once after 120 DIM. Cows were locomotion scored by a single observer (JS) as they exited the milking parlour after morning milking. Cows identified as lame were submitted for treatment by the same professional foot trimmer for all 10 farms within 8 days of the scoring session.

Statistical analysis was carried out in Stata 13.0 (StataCorp, 2013). Descriptive analyses were performed for all the variables of interest. Associations between lameness status and potential cow-level risk factors were determined using multivariable logistic regression. The statistical model was built by removing non-significant variables by manual backwards stepwise elimination and confounding was checked for. The variable Farm was forced into the multivariable model to correct for a potential confounding effect. The fit of the multivariable logistic regression model was assessed using the Hosmer-Lemeshow goodness-of-fit test and the Pearson χ^2 test. Both tests showed an overall good fit of the model.

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Results

Table 1 shows the study population descriptive statistics. A total of 1715 cows were present in the study population. After excluding cows due to missing BCS data, 1675 cows were available for analysis. A total of 337 cows (19.7%) were identified with a case of lameness during the study. Of all the risk factors presented, month of calving group was the only variable not showing a significant association with lameness status in the univariate analysis ($p = 0.89$) and was subsequently not used in further multivariable analysis. After accounting for correlations, the final model consisted of the variables Farm, Lactation group, BCS at calving group and Maximum BCS loss after calving group (Table 2). Lactation group showed the largest odd ratios (ORs), parity 2 cows showed a near significant OR and parity 3 and 4+ cows showed a significant OR of 1.52, 3.92 and 8.60 respectively (95% CI 0.92 – 2.50; 2.46 – 6.24; 5.68 – 13.0 respectively). The odds ratio for Maximum loss of BCS after calving group was 1.49 (95% CI 1.08 – 2.04) if cows lost 0.5 in BCS after calving and 2.26 (95% CI 1.30 – 3.95) for cows losing more than 0.5 BCS after calving. Increased BCS at calving group showed a protective association with lameness status. Animals calving in BCS 3.25 and ≥ 3.5 respectfully had an OR of 0.54 (95% CI 0.34 – 0.87) and 0.33 (95% CI 0.16 – 0.65) of being lame compared to cows calving with BCS ≤ 2.75. The BCS 3 at calving group did not show a significant OR ($p = 0.31$) but followed the protective trend found in this variable.

Conclusions

Despite access to pasture having a protective effect on the occurrence of lameness (Chapinal et al., 2013), we identified nearly 20% of cows lame during the study. Increasing parity and BCS loss after calving were associated with an increased risk for lameness whereas increased BCS at calving was associated with reduced risk for lameness.

The results of this study show that data gathered as part of a routine herd health programme have the potential to be used in conjunction with lameness records to identify shortcomings in the on-farm lameness management. Findings and recommendations on lameness management of different age groups and cows in different nutritional status can be formulated from readily available information on cow-based risk factors for lameness. Further analyses of lameness data and identification of associated risk factors is required to further understand the dynamics of lameness in pasture-based, spring calving dairy herds and to formulate strategies to reduce the incidence of this debilitating condition.

Acknowledge

The authors wish to thank Mary Duane, Lea Krump, Eoin Ryan and Miha Savç for assisting in the locomotion soring, Farm Relief Services for providing the foot trimming service and the 10 farmers for taking part in the study.

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Tables

Variable	N (cows)	Mean (SD)	Median	Min / Max[1]
Lactation number	1715	2.73 (1.74)	2	1 / 11
1st Lactation	542			
2nd Lactation	387			
3rd Lactation	283			
4th+ Lactation	503			
305day ECM yield (Kg)		6423.9 (1331.1)	6374.5	2792 / 10242
Peak milk yield (Kg)		33.9 (7.1)	33.7	14.70 / 53.90
EBI overall (€)		128.0 (42.6)	132.3	-80.9 / 283.7
EBI fertility (€)		64.3 (32.1)	66.4	-53.8 / 154.4
No. of LS recorded		2.9 (0.90)	3	1 / 4
DIM identified lame (days)	337	84.4 (53.2)	73	2 / 231
Calving month				
January	309			
February	757			
March	439			
April, May and June	210			
BCS at calving				
≤ 2.75	223			
3	694			
3.25	613			
≥ 3.5	146			
Max[1] BCS loss post calving				
< 0.5	1057			
0.5	500			
> 0.5	118			

Table 1: Study population descriptive statistics of parity, calving date, milk production, BCS at calving and BCS loss post calving, EBI, the number of locomotion scores recorded per cow during each lactation and DIM cows were identified as lame.

Variable	Odds ratio	SE	p value	95% CI for OR
Intercept	0.06	0.02	<0.0001	0.03 – 0.13
Farm				
1	1	reference		
2	0.97	0.30	0.93	0.53 – 1.79
3	1.07	0.38	0.85	0.53 – 2.14
4	1.53	0.54	0.23	0.77 – 3.05
5	1.63	0.52	0.13	0.87 – 3.04
6	1.02	0.35	0.96	0.52 – 1.98
7	1.35	0.51	0.43	0.64 – 2.85
8	1.77	0.56	0.07	0.96 – 3.28
9	1.57	0.73	0.33	0.63 – 3.93
10	1.96	0.60	0.03	1.07 – 3.59
Lactation group				
Lactation 1	1	reference		
Lactation 2	1.52	0.39	0.10	0.92 – 2.50
Lactation 3	3.92	0.93	<0.0001	2.46 – 6.24
Lactation 4+	8.60	1.82	<0.0001	5.68 – 13.0
BCS at calving group				
≤ 2.75	1	reference		
3	0.82	0.16	0.31	0.56 – 1.20
3.25	0.54	0.13	0.01	0.34 – 0.87
≥ 3.5	0.33	0.11	0.001	0.16 – 0.65
Max BCS loss				
< 0.5	1	reference		
0.5	1.49	0.24	0.01	1.08 – 2.05
> 0.5	2.26	0.64	0.004	1.30 – 3.95

Table 2: Summary of the final model of routine herd health data as cow-based risk factors associated with lameness in dairy cows. Lameness was defined as a LS ≥ 3 being awarded during lactation.

Impact of permanent grassland, pasture management, perennial field forage cultivation and fodder conservation on efficiency, animal health, value and environmental compatibility of dairy production in the grassland region "Eifel", Germany

Andrea Fiedler[1*], Katharina Luhmer[2], Rudolf Leifert[3], Stéphanie Zimmer[3], Hanna Heidt[3]

Introduction

In recent decades, more and more new symptoms have developed on dairy farms which no longer can be attributed to classic diseases. Subclinical acidosis, subclinical ketosis as well as digital dermatitis and other diseases have not been known forty years ago. The causes of these diseases are due to several factors and can no longer be clearly analysed and named. These diseases are therefore grouped together as "factor diseases". In both advisory and research, the disciplinary approach is the common method to find a solution. This makes it difficult to analyse causal relations within complex systems such as keeping and feeding of dairy cows. An interdisciplinary approach is therefore indispensable in order to optimize dairy production in a sustainable and economically efficient way. Such an innovative, interdisciplinary approach needs to focus on actors (practice, consultation, research), as well as observations and analyses (soil, grassland, feed conservation, feeding, animal health).

Materials and Methods

Data collection started in 2016. In the region of Eifel, Germany, there are five dairy farms involved in this project, farm size from 65 to 230, 250 and 600 dairy cows. In relation to the weather conditions grassland and forage production was analysed with regard to their yields while taking into account their fertilization and cutting times. Soluble contents in grass material like nitrate, ammonium and soluble carbohydrates play an important role in fertilization processes with great impact on silage quality (Kaiser et al. 1997; Palhlow et al., 1992; Weiß, 2001). That is why these parameters were determined in freshly cut forages on the associated farms. On each harvest date and also in timeframes in between forage samples from five representative fields per farm were processed with a meat mincing machine and a kitchen press to gain access to the liquid content. Laboratory analyses were carried out immediately afterwards with the use of a reflectometer (RQflex® 20Reflectoquant®, Merck KGaA) to determine the chosen parameters via spectrophotometry. Additionally, biomass yield estimations were made at every harvest by taking replicated forage samples from the individual fields to analyse fresh and dry matter weight. Regarding dairy production, hoof health will be analysed by evaluating the data collected during regular trimming (Egger-Danner et al., 2015) with regard to change of feed; herd health data will be analyzed on the basis of veterinary care. Body condition scoring (Ferguson et al., 1994) and Locomotion Scoring has taken place on a regular base since 2016.

Results

Analyses of nitrate, ammonium and sugar in the harvest were made to investigate quality parameters of annual and permanent grasslands to gain information about changing plant chemical composition and in consequence the influence on fermentation processes (Luhmer, 2018). In 2017 nitrate concentrations stayed below 700 mg L^{-1} in the pressed grass liquid on all investigated sites until the end of may but variability

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increased towards late summer. Nitrate concentrations in June varied in the range of more than 4000 mg L^{-1} revealing a very inhomogeneous pattern that corresponds to the findings of PAHLOW et al. (1992) who also noticed greater variability of nitrate levels in harvests made later in the year compared to early cuts. Ammonium concentrations were also measured, showing similar distribution patterns as nitrate with even stronger variation throughout the whole sampling season. As high nitrate levels do not provide optimal ensiling conditions, the harvests made in summer from second to fourth cut were more at risk for containing too much nitrate. However low concentrations were detected at the same time on neighbouring fields, contributing to other risks caused by lack of nitrate as for example insufficient clostridia suppression (KAISER et al. 1997). Regarding sugar contents a reversed trend was observed. The concentration of glucose and fructose in the forage samples was increased at the beginning of the growing period and decreased until September.
Still an overall high variability between 12 g L-1 and 67 g L-1 was noticed and this variation occurred not only between fields but also on the same fields in short time-frames (24 h). High contents of water-soluble carbohydrates like glucose and fructose are favored in the fermentation process because they provide resources for the probiotic communities, especially lactobacilli that are beneficial for obtaining good silage qualities (WEISS 2001). According to that forages from the early harvests in 2017 tend to provide preferable conditions for ensilage.

Conclusions

In 2017 the contents of nitrate, ammonium and water soluble carbohydrates in form of glucose and fructose in freshly cut grass showed great variability throughout the growing period with small trends of lower nitrate and higher sugar concentrations in grasses of early harvests. The influence of the individual farm was not as distinct as the differences between cutting times. Analysing the resulting silages and further monitoring cow health status will provide insight in the connections between forage material composition, fermentation processes and animal health. Along with monitoring additional parameters like climatic conditions, soil and plant species composition, fertilization and weed management the project aims at a better understanding of factors influencing feed quality made from grassland. Due to the project duration from 2016 to 2019 analysing the influence of the grassland and forage production, as well as the conservation methods on the basic feed intake and animal health of the dairy cow, thus improving the profitability of dairy cattle as a whole will be finished in Summer 2019.

Acknowledge

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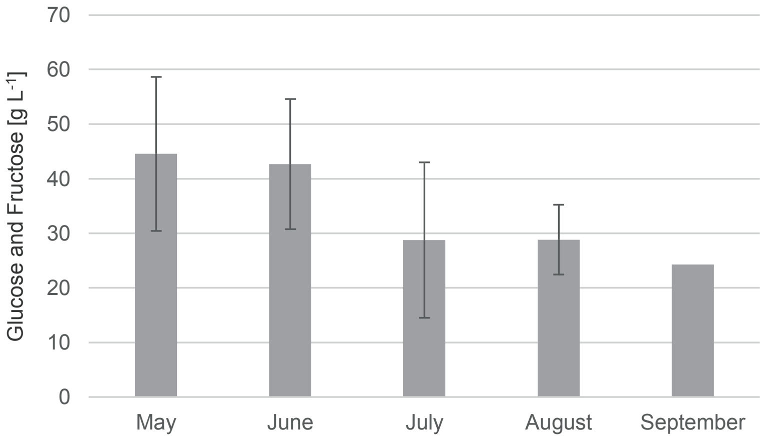

Fig. 1 Average concentrations of glucose and fructose in g L^{-1} measured in fresh forage samples from grasslands of four farms in the Eifel region in 2017

Fig. 1 Evaluation of silage

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Fig. 1 Locomotion Score

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Effect of soil moisture and rainfall: Observations on an unusual presentation of toe ulcers in pasture-based dairy cattle

Linda J. Laven[1], Kristina R. Müller[1]

Introduction

Toe ulcers, as defined by the ICAR claw health atlas, are a well-known disease of the claw horn capsule and cause of lameness in cattle. Prevalence of these lesions is usually low compared to other claw horn lesions like sole ulcers and white line disease. Toe ulcers are usually located in claw zone 1 or 5 with most lesions being in the lateral claw of a hind limb. They are usually attributed to overzealous claw trimming, housing on abrasive concrete floors, or thin soles. This paper describes the seasonally increased incidence of an unusual form of toe ulcers in a pasture-based dairy herd.

Materials and Methods

Fortnightly lameness visits were carried out on a 600-cow spring-calving pasture-based dairy farm in the Manawatu region of New Zealand. All cows with abnormal locomotion scores were presented at these visits for veterinary lameness examination in a hydraulic WOPA foot-trimming chute. Regular lameness visits were carried out from October 2016 to March 2017 for an unrelated trial and continued in the 2017/18 season on a commercial basis. Claw lesions and affected claws were recorded and the cows were treated according to the lesions that were present. There was no preventative functional claw trimming performed in this herd.

A total of 67 lameness events attributable to claw horn lesions were documented from October 2016 to March 2017 and 59 lameness events in the same period in the 2017/18 season. White line disease was the most prevalent lesion found in lame cows during both of these periods (accounting for 69% of lameness and 54% in 2016/17 and 2017/18, respectively). However, in February 2017 there was an unexplained increase in toe ulcers with an uncommon location and presentation. These toe ulcers made up 65% of all lameness cases in February while white line disease accounted for only 30%. In the 2017/18 season the client moved his herd to another farm, in the same region, however, an increase in incidence of these unusual toe ulcers was observed again between January and March 2018.

