Lameness Research at the UBC Dairy Research Centre

Daniel M. Weary & Marina A.G. von Keyserlingk
Animal Welfare Program, University of British Columbia

Summary

- More that 80% of cows in the BC's Fraser Valley have hoof injuries.
- Cows with injuries can show impaired gait, but not all injuries cause changes in gait, and changes that do occur can be subtle. We are developing new, more sensitive ways of assessing these changes.
- Our research has focused on improving freestall design (to reduce standing outside of the stall) and surfaces for standing. Good stall design and management can much improve stall occupancy. Alternative flooring surfaces outside of the stall also provide advantages to cows.

Who are we?

UBC's Animal Welfare Program has focused its dairy research at the UBC Dairy Research Centre in Agassiz for the past 6 years, and much of this work has been on lameness and ways of preventing lameness by designing better environments and management strategies for dairy cattle. In this research we have collaborated closely with Agriculture and Agri-Food Canada researchers Jeff Rushen and Anne Marie de Passillé. Now this collaboration will be further strengthened, as both Jeff and Anne Marie will be moving to Agassiz later this year. Below we provide a brief overview of our recent and on-going research projects in this area, together with some key findings and recommendations.

Assessing lameness

Before we can really solve a problem, we need to have good methods of describing it and of tracking any changes that occur. Although lameness is commonly recognized to be one of the most important problems faced by dairy cattle today, there has been almost no work on describing the problem in BC, and little research on developing more accurate tools of identifying lame cows. Cows become lame as a result of injuries and diseases of the hooves and legs. We begin by summarizing a recent study on prevalence of sole lesions, one of the most common types of hoof injuries in dairy cattle, and then go on to describe work looking at changes in gait. Finally, we summarize recent research findings about facility design and management, with an emphasis on lameness prevention.

Prevalence of sole lesions in Fraser Valley dairy herds

Sole lesions are signs of tissue damage in the hoof and can range in severity from minor bruising to severe ulcers. Results from our study on 20 Fraser Valley dairy herds indicate that such lesions are common in our region. During the observations at hoof trimming, M.Sc. student Erin Bell recorded the number, severity, and location of lesions in the claws