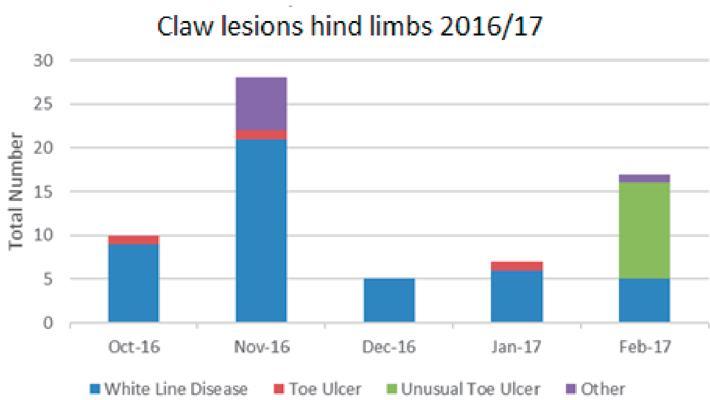

Figure 1: Claw lesions hind limbs 2016/17

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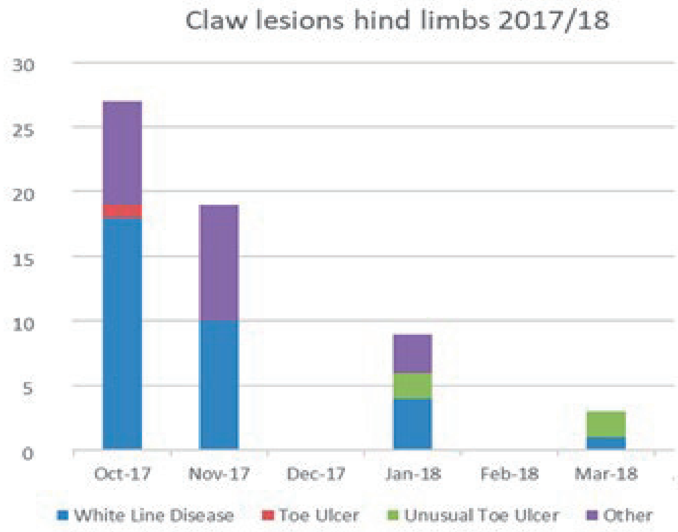

Figure 2: Claw lesions hind limbs 2017/18

All these unusual toe ulcers were located in the medial claw of either the left or right hind limb. The lesions were painful; cows were scored with a lameness score of 3-4 (5 point scale). In all cases there was a lentil-sized, punctate lesion in zone 5 of the sole horn towards zone 2/3. While close to the white line in many instances lesions were independent of it and sited in the sole horn, and were often surrounded by an area of horn haemorrhage. The amount of underrun horn seen when the lesion was pared was usually moderate, and no tracking to the tip of the toe was observed. Signs of toe necrosis were not present. In many cases a similar looking lesion was found to be developing on the other hind foot in exactly the same position even though there was no apparent lameness in that claw.

The lesion responded well to debridement and topical antibiotic spray. The lateral claw of the affected limb received a hoof block to elevate the lesion and relieve the pain associated with it. Although, NSAID treatment was considered on a case-by-case basis, elevation provided good relief for pain and only cows with other disease (e.g. foot rot) required additional treatment.

As the seasonal occurrence of the lesion was consistent between farms and between years it was decided to look at the meteorological data to see if there was any evidence that lesion occurrence was being influenced by soil moisture or rainfall. This abstract presents the analysis for the 2016/17 outbreak, further detail on the 2017/18 season will be available at the conference.

Results

The changes with time in average soil moisture, maximum rainfall and average rainfall for each month are presented in Table 1.

2016/17 season	Soil moisture (*%)	Average rainfall (mm)	Peak rainfall (mm)
September	28.2	2.9	22.2
October	25.7	3.7	28.8
November	26.3	4.1	24.8
December	19.9	4.2	56.2
January	21.6	5.5	56.2
February	22.7	8.1	48.8

Table 1: Changes in average soil moisture (*temperature corrected, %) and rainfall (mm) for the 2016/17 production season.

There was no evidence that soil moisture was associated with the occurrence of the lesions. Initial analysis suggested that increased rainfall in February which was over five times the expected total may be linked to the detection of this unusual ulcer. Further analysis is ongoing.

Conclusions

Sole injury and white line disease are the most common causes for lameness in dairy cattle in New Zealand. While toe ulcers can be diagnosed sporadically in New Zealand, they are more commonly found in the front feet in heifers rather than in the hind feet of mature cows. The seasonal increase in the incidence of toe ulcers with an uncommon presentation was not attributable to any of the known risk factors for development of toe ulcers, and did not coincide with seasonal management factors such as mating which have been described to contribute to an increased prevalence of clinical lameness in seasonally-calving, pasture-based dairy cattle. Furthermore, the seasonal pattern persisted even when the client moved his herd to a different farm in the following season. More research is required to determine the mechanisms behind the development of these claw horn lesions in order to implement effective preventative measures on farm. It is also paramount to establish more precise terminology of claw horn lesions to enable comparison and establish risk factors.

Fescue foot proven in the Netherlands

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GD Animal Health

Introduction

Fescue lameness, which resembles ergot poisoning, is believed to be caused by ergot alkaloids, especially ergovaline, produced by the endophyte fungus *Neotyphodium coenophialum* in tall fescue grass (*Lolium arundinaceum*, formerly *Festuca arundinacea*). It begins with lameness in one or both hindfeet and may progress to necrosis of the distal part of the affected limb(s). The tail and ears also may be affected independently of the lameness. In addition to gangrene of these extremities, animals may show loss of body mass, an arched back, and a rough coat. Outbreaks have been confirmed in cattle, and similar lesions have been reported in sheep.

Materials and Methods

At the end of 2017 GD-AH was contacted about serious claw-health problems in both young dairy cows and in young stock also. The clinical symptoms started with severe lameness on the hind legs of several dairy cows and in young stock. Especially in some heifers the claw condition deteriorated rapidly and the animal had to be euthanized or slaughtered. The original clinical picture presented itself as an attack on the wall of the horn shoe, which showed not any recovery after functional and therapeutic trimming. Since the final diagnosis could not be made clinically, a heifer and a calf of 6 weeks, both with typical symptoms, were offered to GD-AH for pathological examination.

Results

A striking vasoconstriction in the blood vessels in the horn shoe was observed during histological examination. After excluding other possible causes such as Salmonellosis, Fescue foot was suggested as a probably diagnosis. The silage, which looked completely normal, was examined at a toxicological laboratory (RIKILT, WUR) in Utrecht and the toxins ergot alkaloids were proven.

Conclusions

As far as we know this is the first time a confirmed diagnosis was made of Fescue foot in Western Europe.

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Comparison of hoof measurements when using a Japanese butterfly gauge and a standard gauge.

Ángel García Muñoz[1] and Gerard Cramer[2*]

Introduction

Lameness is an important disease in dairy cattle and hoof trimming is a common preventative practice. A key step in hoof trimming is determining the appropriate dorsal wall hoof length. Current data suggests the traditional 7.5 cm recommendation might be too short. Recently, a butterfly gauge has been introduced that determines appropriate dorsal wall length based on foot with at the coronary band. The objectives of this project were to compare dorsal wall length and other hoof measurements using either the Japanese butterfly gauge or a traditional gauge.

Materials and Methods

This study was conducted by taking measurements of 43 feet collected from a slaughter plant. These feet were stored in a freezer and thawed the day prior to measuring. On the day of measuring both the hoof width was measured and using the butterfly gauge cut to the appropriate dorsal wall length using a band saw. Once the dorsal wall was cut the hoof was cut in a sagittal plane at 1.5 cm from the interdigital space and various measurements were taken including P3 length, sole thickness under P3 and distance from corium at the tip of P3 to the cut edge of the dorsal wall. After taking the measurements from the hoof cut with the butterfly gauge the hoof was recut with a standard gauge and the measurements were taken again. Measurements were taking on both the sides of the sagittal cut.

Results

Average hoof width was 10.6 cm. Only 19/43 feet were able to be cut with the butterfly gauge. Baesed on the presumed lateral hoof. average DWL based on the butterfly gauge was 9.0 cm. P3 length was 6.3 cm. Sole thickness without trimming the sole was 1.3 cm and distance from the corium to the tip of P3 to the cut edge was 1.7 cm. Average DWL based on the standard gauge was 7.8. Sole thickness without trimming the sole was 1.6 cm and distance from the corium to the tip of P3 to the cut edge was 1.2 cm. No feet cut with standard gauge exposed corium at the cut edge.

Conclusions

Results from this small cadaver feet study indicate the standard gauge did not result in a DWL that was too short. The butterfly gauge resulted in a large proportion of feet that would not have been trimmed.

Acknowledgements

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Can a 30 minute observer training lead to adequate inter-observer reliability in a 3-point locomotion score?

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Introduction

Despite all efforts, lameness is still one of the main health issues in modern dairy herds and mean herd level prevalence has not decreased in the last decades. Besides underlying causes such as housing conditions, selective breeding and feeding, the recognition of lame animals by the farmer is still one reason for the persistently high numbers of lame animals, as they are often treated too late or not at all. That is why we think that lameness observation should be systematized with a scoring system that is suitable for the use on farm. Meaning that it should be simple and fast to be done during daily routine, quantifiable, reproducible and that a person can easily be trained in its application. A three-point locomotion score according to Grimm and Lorenzini [1] was therefore invented. Its validity to represent the lameness status of a cow as well as good inter- and intra-observer reliability have already been proven with experienced observers [2]. In this trial, we wanted to evaluate if already a quick training of professional hoof trimmers could result in high reliability of the scoring system, too.

Materials and Methods

The 3-point locomotion score is defined by 1 = "sound" (animals shows regular, smooth and symmetric gait): the cow needs no further treatment; 2 = "unsound" (like score 1 but animal presents with one or more of the symptoms head bob, arched back and compensatory posture): the cow should be rechecked within a week; and 3 = "lame" (animal shows irregular, uneven and asymmetric gait): the cow should be treated immediately. It was tested for inter-observer reliability with 53 observers. All observers were professional hoof trimmers (HT). They were separated in three groups A, B and C and then trained how to use the score for 30 minutes by observing and discussing the individual features of the score with a person very experienced (PE) in using the score. Following this short training, 14 different cows from the same herd were then observed for the test of inter-observer reliability by the HT. In every group, the PE scored the cows, too, resulting in 3 observations per cow made by the PE.
After data collection, Krippendorff's Alpha [3] was calculated to assess inter-rater reliability of the HT and intra-rater reliability for the PE.

Results

Inter-observer reliability of the HT was low with Krippendorff's Alpha = 0.19 (95 % Confidence interval = 0.09-0.26) indicating high disagreement, where a value of 0 means complete disagreement and 1 means perfect agreement. In contrast to that, intra-observer reliability of the PE was very high with Krippendorff's Alpha = 0.74 (95 % Confidence interval = 0.43-0.95).

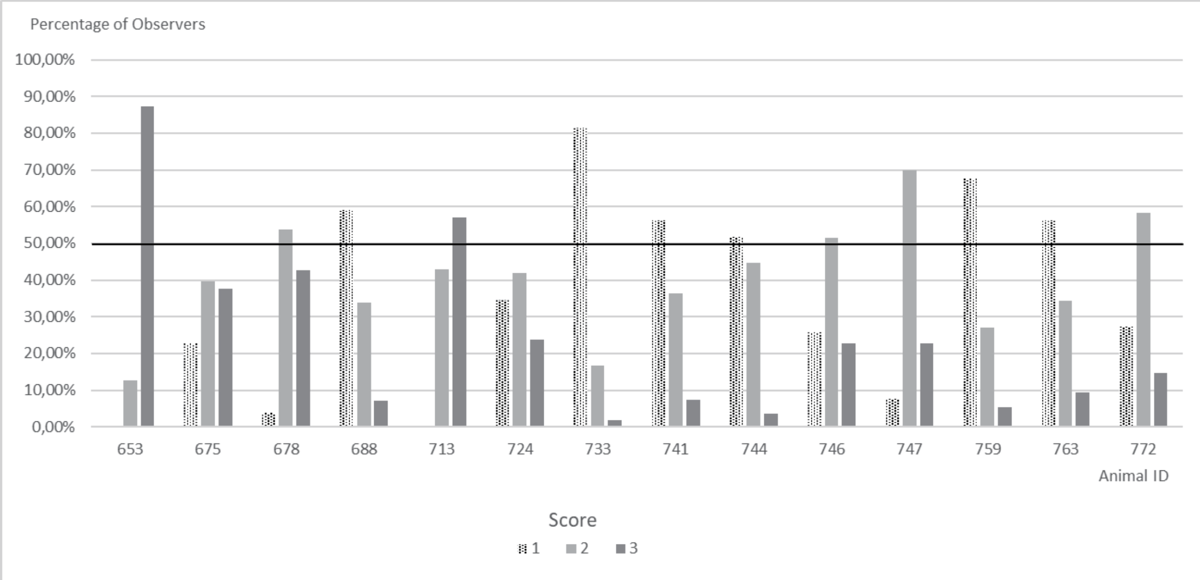

Figure 1, Percentage of assigned scores per animal for the 53 HT

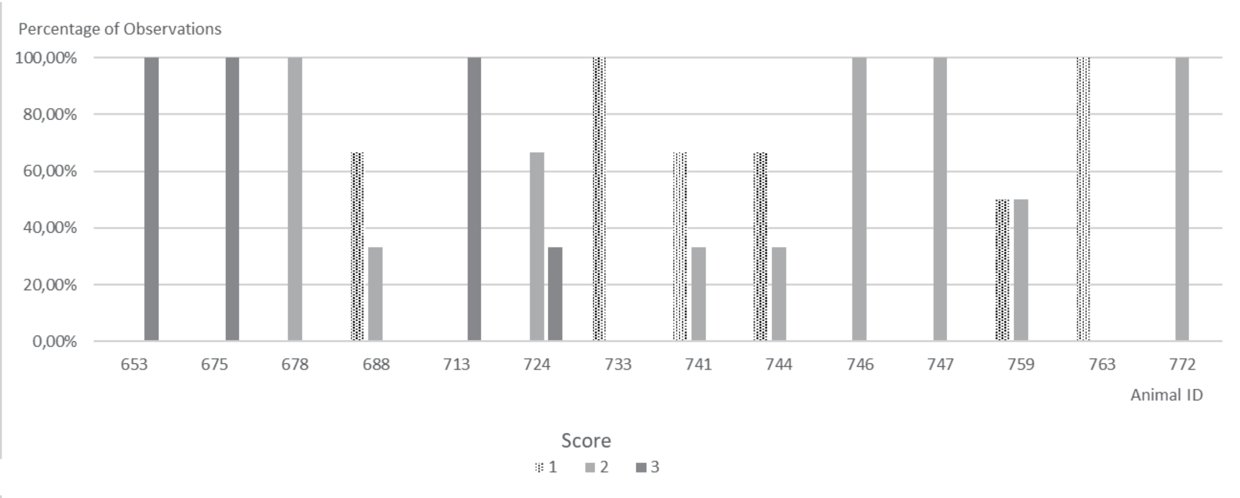

Figure 2, Percentage of assigned scores per animal for the 1 PE

Conclusions

The trial resulted in a high intra-observer reliability for the PE in contrast to a low value for the inter-observer reliability. One major reason for that could be the difference in experience in the use of the scoring system suggesting that the 30 minute training is not enough to train observers in order to reach an adequate inter-observer reliability. Yet, the reliability of the scoring system when used by experienced observers could again be verified.

Acknowledge

We thank all the members of the German hoof trimmers association VGK e. V. for making this trial possible.

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In-shed screening technique for detection of lameness in a pasture-based dairy herd

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Introduction

Lameness detection is still a significant challenge in the dairy industry. Various techniques exist to detect lameness in dairy cows including infrared thermography (IRT), locomotion scoring (LS), and automatic gait analysis. Currently locomotion scoring is the most commonly used method of lameness detection in New Zealand; however, in the pasture-based system in New Zealand, this requires a member of staff to stand watching cows exiting the parlour for the whole period of milking. An alternative to that procedure would be to observe cows for lameness while milking; a process that could permit a staff member to milk and record lameness at the same time. The current study aimed to compare an in-shed screening (ISS) technique, which involved a limited number of indicators, with whole herd locomotion scoring as a method of detection of lameness in a pasture-based dairy herd in New Zealand.

Materials and Methods

The checklist of indicators observed is summarised in Table 1. Data were collected from a 1200-cow dairy farm with a rotary parlour in the North Island of New Zealand. This was followed by whole herd locomotion scoring (Dairy NZ 0-3 scale) as cows exited the milking parlour. A linear mixed model and Chi-squared tests were employed to explore the association between the in-shed screening and locomotion scoring system (0 – 3) for detection of lameness in dairy herds.

Results

Of the 940 cows milking at the time of examination 232 cows had results for both methods. The in-shed screening technique identified 58 (25%) cows with at least one of the indicators in the checklist while locomotion scoring system detected 38 (16.4%) lame cows with scores ≥ 2.

A linear mixed model in –2 restricted log likelihood and the Chi-squared test ($X^2 = 46.57$, $P < 0.0001$) revealed a significant association between both methods tested.

Conclusions

This study has shown that the results of in-shed screening are related to locomotion score. Further research is required to i) establish this relationship across more farms (with both rotary and herring-bone parlours); ii) to identify the feasibility of all milking cows rather than just a proportion being assessed; and iii) to identify whether in-shed screening can reliably differentiate cows with locomotion score 1, which should just be monitored, from cows with locomotion score ≥2 which need treatment.

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Table 1: The checklist of indicators used during the in-shed screening

Indicator	Description
Shifting weight (SW)	Frequently changing of feet, i.e., twice or more per 30 seconds
Abnormal weight distribution (AWD)	The asymmetric placing of the claws on the ground
Swollen heel or hock joint (SHH)	Abnormal swelling of the heel and hock joint
Overgrown hoof (OH)	Excessive growth of the toe on at least one claw
Abnormal claw injury (ACI)	Any visible injury on the foot

MobilityCheck for holistic data pooling in the programme "CowsAndMore" – Digital weak point analysis

Andreas Pelzer[1], Anna-Lena Ahring[1]*, Andrea Fiedler[2]

Concept approach

The software "CowsAndMore" has launched an assistance system that enables us to systematically and objectively detect weaknesses in husbandry conditions and management in free stall dairy barns based on criteria of animal husbandry and the animals themselves. The digital weakpoint analysis compares the individual farm to defined target values and comparative values of a specific data pool as well as to calculated scientific model calculations of animals, environment and management.

In order to be able to take a holistic view of the farms and to further optimise them, the on-farm examination has been extended to include the MobilityCheck module.

Method MobiltyCheck

For the analysis of claw health and mobility, specific indicators were selected and summarised in a digital acquisition matrix. With MobilityCheck farmers and advisors are able to detect weak points of mobility and lameness at an earlier stage.

<table>
<tr><th colspan="3">Behaviour</th><th colspan="3">Habitus</th></tr>
<tr><th colspan="3"><u>Standing</u></th><th colspan="3">Claw</th></tr>
<tr><th>Indicator</th><th>Type of detection</th><th>System</th><th>Indicator</th><th>Type of detection</th><th>System</th></tr>
<tr><td>Standing on three legs</td><td>Observation</td><td>CowsAndMore</td><td>Length of dorsal wall</td><td>Measurement</td><td>CowsAndMore</td></tr>
<tr><td>Locomotion Score Standing Score</td><td>Quality rating</td><td>Sprecher 1997</td><td>Curving of dorsal wall</td><td>Quality rating</td><td>CowsAndMore</td></tr>
<tr><td>Basewide standing
Toes pointed outwards</td><td>Quality rating</td><td>Claw positioning code score (Kofler)</td><td>Evenness of toes</td><td>Quality rating</td><td>CowsAndMore</td></tr>
<tr><td>Pattering</td><td>Observation</td><td>Count</td><td>Height of claw</td><td>Quality rating</td><td>CowsAndMore</td></tr>
<tr><td>Lightening the weight on a limb</td><td>Observation</td><td>CowsAndMore</td><td>Angle of claw</td><td>Quality rating</td><td>CowsAndMore</td></tr>
<tr><td colspan="3"><u>Walking</u></td><td>Condition of skin and horn in heel area</td><td rowspan="2">Quality rating</td><td rowspan="2">CowsAndMore</td></tr>
<tr><td>Head back line</td><td>Observation</td><td>CowsAndMore</td><td>Distortions</td></tr>
</table>

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Outlook

With the help of this digital acquisition, a farm can be advised more holistically. In addition, the quality of advice is further optimised by clearly defining when the data is collected in order to be able to connect farms more closely and issue better recommendations of action.
By objectively and systematically recording criteria and indicators relating to herd behaviour, habitus and metabolism as well as a standardised analysis by the database, weaknesses in husbandry and management can be identified and important approaches to optimisation can be undertaken.
The programme provides scientific research, facilitates giving neutral advice and helps self-critical practitioners to create an environment for cows in which animal welfare and well-being in the sense of an economic-oriented milk production play a significant role.

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Ultrasonographi findings of healing process in fracture of the distal phalanx in a cow

Katsufumi Ooshita[1,*] , Yasutake Itou[1] and Ichiro Ishibashi[1]

Introduction

Fractures of the distal phalanx are the rare claw diseases occurring typically within the inner claw of fore-leg. Radiography is the most accurate diagnostic tool, because of the definite finding showing the fracture's lines (seen as radiolucent compared with the peripheral bone structure) running at proximal–distal direction within bony body of the distal phalanx under the distal interphalangeal joints. However, overlapping of both the inner and outer claws (as the inevitable problem in radiographic examinations for even-toed ungulates) is always the disadvantage in the diagnosis. Ultrasonography is recently utilized to measure thickness of the sole horns and the soft tissue layers, and to diagnose various sole diseases. This study shows diachronic changes of radiographic and ultrasonographic findings indicative of the healing process in fractures of the distal phalanx in cattle.

Materials and Methods

Radiographic examination: The lateral radiographic images of the claws were obtained using portable radiographic device (PX-20BT; KenkoTokina Co., Tokyo, Japan), and were generated using 60 kV and 2 mAs,

Ultrasonographic examination: A 5-MHz linear probe with portable ultrasonographic device (HONDA HS-101V; HONDA Electronics, Tokyo, Japan) was applied to the sole surface of the claws that have been trimmed before examinations.

Imaging analysis: the dorsal and ventral widths of the fracture's gap under the distal interphalangeal joint were measured on the radiographic images using an imaging software (ImageJ 1.42; NIH, USA).

Results

A 5 year-old Holstein female cattle presented lameness in the left hind limb. On Day 1, swelling was evident in the coronet, but the lesion was not grossly observed in the sole surface and the interdigital space. On Day 12, pain was evident in the heel region of the outer claw, in spite of no horny and skin lesions after trimming. Claw block was attached to the inner claw. On Day 25, use of radiography revealed the radiolucent line of fracture running dorsal-ventral direction within the distal phalanx under the distal interphalangeal joint. The distal phalanx was separated into the cranial and caudal bone fragments due to the gap. On radiograph, the dorsal and ventral widths of the gap (DWG and VWG) were 0.75 cm and 1.69 cm, respectively. Length between the apex and the fracture line within cranial bone fragment (LA-F), length between the fracture line and the caudal edge within caudal bone fragment (LF-C), and length of the apex and the caudal edge of the whole body (LA-C) were 5.25cm, 1.26 cm, and 8.04 cm, respectively. On Day 50, lameness was gradually improved. Use of ultrasonography revealed that echogenic line of ventral surface of the distal phalanx was interrupted between the deepest concaved site and the flexor tuberosity. The gap was seen anechoic inside, and represented by echogenic line at most distal region. On ultrasonograph, width of the fracture gap (WG) was 1.32 cm. On Day 166, second radiographic examination revealed the decreased DWG (0.15 cm) and VWG (1.03 cm), despite fracture line was seen clearly. LA-F, LA-C, and LA-C were 5.20cm, 1.27cm, and 7.37 cm, respectively. Second ultrasonographic examination revealed that the fracture gap was filled with the heterogenous echogenic structures, resulting in connection between cranial and caudal edges of the interrupted site of echogenic bone line (suspecting bony union). On Day 313, fracture gap with DWG (0.07 cm) and VWG (0.97 cm) was seen comparatively radiopaque on radiograph. On ultrasonograph, the echogenic line was present between cranial and caudal edges of the fracture gap. Finally, lameness was disappeared, and the cow was kept for milking.

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Conclusions

Clinical uses of radiography and ultrasonography for a cow with sudden lameness enabled antemortem diagnosis of fracture of the distal phalanx, and visualization of healing process of the disease when the claw was continuously examined. Interruption of echogenic bone line is a definitive ultrasonographic sign to diagnose this disease, and increase in echogenicity within the fracture gap is easily suspected healing process of this disease. Thus, ultrasonography can be utilized as one of the diagnostic imaging tools as well as radiography.

Measurement Error of Sole Thickness in Uses of Ultrasonography to Cow's Claws

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Introduction

Application of ultrasonography (US) to bovine claws has been reported as the most objective technique to measure sole thickness (ST). Errors in measured values of STs may limit field applications of US to bovine claws. On the basis of a previous report, the correlation coefficient between US and anatomical measurements of STs was high (r = approximately 0.9)[1], but underestimations of STs were frequently recorded in claws with ST of 10 mm using US [2]. The main aim of this study was to determine the US measurement accuracy in claws of any STs, by comparison between data obtained from the US and computed tomographic (CT) images of the same claws.

Materials and Methods

In this study, the specimens comprised 300 inner and outer claws of 150 pairs of hind limbs obtained from culled lactating Holstein-Friesian cows from a slaughterhouse (Tottori Meat Inspection Center, Tottori Prefectural Government, Tottori, Japan); applied to 150 pairs of hind limbs obtained from slaughterhouse. Slight trimming was performed for all claws before CT and US examinations to achieve smoothing of the irregular sole surfaces.

US examinations: US device (HI VISION Preirus; Hitachi-Aloka Medical, Tokyo, Japan) was used. US probes were a linear 6.5-MHz type, and a convex 5.0-MHz type. The sensitivity of the probes was 0.1 mm. Transmission gel was applied to the contact surface of the probes, which were subsequently applied to the weight-bearing surface on longitudinal virtual straight lines reaching from the midpoint of the toe area to the middle of the heel (= palmar/plantar) area of claws [2]. Measurements were performed at three points: Point sole 1 (S1), located on virtual lines from the most apical margin of the distal phalanx to the sole surface; Point sole 2 (S2), located on virtual lines from the deepest concavity of the ventral surface of the distal phalanx; and Point sole 3 (S3), located on virtual lines from the flexor tuberosity

CT examinations: CT images were obtained using two device types; a slip-ring scanner (Pronto SE, Hitachi, Tokyo, Japan) and a 16-section multidetector scanner (ECLOS; Hitachi, Tokyo, Japan). Sagittal two-dimensional images were obtained through an image analysis system (AZE Virtual Place, AZE Corp., Tokyo, Japan).

Statistical examinations: US measurement error of STs was evaluated based on difference between the US and CT values obtained using each of two devices in the same claws, and the values measured on the US images were subtracted from the values measured on the CT images (named as C-U value). The statistical correlation between the C-U value and the SHT on the CT images was investigated using Pearson's correlation coefficients. In addition, it was defined as moderate that STs measured using US were within a measurement error of ±1 mm compared to those measured using CT. US measurement accuracy within a ±1-mm range was assessed in claws with the common US views. The claws were classified into four groups on the basis of STs measured on CT as follows: <5 mm, 5-<7 mm, 7-<10 mm, and ≥10 mm. Proportion of moderate C-U values among the four SHT groups, and that of the total values was assessed using chi-square test. A P value <0.05 was considered as statistically significant.

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Results

In this study, the STs could be measured on the US images of 552, 548, and 534 claws of 600 claws at points S1, S2, and S3, respectively. Statistically significant and strong correlations between the C-U value and ST were detected at points S1, S2, and S3 (r = 0.68, 0.61, and 0.57, respectively). US measurement accuracies within a ±1-mm range at points S1, and S2 were 56.2%, and 50.5%, and were significantly higher than that at point S3 (40.1%). The values in claws with STs <5 mm, 5-<7 mm, 7-<10 mm, and ≥10 mm were 84.9-91.3%, 66.7-71.9%, 28.9-51.2%, and 6.2-.19.7%, respectively; with significantly higher values in <5 mm group versus 5-<7 mm, 7-<10 mm, ≥10 mm, and total groups.

Conclusions

Measurement accuracy within a ±1-mm range was found in approximately 90% of claws with a ST <5 mm through US devices. This indicates that application of US devices to bovine claws is useful for diagnosing cattle with the thin soles.

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Bayesian superpopulation approach to evaluate the ability of detecting bovine digital dermatitis in the milking parlour without washing cows' feet

D. Aaron Yang[1] & Richard Laven[1]

Introduction

Bovine digital dermatitis (BDD) is an infectious foot disease which affects cattle worldwide. The most cost-efficient diagnostic method is visually assessing cows' feet in the milking parlour during milking. Generally the visual assessment requires washing feet before examination. Although it has been suggested that visual assessment without washing could miss BDD cases, simply comparing prevalences reported by with or without washing is inadequate as some of the positives reported by without washing method may be "false positive". Then the true prevalence ratio (prevalence with washing/prevalence without washing) may be even higher than the raw prevalence ratio. This analysis therefore collected cow ID for positive cows reported by each method, and provided more information about these two diagnostic methods.

Materials and Methods

Two herds with 286 (herd 1) and 254 (herd 2) cows in Waikato, a region in the North Island of New Zealand (NZ) were selected. In each herd, half of the total numbers of cows were selected as study population. The two diagnostic methods were assumed to be correlated and the data were analysed using a Bayesian superpopulation approach. The basic idea is using the samples to make inference on a postulated superpopulation where the actual finite population was drawn from and which could be used to make inferences on the unsampled portion. Different priors were placed on the sensitivity of without washing method as sensitivity analyses.

Results

Compared to visual assessment without washing, visual assessment with washing had higher sensitivity. The difference in sensitivities was 33.9% (95CrI:14.9%-50.8%) and the probability of the difference being greater than zero was 0.9997. However, the specificities of both methods were very high, approaching one.

Conclusions

As in the confined system, visual assessment without prior feet wash in the milking parlour is not appropriate to detect BDD lesions in pasture-based system. Particularly in a herd with very low within-herd prevalence, visual assessment without washing is much more likely to miss the limited cases compared to visual assessment with washing. This results in underestimations of both herd and animal level prevalences.

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3D image analysis system for scanning body condition, body measurements and gait in dairy cows

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Introduction

Animal welfare and animal health are very much in the public eye. EBERT et al. (2017) estimate that up to 50% of cows in a herd suffer from claw and limb diseases which are the second largest causes of death (LKV SACHSEN, 2017). Monitoring early signs of lameness and excessive conditioning in dairy cows requires much training. Scoring is subjective, arduous and somewhat stressful for the test subjects. Irregular scoring can have severe consequences for herd management. The animals are not in ideal condition, and suffer from metabolic disorders that affect milk yield, fertility and lameness. Automatic 3D image analysis sensors can assist the herd manager with the necessary everyday health checks of their cows.

Aim

The assistance system *CowBodyScan* is a further development of the technology used in contactless evaluation of moving dairy cows by means of 3D image sensors (PACHE et al., 2013).
The aim of this technology is to support everyday animal observation and to automatically determine three key parameters to success:

- body condition: Cow Condition Score (ccs),
- gait: Cow Movement Score (cms),
- body measurements: Cow Size (cs).

The parameters gathered from the 3D image analysis are evaluated within the herd management system, deviations from the ideal model for the individual animal are detected and recommendations for further actions are visualised for the farmer.

Concept of *CowBodyScan*

A 3D image sensor is installed above an obstacle-free walkway with electronic animal identification. A 3D model is produced of each cow that goes along the walkway, and defined body points are marked, so their three-dimensional movement can be measured (Figure 1).
The output values for body condition, gait and body measurements – height of withers, sacrum and tailhead, length of back and pelvis, width of shoulder, hips and pelvic floor – are calculated using specific algorithms in real-time.
The herd management system *HERDEplus* receives the ccs, cms and cs parameters via an online interface. The system assesses the animal-specific progressive graph for the individual parameters and detects deviations of the condition and movement parameters from the individual ideal value and generates alerts to help decide whether any action needs to be taken.
As the animals are electronically identified, those animals whose parameters deviate from the norm can be treated immediately. Reports listing lame animals can be transferred to the hoof trimmer using the management software *KlauePad.*

Discussion

Determining the key figures for body condition and gait with no added work load and the fast presentation of cows suspected of having claw problems opens up a whole new dimension for farmers in terms of animal monitoring and preventive health care. Combining the parameters may greatly improve early detection of lameness and general claw health. *CowBodyScan* supports targeted animal monitoring and reduces the response time for necessary treatments. With the assistance system farmers can improve both animal welfare and the economic situation of their dairy farms.

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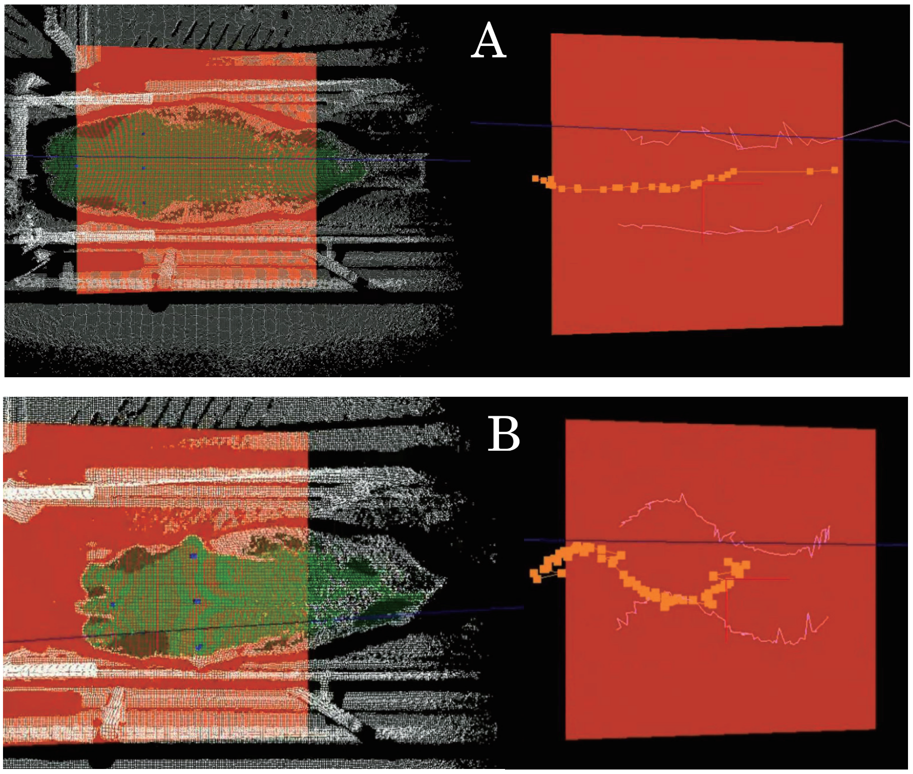

Figure 1: 3D gait profile of a cow without (A) and with lameness (B)

Link to *CowBodyScan*
https://www.youtube.com/watch?v=vnWKZ-t0mDc

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Relationship between automatically recorded activity, health and production data and the diagnosis of lameness in the post-parturient cow

Gitta Borghart[1], Luke E. O'Grady[1], Joris R. Somers[1*]

Introduction

Lameness is usually detected by the herdsman or veterinarian, during routine foot trimming or by visual inspection of the cow's locomotion. Other indicators of lameness include a change in the behavioural time-budget of cows, weight shifting between hind legs and resting of a painful foot (Thorup et al., 2015, García-Muñoz et al., 2016). However, locomotion scoring and other visual inspection methods can be time consuming and subjective, and farmers currently have less time to intensely monitor herd health due to increased farm size (Schlageter-Tello et al., 2014). Automated detection methods for lameness have been developed to aid in early and accurate detection of lameness. However, scarcely any of the researched methods and models have been implemented in practice, mostly due to excessive error rates and false positives alerts.
The objective of this study is to develop a prediction model for lameness in dairy cattle, using remote sensor technology, that will translate sensor data into useful information for the farmer.

Materials and methods

Animals, housing and herd management

Data were collected throughout a single lactation from 164 Holstein-Friesian dairy cows, housed at University College Dublin's Lyons Research Farm. The cows were divided into a systems herd (n=60 spring calving cows), a research herd (n=66 spring calving cows) and an autumn herd (n=38 autumn calving cows).
Cows of the research and autumn herd were trimmed by a lay cattle foot trimmer based on locomotion score results. Foot trimming of the system herd cows was carried out by a trained veterinarian (JS) using the Dutch 5-step method (Toussaint-Raven et al., 1978).

Data collection

Neck-mounted accelerometers (MooMonitor®, Dairymaster®, Causeway, Ireland) continuously recorded activity of the cows. Additional automatically collected data included milk production data and weekly live body weight. Body condition score (BCS), locomotion score (LS) and foot lesion data were manually recorded. BCS was collected by trained farm staff on a weekly basis. LS was recorded by a trained veterinarian (JS) according to Sprecher et al. (1997) during weekly locomotion scoring of the cows exiting the parlour after milking. Cows which received LS 1 were labelled as sound, cows with LS 2,3,4 or 5 were labelled as unsound. Foot lesion data were collected during regular foot trimming.

Data analysis

The data sets for each of the three herds were analysed separately.
Supervised classification analysis was used to classify cows as sound or unsound, based on all available data, using the assigned LS as reference. The classification models for the three herds were build four times; once with all the variables included, and once with the variables "BCS" and "body weight" removed, since not all farmers have an integrated weighing scale at their disposal or collect BCS. The models were then also tested with a different cut-off value; once with the default 0.5 and once with 0.75. To improve the accuracy of the classification tree, machine learning algorithm boosting was applied. Additionally, hyperparameter tuning was added by doing a grid search. A confusion matrix, receiver-operator curve (ROC-curve) and a calibration plot were built to evaluate prediction output, diagnostic ability and accuracy.
Secondly, foot lesion data were added to the analysis to detect cows that would benefit from treatment within the cohort of cows classified as unsound in the previous step.

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Results

The number of sound/unsound recordings were 880/727, 820/634 and 279/459 in the systems, research and autumn herd respectively.
For the systems herd, the supervised classification analysis resulted in an accuracy of 78%, a specificity (SP) of 80% and a sensitivity (SE) of 76% for the full model with the default cut-off (Table 1). With the cut-off value of 0.75, the full model achieved an accuracy of 77%, SP of 80% and an SE of 75%. The reduced model, with the default cut-off, yielded an accuracy of 78%, SP of 81% and an SE of 74%. With the cut-off value of 0.75, the model achieved an accuracy of 77%, SP of 79% and an SE of 76%.
The same classification models were used on data of the research herd. For the full model of the research herd an accuracy of 80%, SP of 86% and an SE of 74% were achieved. Changing the cut-off value to 0.75 resulted in an accuracy of 80%, a SP of 87% and an SE of 73%. The reduced model showed the same accuracy for both cut-off values. An SP of 86% and an SE of 71% was achieved with the default cut-off value. With 0.75 as cut-off, the SP was 85% and the SE was 72%.
For the full model of the autumn herd an accuracy of 70%, SP of 46% and an SE of 84% was achieved. With 0.75 as cut-off value, an accuracy of 69%, SP of 45% and an SE of 83% were achieved. The reduced classification model for the autumn herd achieved an accuracy of 71%, SP of 50% and an SE of 84%. Changing the cut-off to 0.75, resulted in the same accuracy and SE, but an SP of 48%.
For the systems herd, the best predictive model, and thus the highest AUC, resulted to be the reduced model with the cut-off value of 0.75. For the research herd, the full model is most predictive, irrespective of cut-off value used. The autumn herd models that are most predictive, are the full and reduced models with the cut-off value of 0.75.

Table 1 Accuracy, specificity, sensitivity and AUC for full and reduced classification models, and with the two cut-off values, for each herd.

Herd	Model	Cut-off	Accuracy	Specificity	Sensitivity	AUC
Systems herd	Full model	0.5	78%	80%	76%	0.85
	Full model	0.75	77%	80%	75%	0.85
	Reduced model	0.5	78%	81%	74%	0.85
	Reduced model	0.75	77%	79%	76%	0.86
Research herd	Full model	0.5	80%	86%	74%	0.85
	Full model	0.75	80%	87%	73%	0.85
	Reduced model	0.5	80%	86%	71%	0.83
	Reduced model	0.75	80%	85%	72%	0.83
Autumn herd	Full model	0.5	70%	46%	84%	0.73
	Full model	0.75	69%	45%	83%	0.75
	Reduced model	0.5	71%	50%	84%	0.74
	Reduced model	0.75	71%	48%	84%	0.75

The predicted probabilities of the cows were matched with the foot trimming findings of the cows. The number of foot lesion cases per predicted class (sound/unsound) were compared to the number of foot lesion cases per actual class. The results for the systems herd (full model, cut-off= 0.5) are shown in Table 2. The upper part of the table shows the number of foot lesion cases per predicted class obtained from the model. The lower part shows the number of foot lesion cases per actual class, which was used as a reference. The number of digital dermatitis (DD) lesions of the predictions match the true outcomes for cows classified as sound or unsound. For heel horn erosions (HHE), the predictions of both classes are almost correct, two lesion cases are predicted to be present among unsound cows, while they were present among sound cows.

Table 2 Total number of lesion cases per class of the systems herd (Full model, cut-off=0.5). The upper part of the table shows number of foot lesion cases per predicted class (sound/unsound) obtained from the model. The lower part of the table shows the number of foot lesion cases per actual class, used as a reference.

Predicted class	DD	HHE	DS	IH	LT	SH	SU	WLD	AF	TU	SHOE	None	Total
Sound	4	6	2	0	8	16	0	1	2	0	1	8	48
Unsound	4	7	4	1	6	19	1	4	1	2	3	4	56
True Class	DD	HHE	DS	IH	LT	SH	SU	WLD	AF	TU	SHOE	None	Total
Sound	4	8	3	0	8	15	0	2	1	0	1	8	50
Unsound	4	5	3	1	6	20	1	3	2	2	3	4	54

Note: DD=digital dermatitis, HHE=heel horn erosion, DS=double sole, IH=interdigital hyperplasia, LT=long toe, SH=sole haemorrhage, SU=sole ulcer, WLD=white line disease, AF=axial wall fissure, TU=toe ulcer, SHOE= shoe applied

Conclusions

The objective of this study was to develop a prediction model for lameness in dairy cattle, using remote sensor technology, that will translate sensor data into useful information for the farmer.

Differences between the classification models were small. Changing from a full to a reduced model, keeping the cut-off value equal, had minimal effect on the accuracy, specificity, sensitivity (±1% change) and AUC. The same holds for changing the cut-off value from 0.5 to 0.75, while the type of model remained equal. However, the performance of the models is different between the three herds. Classification models with AUC values around 0.85, which models for the systems and research herds achieve, can be interpreted as good models (0.80>AUC<0.90) according to Swets (1988). The best models for predicting sound cows, those with the highest specificity, are the models of the systems and research herds, which both consist of more cows compared to the autumn herd. The smaller size of the autumn herd contributes to the lowest AUC seen in the autumn herd models (Foody and Mathur, 2006). The full model, with the default cut-off, of the systems herd correctly predicted the foot lesions to a high degree, allocating the predicted presence of lesions correctly to either sound or unsound cows in 94% of cases.

Altogether, the accelerometer, production and health data show potential to predict lameness and identify the cows that would benefit from corrective foot trimming.

Acknowledge

This study was funded through the Enterprise Ireland Dairytech project with particular acknowledgement for the additional technical support from Dairymaster.

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Utility of Pedometer and Activity System for Reproductive Performance in Dairy Farm with High Prevalence of Claw Diseases

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Introduction

Decreased reproductive performance in mega farms is commonly associated with failure of estrus detection due to lack of manpower and insufficient time of reproductive observation, and the temporal or chronic decreased reproductive abilities in dairy cows (including weak estrus signs and shortened duration of estrus). Robot milking system is recently being introduced in dairy farm, resulting in utilization of pedometer for reproductive management. However, usefulness of activity system (obtained from sensing technology) to elevate reproductive performance has not been adequately evaluated compared with that of pedometer. This study includes comparison between pedometer and activity system in sensitivity of estrus detection in situation that lameness continuously contributed to low reproductive performance in a dairy farm.

Materials and Methods

The targeted dairy farm was free-stall housing (with Pasture Mat), and introduced robot milking system (MIone, 2BOX; GEA Orion farm technologies Co. Ltd). Seventy-six Holstein milking cows were kept during test period. Claw diseases were found in 45% of animals

Pedometers (CowScout for leg; GEA Orion farm technologies Co. Ltd) were applied to one leg of 54 cows (Figure 1). Activity system (CowScout for neck; GEA Orion farm technologies Co. Ltd) were applied to 70 cows (Figure 2). These sensors could monitor activity level via the direction, magnitude and speed of motion.

Estrus detection using pedometer: number of steps was sensed in passing through entrance gate of milking parlor. Based on the increasing level of number of steps than the average value of the past 7 days in each cow, 4% increase meant "attention of estrus", and >5% increase meant "detection of estrus".

Estrus detection using activity system: motions were sensed every five minutes by the receiver in the house, and data were sent every fifteen minutes into the main computer. Through the data, frequency of activity levels in "motion to smell something" and "motion to set its chin on something" was monitored. A two-hour continuation of these motions was defined as one interval. Two intervals meant "attention of estrus", and >3 intervals meant "detection of estrus".

Figure 1

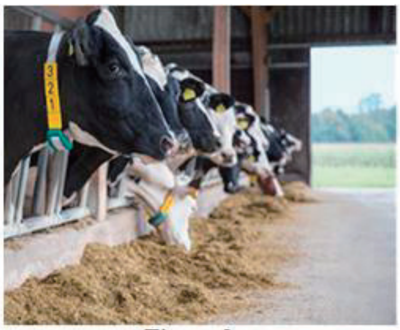

Figure 2

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During experimental period (36 months), pedometer was tested at first 18 months, and activity system was tested at following 18 months. Reproductive performance base on dairy herd performance test, therapeutic history for reproductive disorders after 35-day postpartum and economic loss were evaluated in this study. In addition, under regular uses of ultrasonographic and observations, frequency in failure of estrus detection, and prevalence of embryonic death and abortion were also evaluated. A student t-test was used for statistical comparison between pedometer and activity system.

Results

During experimental periods when pedometer and activity system were applied (P and A periods), calving intervals were 471.6 and 447.7 days, dry periods were 79.3 and 55.2 days, lactation periods were 217.3 and 188.8 days, intervals between calving and first insemination were 79.8 and 64.1 days, times of insemination were 3.06 and 3.72, non-pregnant periods were 190.9 and 175.1 days, milk yields were 28.8 and 30.0 kg/day, respectively. Statistically significant differences between P and A periods were found in dry periods, lactation periods, times of insemination and non-pregnant periods. Therapeutic frequencies for reproductive disorders were 3.04 and 2.51 per head during P and A periods, respectively. Economic loss associated with low reproductive performance was estimated 24,695 thousand yen per year during P period. This value was higher 4,791 thousand yen higher than the estimated value during A period (19,904 thousand yen per year). The difference of the estimated economic loss was higher than the introduction cost of activity system (approximately 4 million yen). Failures of estrus detection were found, respectively, in 41 and 4 cows during P and A periods, and tended to be associated with lameness. Uses of pedometer and activity system enabled detection of embryonic death in 68.8% and 92.3% of the affected cows, respectively. Abortion could be detected in all affected cows using both systems. However, detection sensitivity of embryonic death below 40-days after insemination using activity system was 89.4%, and was higher than that using pedometer (58.3%).

Conclusions

Uses of activity system allowed improved reproductive performance (such as shortened calving interval, low level of failure of estrus detection), and decreased economic loss in a dairy farm with high prevalence of claw diseases. Activity system (with neck-mounted sensor) can sense neck motions related to various types of actions (such as feeding, walking and standing-up) in cows. Through the data, the sensing of neck motion may be related to the higher sensitivity in estrus detection and embryonic death than sensing of leg motion obtained from uses of pedometer. Sensing of leg motion is greatly influenced by lameness. Using pedometer, estrus can be detected based on changes of leg motion (in walking). However, the decreased action and speed of waling associated with lameness is the negative factor for estrus detection. Through the data, activity system can be utilized for maintenance of good reproductive performance in dairy farms with high prevalence of claw diseases.

Occurrences of Claw Diseases in an Enclosed Japanese Dairy House with Push and Pull Low Profile Cross Ventilation System

Hiroshi Saito[1,*], Atsuo Ikeguchi[2] Takeshi Tuka[3]

Introduction

Enclosed dairy house with push and pull low profile cross ventilation system (LPCV) is recently drawing attention as a next-generation type dairy house. LPCV system can actively generate accurate flow of wind inside entire room of the enclosed dairy house, resulting in maintaining the constant and comfortable room temperature and humidity for milking cattle [1]. This system is really contributing elevated milking production, but the improvement effect in occurrences of claw diseases has not been well-known. In this report, incidence and severity of claw diseases based on a two-year record of hoof trimming were compared between a LPCV farm and the other two farms.

Materials and Methods

Overview of a LPCV farm: This farm has three rows of free-stall barns inside oblong closed house (64 meter length, 24.9 meter width, and 7.4 meter height). Air fans are attached in both sidewalls of the house, so that air flow is generated perpendicular to the long axis of the house. Numbers of the attached air fans are 66 in the inlet sidewall, and 78 in the outlet sidewall. Inlet damper attached in each inlet air fan, and baffle enable generating constant air flow more than 2 m /s. In the experimental period, approximately 260-316 limbs in 65-79 heads of Holstein milking cattle were investigated.

G and I farms: These farms is open-type housing with robot milking system. In the experimental periods, 124-164 limbs in 31-41 heads, and 164-176 limbs in 41-44 heads of Holstein milking cattle were investigated, respectively.

In this report, incidences of digital dermatitis (DD), interdigital dermatitis (ID), and sole ulcer (SU) were calculated by (affected limbs / total limbs)*100 (%) or (affected animals / total animals)*100 (%) in each four record of hoof trimming over two years. Severity of each claw disease was scored into mild, moderate and severe. Proportions of three severities were calculated by (applicable limbs / affected limbs)*100 (%). These values were statistically compared between a LPCV farm and two farms using a chi-square test.

Results

DD: The lesions were totally found in 7.2% of limbs (84/1164)) in 26.5% of cattle (77/291) kept into a LPCV farm. The incidence was significantly lower compared with those in G and I farms [33.8% of limbs (184/544) in 89.7% of cattle (122/136), and 12.6% of limbs (87/692) in 41.6% of cattle (72/173), respectively]. Proportion of limbs with mild DD lesions in a LPCV farm was 32.1% of the affected limbs (27/84), and was significantly higher compared with those in G and I farms [2.7% (5/184) and 4.6% (4/87), respectively].

ID: Two-year incidences of the affected limbs and animals ranged 1.4-2.5%, and 5.5-9.2% in a LPCV farm, respectively. These values were significantly lower compared with those in I farm (8.0-23.2%, and 27.3-75.6%, respectively). Severities of the lesions were moderate in many of the affected limbs in three farms.

SU: The lesions were totally found in 2.0% of limbs (23/1164) in 3.8% of cattle (22/291) kept into a LPCV farm. The incidence was significantly lower compared with those in G and I farms [8.1% of limbs (44/544) in 25.7% of cattle (35/136), and 10.8% of limbs (75/692) in 34.7% of cattle (60/173), respectively]. Proportion of limbs with mild lesions in a LPCV farm was 61.5% of the affected limbs (8/13), and was significantly higher compared with those in G and I farms [29.5% (13/44) and 30.7% (23/75), respectively]. No severe lesions were present in 13 affected limbs of cattle kept into a LPCV farm.

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Conclusions

Lower incidences of DD and ID in a LPCV farm may be associated with the comfortable conditions in room temperature, humidity and air flow for milking cattle kept into a LPCV farm. Such circumstance can contribute to decrease in opportunity of infection in bovine claws. Efficacy to reduce incidence of claw diseases due to LPCV system should be assessed by multiple factorial analysis such as nutrition, age and parity of animals, milk productivity, and frequency of foot bath.

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Let's save over 100 cows by the improved floor

Yuki Hayashi*

Introduction

We saved over 100 cows in a year.
COW HAPPY Corporation is a company that makes cows happy.
We vender 4 services.Hoof trimming service, Import sales business, Concrete flooring resurfacing service and Hoof trimming training service.
I would like to talk about the concrete resurfacing service we provide.
Note（A culled cow in this sentence means a culled cow that has been lost in slipping / falling accident.）
A farm that makes 10 culled cows in a year.
B farm that makes only 1 culled cow in a year.
(Both farms built in the 5th year / both have 400 cows)
What are the causes of these two differences?
What are the factors affecting this difference?
Step? Bedding? Cow's health condition? Bad handling?
All answers are correct.
The biggest factor is the quality of the floor.
I think that if we can improve the quality of the floor we can reduce the number of culled cows.
We saved over 100 cows in 2018 by concrete resurfacing.

Materials and Methods

Scope farms: farms resurfaced in 2015-2017
period: 1 year BEFORE resurfacing date and 1 year AFTER resurfacing
Number of farms: 50
Number of cows: 11889 before resurfacing and 12245 after resurfacing.
Check items (1)-(6)
(1)How many fall accidents occurred BEFORE resurfacing?
(2)How many fall accidents occurred AFTER resurfacing?
(3)How many culled cows BEFORE resurfacing?
(4)How many culled cows AFTER resurfacing?
(5)How many percent of accidents were prevented per year?
(6)How many cows we have saved each year?

Results

(1)How many fall accidents occurred BEFORE resurfacing?
=769 cases
(2)How many fall accidents occurred AFTER resurfacing?
=129 cases
(3)How many culled cows BEFORE resurfacing?
=260 cows
(4)How many culled cows AFTER resurfacing?
=35 cows
(5)How many percent of accidents were prevented per year?
=Reduced 83.2% of accident
(6)How many cows have we saved each year?
=260-35
=225 cows are saved on 50 farms.

*COW HAPPY Corporation, Japan

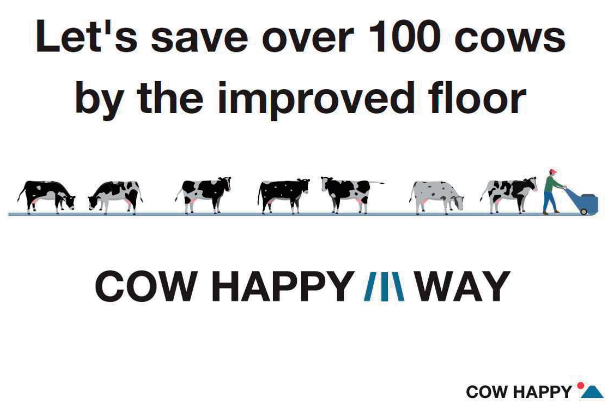
Conclusions

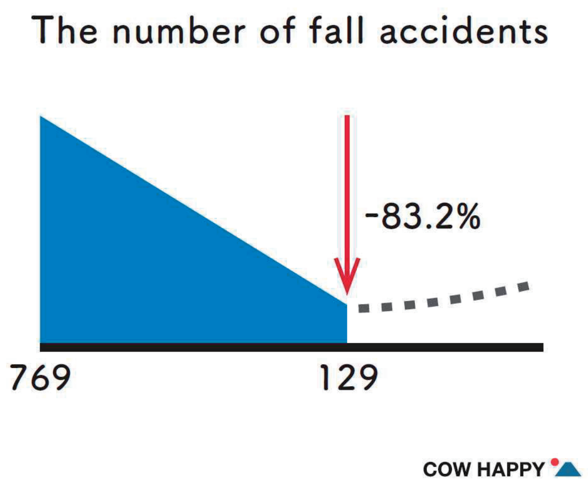
We saved 225 cows a year.
The risk of accident decreased by 83.2%.
It was not the only good result.
Many farmers have expressed the impression that the cows have become healthier.
For example,
The amount of food to eat has increased.
The safety of workers has increased.
Moving time has been shortened to the holding area.
Milk yield has increased.
Shortening of estrus regression days.
(Source : Phone questionnaire with 30 manager of researched farms)
Imagine if you are in the same situation. You can easily understand reasons.
If the outside is a floor that is slippy like an ice skating rink, We are probably reluctant to do anything.
Things need to be improved.Cows have the right of non-slipping floors.
I also need to refer to negative aspect, which is wear and tear of the hooves caused by floor resurfacing.
There are things I have to talk about when making this announcement.
It is wear of the hooves (Disadvantage) by floor resurfacing.
Excessive wear of hooves is not good for the health of cows.
We are a hoof trimmer and a hoof specialist.
Excessive abrasion puts down the hoof angle, so there is a risk of hoof disease.
After the Resurfacing, the first hoof trimming please leave little thicker than usual hoof shape.
To control wear
We have several construction methods.
This time we briefly explain the types of 5 floor constructions.
(1)Deep groove: It is common for newly constructed floor or flat floor.
Groove spacing is design for hoof function, reduce claw trauma.
This is obtain ideal groove pattern, as promoted by the University of Wisconsin – Madison, The Dairyland Initiative.
The only possible way in the environment of sand bedding.

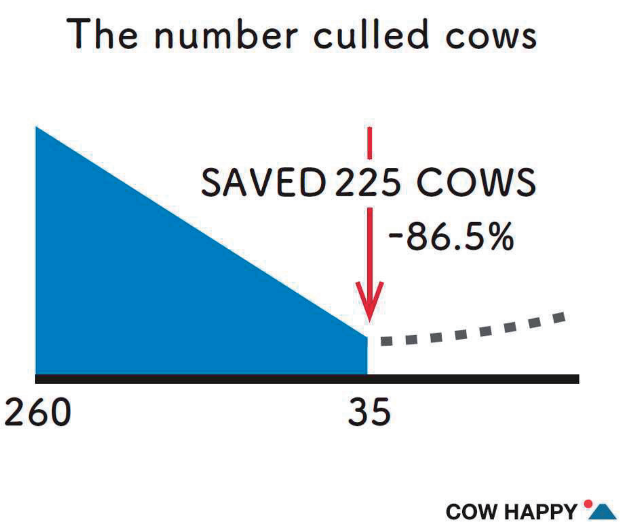
(2)Mini groove: It is often done when there are existing grooves.
Regain traction of slippery and smooth concrete caused by repetitive scraping.
Please don't make it if bed is sand bedding, because hooves are liable to be worn out too quickly.
(3)Planing: It makes smoothing the floor surface which is too rough and has much wear.
Sometimes it is done more than once in order to make a flat ground.
After that we can make mini groove or deep groove.
(4)Recut grooving: It is often done when the groove width is narrow and the groove is straight.
To make the groove deeper and wider.
(5)Texturing: Although it has an anti-slip effect.
Level rough or rounded grooving patterns.
We abolished it because hooves are liable to be worn out too quickly.
Construction methods should vary, depending on various situations. It is nevertheless, difficult to maintain hooves under good control.
This project is not complete yet.
We calculated the results before and after construction and believe that certain promising results have been obtained.
Our goal is a comfortable floor surface that could enable cows' hooves to last longer.
Let 's save cows with us.

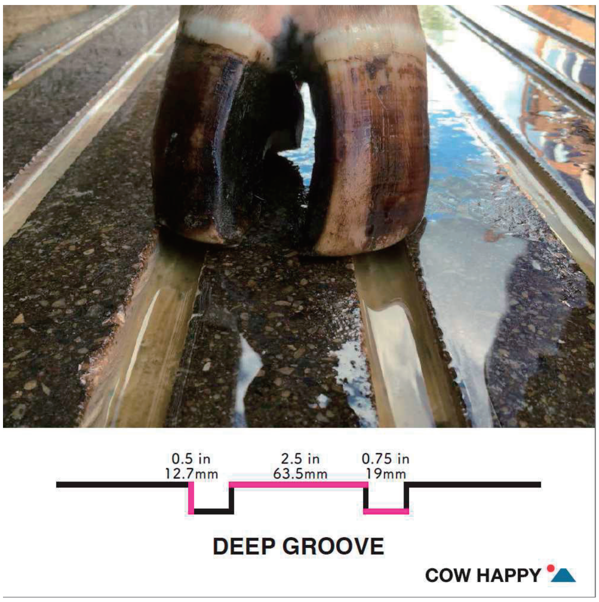
References

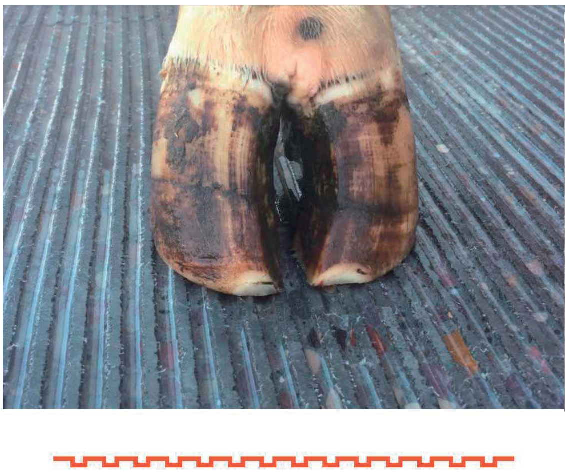
COW HAPPY
www.cowhappy.com
University of Wisconsin - Madison, The Dairyland Initiative.
https://thedairylandinitiative.vetmed.wisc.edu
SAVE COWS
www.savecows.com





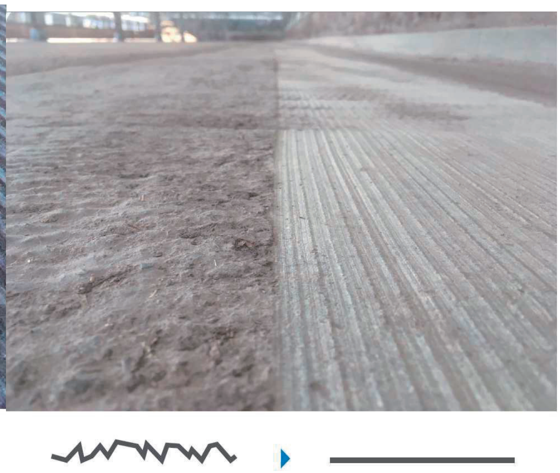






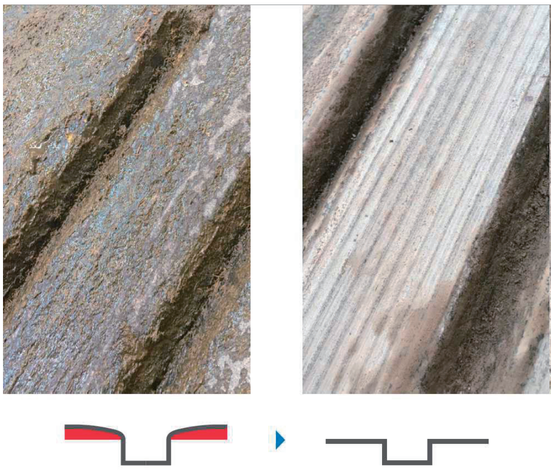
MINI GROOVE

COW HAPPY



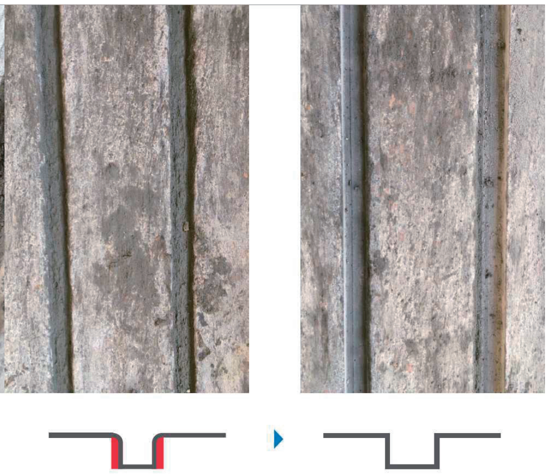
PLANING

COW HAPPY



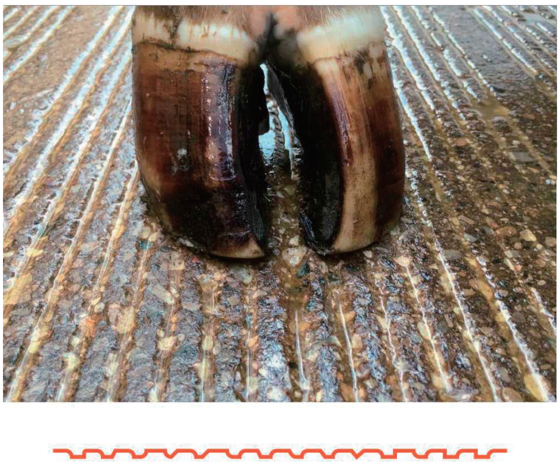
PLANING

COW HAPPY



RECUT GROOVING

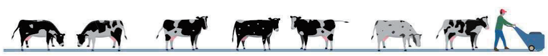
COW HAPPY



TEXTURING

COW HAPPY

We saved 225 cows by the improved floor



COW HAPPY /|\ WAY

COW HAPPY

Claw deformation of the inner claws in the dairy cows kept in Japanese dairy farm using sand bedded stalls

Ichiro Yasutomi[1,*], Takeshi Tsuka[2], Takeshi Yoshinari[1], Tomoyuki Masaki[1] and Kazuhiro Yamakawa[1]

Introduction

It is recent common knowledge that deep sand bedded stall is the best environment in dairy cattle from the viewpoints of both animal welfare and high productive performance. However, the opposite case is indicated from up-to-date topic that sand bedded stall may be associated with the development of corkscrew claw in the inner claws of dairy cows (Tomlinson, 2016). In a Japanese dairy farm, it was recently experienced that remodeling of deep sand bedded stall triggered increase of the claw deformation of inner claws in front and hind limbs. The aims of this study are 1) to observe the internal structures of the claws by the application of computed tomography (CT) to the affected claws obtained from slaughterhouse when the cows kept in this farm were culled, and 2) to investigate the incidence and severity of the claw deformation.

Materials and Methods

The targeted farm is free-stall housing, in which 569 dairy cows and 413 dairy heifers were kept at May 2018. Turnover rate was 26% at 2017. All stalls in which dairy cows and heifers were kept, were remodeled from mattress to deep sand bedding at 2012.

Experiment 1: CT images were obtained using a 16-section multidetector scanner (ECLOS; Hitachi, Tokyo, Japan), and were reconstructed through an image analysis system (AZE Virtual Place, AZE Corp., Tokyo, Japan). CT was examined for 32 front and hind limbs of 8 milking cows, which were culled by lameness (n=1), poor reproduction (n=6) and bad temperament (n=1).

Experiment 2: The claw deformations were observed from rear side when the cows were standing during milking in the milking parlor at August 2017 (S1) and May 2018 (S2), and were scored 0 to 3; Scores 0, 1, 2 and 3 signified no, mild, moderate and severe claw deformation, respectively. In addition, differences among 4 grades in severity of the claw deformation (scored at S1) were statistically investigated for the enrollment period after S1 using a statistical software (IBM SPSS StatisticsV25, IBM, Tokyo).

Results

Experiment 1: Common characteristics of the claw deformation was the overgrowth toward interdigital space in the axial and sole horns of the inner claws. This axial overgrowth allowed rotation of the distal phalanx toward abaxial direction. But inward displacement was not evident within the bearing surface of the wall, like as in corkscrew claws.

Experiment 2: The claw deformations were typically found in the inner claws. The proportion of the abnormal claws was decreased from 42% at S1 to 35% at S2, and that of severe deformed claws (score 2 and 3) was also decreased from 14% at S1 to 12% S2. There was no significant difference between severity (at S1) of claw deformity and survivability in the enrollment period after S1.

Conclusions

The internal structure of this claw deformation was not identical with those of corkscrew claw which is characterized by an excessive growth of the abaxial wall and an inward spiral rotation of the toe region, allowing weight bearing on the displaced abaxial wall surface (van Amstel, 2017). Based on the CT findings, Dutch method may not be recommended as trimming for this claw deformation. The claw deformation can be corrected by cutting-off of the overgrown axial walls, following trimming the bearing surface in especially axial region, so that the parallel correlation between ventral surface of the distal phalanx and sole surface is

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obtained. No difference in survivability among 4 grades of severity in the enrollment period suggests that corrective trimming for the claw deformation enables longevity in milk productivity, even if the cows have the various severities of the claw deformation.

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A pilot trial to examine the effects of manure properties and processing on the testing of footbathing products

Maeve Palmer[1,2,*], Martin Garland[2] and Niamh O'Connell[1]

Introduction

Digital dermatitis (DD) is a polybacterial disease that can cause painful lesions on the heels of dairy cows. Disinfectant footbaths are commonly used on farms in an attempt to prevent the spread of this disease between animals. The footbaths become increasingly contaminated with manure and dirt as animals pass through (Ariza et al., 2018), and this contamination is likely to affect the performance of the active ingredients in footbathing products (Hartshorn et al., 2013). There is, however, little published work on the impact of manure on the efficacy of footbathing solutions in laboratory testing or on farms. There is also very little information available about how natural variation in the properties of manure (including bacterial load, microbiome composition and dry matter content) or variation in the treatment of manure before testing (such as sterilizing by autoclave to kill bacteria) might affect the results of laboratory evaluations. The aims of this pilot study were to examine the aerobic bacterial load and dry matter content of manure from animals fed different diets and to investigate how these properties might affect the results of disinfectant efficacy testing.

Materials and Methods

Manure was collected immediately after defecation from 10 dairy cows (parity 1-3) at the Agri-Food and Biosciences Institute, Hillsborough, Northern Ireland. Five of these animals were cubicle housed and fed a diet of grass silage supplemented with 10kg concentrates per day. The other five cows were kept at pasture with a diet of grazed grass supplemented with 5.5 – 7.0kg of concentrates per day. Manure samples were transported immediately to the laboratory, well mixed and aliquoted for testing. The number of colony forming units (CFU) of aerobic bacteria per ml present in the fresh manure and the dry matter content of each manure sample were determined.

Quantitative suspension tests were carried out to test the efficacy of three footbathing products when altered to contain 20% raw manure (v/v) from each of the 10 animals, using a protocol modified from BS EN 1656:2009 (British Standards Institute, 2009). The products tested were formalin, a trial product containing peracetic acid (Trial Product 1) and a trial product including chlorocresol and triamine (Trial Product 2), all at final concentration of 5% (v/v). *Staphylococcus epidermidis* was used as the challenge bacteria, with a contact time of 30s and temperature of 20°C. A further set of the manure samples was sterilised by autoclaving and the quantitative suspension test was repeated using Trial product 2 and 20% sterile manure. The number of CFU of bacteria in the test suspension was determined before and after disinfectant contact and log reduction values were calculated, with a higher log reduction value demonstrating a higher product efficacy. Data were analysed using Mann-Whitney U test, Wilcoxon signed rank test and Spearman's Rank correlation as appropriate in SPSS v25 (IBM, New York, USA).

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Results

There was no difference in the (log_{10} transformed) initial number of CFU of aerobic bacteria per ml between manure from housed (median = 6.00, IQR = 0.60) and pasture animals (median = 5.70, IQR = 1.54). Median dry matter content was higher in manure from housed cows (median = 13.54%, IQR = 2.42) than cows at pasture (median = 10.30%, IQR = 2.21; p<0.01). There was a negative correlation between manure dry matter content and log reduction in bacteria numbers caused by Trial Product 2 (r_s = -0.796, p<0.01) and a non-significant trend for a negative correlation between dry matter content and the log reduction caused by Trial Product 1 (r_s = -0.614, p = 0.059) but no relationship between dry matter content and log reduction when formalin was used. Both Trial Product 1 and Trial Product 2 achieved higher median log reductions in bacteria numbers when manure from pastured animals was used in testing than when manure from housed cows was used, but no such difference was seen for formalin (Figure 1). The median log reduction in bacteria numbers obtained by Trial Product 2 was greater when manure was sterilised by autoclaving before testing (median reduction sterile manure = 3.88, IQR = 1.92; median reduction raw manure = 2.49, IQR = 1.13; p<0.01), indicating that the disinfectant was more effective when sterile manure was added than when raw manure was added.

Conclusions

This small pilot trial found that manure source (housed or pastured cows with differing diets), properties (such as dry matter content) and processing (by sterilising) could all impact the efficacy of some footbathing products during quantitative suspension tests. Manure from the two groups of animals differed in dry matter content and variation in dry matter content of manure affected the performance of the three footbathing disinfectants to differing extents. These findings could have implications for the testing of footbathing products and also for the control of DD in different farming systems. Further work on a larger scale is required.

Acknowledge

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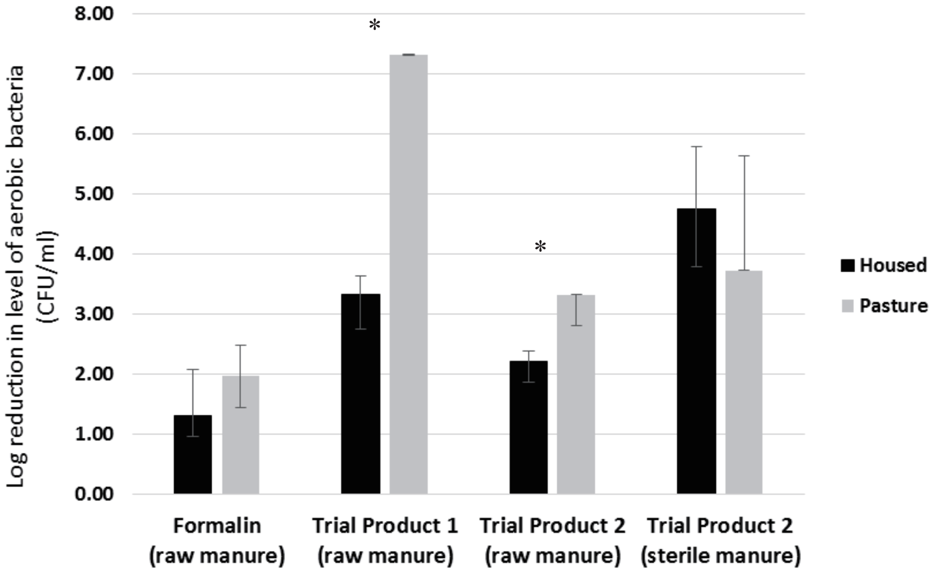

Figure 1.　Median log reduction in bacteria numbers caused by disinfectants containing manure from dairy cows housed or at pasture when tested using *S. epidermidis* (error bars show interquartile range). Significant differences between the log reduction value when using manure from housed and pastured animals are marked with an *.

Dynamics of *Mycoplasma bovis* in Dutch dairy herds with a clinical outbreak

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GD Animal Health

Introduction

Mycoplasma bovis (*M. bovis*) can cause serious illness in cattle, with mainly arthritis and mastitis in dairy cows and pneumonia, arthritis and otitis in calves. Not all infected animals show clinical symptoms, allowing for transmission of *M. bovis* between animals. However, knowledge on the dynamics of *M. bovis* transmission within dairy farms is limited. The objective of this study was to provide insight into the dynamics of *M. bovis* transmission within dairy herds experiencing an acute clinical *M. bovis* outbreak in dairy cows.

Materials and Methods

Between February 2016 and April 2017, a longitudinal study was performed in which 20 farms experiencing an acute clinical *M. bovis* outbreak (arthritis and/or mastitis) in dairy cows were closely followed. At a 3-wk interval, farms were sampled five times, including blood, milk and eye swabs from clinically diseased and randomly selected healthy animals from three different age groups: calves, young stock and dairy cows. Additionally environmental samples were taken at the first and last visit. The presence of *M. bovis* was tested by culture (milk samples) and PCR (eye swabs and environmental samples), whereas the presence of antibodies against *M. bovis* was tested by ELISA (blood samples). All data were analysed using logistic regression models, corrected for repeated sampling and within-herd correlation.

Results

Results show that at the moment of reporting a new clinical outbreak, *M. bovis* (bacteria and/or antibodies) was not only present in the group of dairy cows, but also in the calves and young stock groups (80% of the farms). Most *M. bovis* positive tested cows, calves and young stock did not show typical clinical symptoms during the whole study period of three months. These clinically healthy animals form a potential source of infection to their herd mates. It was shown that *M. bovis* was present in the environment of the animals. At T_0, 80% of the farms had *M. bovis* contaminated environmental samples, whereas only 45% of the farms tested positive three months later. At the end of the three-month study period, none of the twenty clinical outbreak farms were free of *M. bovis*, even though hardly any clinical cases were observed at that moment.

Conclusions

About 6 weeks after reporting the start of a clinical outbreak most of these companies were negative again. It may be too early to speak of an '*M bovis* unsuspected herd', based on a negative tank milk survey. However, periodical bulk monitoring could be used to control the *M. bovis* situation in the longer term.

References

Available on request.

Detection, Preventive and Management of Footrot in Sheep and Goats

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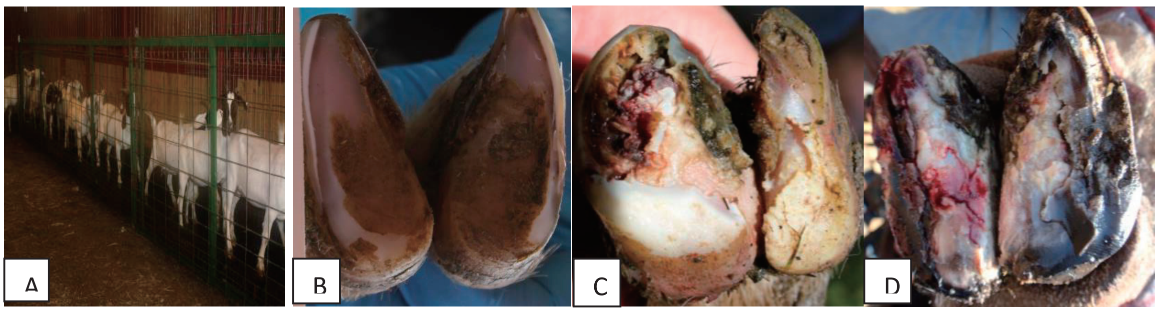
Introduction

Footrot outbreaks in goat, sheep, and cow herds have been reported frequently throughout the US (Espejo et al., 2006; Casas and Snowder, 2008), especially during warm, humid, and wet seasons. This infectious disease begins as an interdigital dermatitis that can extend into the adjacent hard horn tissue of animal hooves and cause debilitating pain and lameness as well as economic loss in ruminant enterprises. Although it is not realistic to eradicate footrot disease from goat and sheep flocks, an early detection, prevention, and management program may help avoid large-scale or frequent outbreaks. Understanding the cause of footrot outbreak and its prevalence is essential for developing a sustainable management, control, and prevention program. This project's objective was to detect and monitor footrot outbreaks in small ruminants, conduct training for foot and hoof care, and demonstrate an effective footrot management practice. The outcome of this project has benefitted producers through their collaboration and hands-on experience using the footrot detection, prevention, and management protocol for their farms, which has decreased their disease control cost and breeding stock loss.

Materials and Methods

Forty-eight goat or sheep farmers participated in the footrot detection and monitoring activity annually for three years, which involved reporting footrot outbreak and then using diagnostic inspection; lesion swabbing and pathogenic identification; and periodic preventive foot-bathing. This culminated in developing a footrot control protocol. A workshop on footrot detection, diagnosis, preventive foot-bathing (Figure. A), and animal health care was conducted each April, prior to footrot prevalent seasons. The footrot scoring was standardized by using a 5-point scale (0-4), where a score of 0 is normal (Figure. B), but scores of 3 (C) and 4 (D) are severe footrot and treatable grades.



Producers were trained in hoof trimming, foot-bathing, footrot diagnosis, lesion swabbing, and developing a footrot control protocol on their farms.

Hoof lesion swabs were collected from 36 flocks (26 sheep and 10 goat flocks), which had reported current or chronic footrot infections during these seasons. From each flock, 5-7 animals were sampled that had apparently showed either a sign of limping or a footrot score of 3 or 4 on their inspection record. Over the period of this study, 320 animal footrot swabs or hoof lesion specimens were collected for culture and bacterial identification. Footrot lesion swabs were collected in transportation broth culture tubes and subsequently inoculated on sheep blood agar culture plates in duplicate for both aerobic (incubators) and anaerobic (anaerobe chamber) bacterial isolates. Bacterial colonies were segregated and subcultured three or more times until there was confirmation of a single species. The isolates were identified and verified for species identify by comparative tests using Biolog® and Biotyper® or Biotyper® and Sherlock® Microbial Identification systems. Selected species, including *Dichelobacter nodosus*, *Fusobacterium necrophorum*, *Prevotella* spp., *Porphyromonas* spp., *Bacteroides* spp., and *Spirochaeta* spp. were also examined with antibiotic resistant assays for commonly used drugs (penicillin, oxytetracycline, and ZACTRAN®) at the Crowder College Farm (Neosho, Missouri) and at Lincoln University's Alan T. Busby Farm (Jefferson City, Missouri).

Demonstrations of hoof care and periodic preventive foot-bathing were conducted for a goat flock (n = 75) at the Crowder College farm and for a sheep flock (n = 110) at Busby Farm. A selected number of animals (15 goats and 20 sheep) from these flocks were used by the training workshop's participants for operational skill practice, such as footrot inspection, hoof lesion swabbing, footrot scoring, body condition scoring, footbath solution formulation, FAMACHA© score, and fecal egg counting exercises. The goat flock experimented with a biweekly (every 14 days) foot-bathing schedule during the spring and summer. The footbath solution was made with zinc sulfate at 12% ($ZnSO_4$/water) concentration built in grand or portable troughs, where animals could stand and soak for 30 mins. The sheep flock at Busby Farm was managed as a control without a preventive foot-bathing schedule in the spring and summer. Animals were given a footrot score and had their hoofs trimmed prior to the start and end of the schedule (April and September).

The control and preventive footbath flocks were compared to determine the number of animals infected and treated for footrot during the spring and summer. Data were analyzed using chi-squared statistical procedures (SAS). Footrot lesions and infected wounds were treated with topical sprays of long-acting antibiotics in an alcohol (70%) formulation or Kopertox®. Animals with severe footrot were isolated and treated with antibiotics (oxytetracycline or ZACTRAN®) prescribed by a local veterinary service.

Results

There was no difference in the bacterial species that were isolated and identified from goat and sheep footrot lesion swabs. Most swab cultures resulted in isolation of three to nine species, a mixture of anaerobe and aerobes, which are mostly commensal microbes. However, identification of about 1,000 isolates resulted in significantly ($P < 0.01$) more aerobic species and subspecies (74) than anaerobic bacteria (21). The bacterial species that were most frequently isolated from these lesion swabs were *Staphylococcus spp*., *Prevotella spp*., *Actinomyces spp.*, *Fusobacterium spp.*, *Spirochaeta spp.*, and *Corynebacterium spp*. In contrast, *Dichelobactor nodosus* and *Fusobacterium necrophorum*, which are known to cause more virulent footrot in goats and sheep, were identified in only six isolates from two of 36 farms. However, it was unclear if there was either no involvement of these species in most infections on those farms or if the current bacterial analytical procedure was less accurate in relation to these species. Selected species antibiotic resistance test assays indicated that there was no resistance to these antibiotics used in the footrot-infected animals. Footrot diagnosis and treatment or intervention frequency (%) was significantly higher in the control flock (Busby Farm) than in the preventive foot-bathing flock (Crowder Farm) as can be seen in the monthly evaluation summary (Table 1).

Infection rate (%)	May	June	July	August	September
Control flock	10.9ns	10.9**	68.0**	39.5**	27.7**
Footbath flock	8.3	1.6	0.0	0.0	0.0

ns: no statistical difference; **: $P < 0.01$

Conclusions

Hoof trimming and foot-bathing small ruminants prior to and during footrot prevalent seasons seemed to be effective in preventing a frequent outbreak and flock-scale infections. Most footrot and hoof infections in this investigation may have being caused by mixed species of both anaerobes and opportunistic aerobes. However, it is critical to detect and monitor to determine a more virulent bacterial species, such as *Dichelobactor nodosus*, is involved in foot and hoof disease outbreaks in small ruminants.

Acknowledgements

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Cow related risk factors for the occurance of digital dermatitis in one Estonian herd

Hertta Pirkkalainen[1]*, Aino Riihimäki[1], Ian Dohoo[2], Minna Kujala-Wirth[1]

Introduction
The aim of this study was to record digital dermatitis (DD) lesions over a long time period in one Estonian herd and to find cow-related risk factors for the occurrence of DD. The cows were trimmed every six months for half of the study period and then every three months for the rest of the study period. The cows were checked for DD during regular hoof trimming but also if the cows became lame between hoof trimmings. All DD lesions (different M stages) discovered during the study were recorded. Also, the cow's birthdate, breed, calving dates and 305-day average milk yield after the last calving were recorded.

Materials and Methods
The study began with regular hoof trimming in November 2016 and ended in June 2018, so the study period was approximately 1,5 years. The regular hoof trimming was done by the same professional hoof trimmer throughout the study. All the trimmed legs were checked by the same veterinarian and the DD lesions were recorded on paper. The lame cows between the regular hoof trimming visits were treated by five different veterinarians, who had been taught to record and treat the DD lesions in a certain way. All the four legs of the animal were checked for DD if the cow was lame. These lesions were also recorded on paper. The acute DD lesions were treated with salicylic acid powder and then bandaged. The bandage was taken away three days after the treatment.

Altogether 4108 observations (legs) were recorded. DD was diagnosed on 760 occasions. The average age of a cow was 4,22 years.

The number of cases of DD in each leg was modelled using zero-inflated negative binomial models. No adjustment for clustering of observations within cows was required as the between-cow variance was zero.

Results
The model showed that age was a highly significant protective factor. Each year added to the age lowered the number of observed DD cases by approximately 12% (P=0,005). Higher milk yield was a risk factor, with every 1000kg resulting in approximately a 9% increase in DD cases (P=0,04). Estonian red had a slightly higher frequency of DD compared to other breeds, but the risk was borderline significant (P=0,06).

Conclusions
There are cow related risk factors that can affect the occurance of DD within herd. Older cows in the herd that have not had DD could be considered as valuable breeding animals. The effect of breed still needs more studying, but in this herd the Estonian Red cows seemed to be more prone to DD then other breeds. The correlation between higher milk yield and the occurrence of DD is something that needs to be investigated more, but it seems, that higher milk yield is a risk factor for DD.

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prevalence of Treponema in papillomatous digital dermatitis in dairy cattle in central of Iran

Alirezaei Shahraki[1,*], Mostafa Nourbakhsh [2] and Saadat Moshkelani[3]

Introduction

Lameness after infertility and mastitis is known as the third major concern for producers in dairy cattle industry. Papillomatous digital dermatitis "PDD" is one of the most important infectious diseases of feet region causes lameness. Economic aspect of disease is important because of decreased milk yield, weight loss, impaired reproductive performance, increased number of cows culled, and cost of treatment and control. It is believed to be a multifactorial disease in which infectious agents (Spirochaets) are primarily involved. The present study was carried out in order to investigate the prevalence of Treponema in "PDD" lesions using PCR-based technique, in central of Iran (Isfahan province).

Materials and Methods

In order to achieve the goal of present study, left hind leg of 284 dairy cattle was grossly examined in Najaf-abbad abattoir (located in Isfahan province) over a period of six months from November 2017 to April 2018. All of the animals were investigated for the presence of PDD lesions. Samples for molecular detection were collected, during ante-mortem inspection, by 7 mm punch after proper cleaning and disinfection of the PDD lesions. Genomic DNA was purified from samples and PCR was conducted for specific 16S rRNA gene of Treponema. PCR products were analyzed by 1.5% agarose gel electrophoresis and amplified samples were sent for gene sequencing.

Results

Out of 284 examined dairy cattle 61.9% (N=173) had gross lesions of PDD. In the total of 173 PDD samples amplifed by PCR for 16S rRNA gene, 76.8% (N=133) samples showed positive results for Treponema. Sequence analysis of amplified indicate that 58.6% (N=78), 27% (N=36) and 14.2 (N=19) of these samples were positive for *T. pedis*, *T. phagedenis* and *T. medium*, respectively.

Conclusions

To the best of our knowledge, this study is the first molecular epidemiology study of Treponema spp. in PDD lesions of dairy cattle in Isfahan (Iran). The present results showed high prevalence of Treponema spp. infection in "PDD" in central part of Iran. Since "PDD" is multifactorial disease and cause and epidemiology of disease is not well known, so using quick and simple methods like molecular screening to detect infectious agents can be helpful to find ways for prevent and treat this disease in dairy herds. This study shows that more research is needed both on the economic impact of vertical fissures in dairy cows and on the microbiological study of spirochaetes of the genus Treponema. This study recommends that owners of dairy farm should try to control digital dermatitis with preventative herd strategies.

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Confirming freedom from bovine digital dermatitis of dairy farms in the West Coast region of New Zealand

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Introduction

Bovine digital dermatitis (BDD) has been found in dairy farms across most of New Zealand (NZ). However, as part of regional survey of the disease, 27 dairy herds in the West Coast region of the South Island were examined, using visual inspection during milking, and no convincing lesions were observed. The aim of this analysis was to confirm how sure we were that this region was really free of this disease.

Materials and Methods

As no convincing lesions were found, we obtained no information on the prevalence distribution from the data. The cows from the 27 herds were aggregated into one population
The number of BDD animals (Y) was assumed to be binomially distributed with apparent prevalence AP and equal to AP*number of animals sampled (N). AP equals TP*se + (1-TP)*(1-sp), where TP, se and sp are the true prevalence, sensitivity and specificity. TP was further conditional on a Bernoulli distributed (τ) herd level infection status (Z): TP=Z*P, where P is the within population prevalence given the population is infected. Priors from a study in Taranaki, a region in the west coast of the North Island, NZ were used for τ, se, sp and P. This model was then used to simulate the number of BDD animals in the unsampled large population using a Poisson approximation. The step() function in OpenBUGS was then used to create a Boolean variable that counted the number of BDD animals $\geq$ 1. The mean of 1-step() is the probability that number of BDD animal was less than one in the unsampled population.

Results

We were 99.98% sure the West Coast was free of the disease.

Conclusions

Unlike other regions in NZ, the West Coast was not affected by the disease at that time. This may be because most of the dairy herds in that region are self-contained. Dairy farmers in that region may need to keep their current management practices rather than purchasing more cattle from outside regions which are affected by BDD.

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Reporting inter-observer agreement - not just a calculated kappa value, make use of the confidence interval

D. Aaron Yang[1] & Richard Laven[1]

Visual assessment of bovine digital dermatitis (BDD) is a subjective process. The judgement on the disease status may vary across different examiners. Therefore, evaluating the inter-observer agreement was a common process in many publications. However, the way of reporting and interpreting the agreement statistics could have a few drawbacks. This abstract discussed these drawbacks and proposed a method to interpret the agreement statistics in a more meaningful way.

Historically, papers on the inter-observer agreement in BDD area only reported the calculated kappa value and the interpretation was according to Landis and Koch's guideline, where a ≤0 kappa means poor agreement, 0.01 to 0.2 means slightly agreement, 0.21 to 0.4 means fair agreement, 0.41 to 0.6 means moderate agreement, 0.61 to 0.8 means substantial agreement, 0.81 to 1.0 means almost perfect agreement. However, simply reporting a calculated kappa value does not give any information of the uncertainty, therefore, many recent publications also reported the 95%CI of the calculated value. However, even if those papers reported the 95%CI, the interpretation of the agreement statistics was still based on the calculated value, with or without mentioning the agreement could come across to the next level if the 95%CI was wide to cover more than one level of agreement.

To make use of the 95%CI to form a meaningful interpretation, we introduced a method to make probability statement. This probability gives the chance of which level of agreement it is. If the probability does not meet the requirement, sometimes 95%, then the cumulative probability can be calculated and interpreted as the chance that at least which level of agreement will be. The method to compute the probability and its associated dataset will be introduced in the conference.

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No hoof, no horse---and also no cow.
May I explain about the Japan Farriery Association (JFA) ?

Katsunori Takamatsu[1,*]

Introduction

One of the characteristics that horses and cows have in common is that they have hooves. Horses are perissodactylous, having hooves with an odd number of toes, while cows are artiodactylous, having hooves with an even number of toes. The hooves of a horse need to be shoed to protect them against wear due to exercise. On the other hand, the hooves of a cow tend to overgrow due to lack of exercise and thus need to be trimmed periodically to shape them correctly.

The techniques necessary for horseshoeing and cow hoof trimming may look similar at first glance, but the reasons why foot care is required for the two animals are very different. And while actual foot care techniques may differ slightly for perissordactylous and artiodactylous animals, what can be said for sure is that regular, correct foot care is one of the most important things we can provide for these animals in return for all that they generously give to us.

About Industry (approximate) in Japan.
Cattle: 4,200,000 head (Dairy 1,500,000; Beef 2,700,000).
Horse: 70,000 head (Thoroughbred 40,000).

About The JFA

The JFA (Japan Farriery Association) is Public Interest Incorporated Association, approved by the Cabinet office. It consisted of 52 branches to which individual Farriers and/or Hoof trimmers belong, and currently, there are roughly 500 Farriers and 800 Hoof trimmers who are members of the JFA.
Founded in 1940, and then re-established in its current form in 1948, the JFA began issuing certificate for approved Cow Hoof trimmers in 1965. The Government abolished the Farriers Act and ended government licensing for Farriers in 1970. Thereafter the JFA has been issuing certificates for both Farriers and Hoof trimmers.

The JFA is an organization dedicating to animal welfare and the advancement of the equine and cattle industry through the promotion of improved foot-care for these animals.

The JFA is also the only organization in Japan that educates and approves qualified farriers and cow hoof trimmers.

Objective/activities

Following are the main activities of The Japan Farriery Association (JFA):
1. Training/education and qualification of farriers and cow hoof trimmers:

The JFA offers three grades of certifications: Approved class, Senior class, and Master class. The JFA operates the "Farriers Education Center," Japan's only certified farriers training organization. The center is an all-dormitory, paid farrier training course for one year, and a capacity of 16 students each year. These students who passed the exam at the end of course will be certified as Approved class. The JFA also offers 5-6 educational seminars in cow hoof trimming each year, after which student who pass the post-seminar test are again certified as Approved class in Cow Hoof trimmers. There are approximately 500 certified farriers (not only Japanese but also Korean and Taiwanese persons) who went through the program at the center who are now pursuing careers as specialists in the breeding areas, racecourses and training centers across the country, as well as horseback riding industry, etc. There are also 800 certified cow hoof trimmers from the program who are now working in the dairy/beef industry.

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2. Offering a structured national organization for farriers/hoof trimmers:

By organizing certified farriers and cow hoof trimmers into structured groups around the country, the JFA - with contribution to society in mind - aims to develop the farrier industry.

3. Research on farriering and trimming technology

The JFA conducts research on management of healthy hooves and general horseshoeing. To ensure that the results of such research benefit the field of actual shoeing education and practice, the JFA organizes educational lectures across the country.

4. Organization of All Japan Farriery Competition

The JFA holds an annual competition for cow hoof trimmers in November, in which top trimmers (maximum 24 persons) who have passed the preliminary rounds participate. There is also a competition for farriers in October (maximum 40) each year.

5. Encouraging international exchange

The JFA invites prominent farrier/cow hoof trimmer from abroad as a lecturer to disseminate information and techniques from overseas countries with in the farriery industry in Japan. At the same time, the JFA sends the winner of the All Japan Farriery Competition to an international farriery competition to promote world-wide exchange of horshoeing technology.

6. Publication and sales of journals and farrierry-related academic books (all Japanese).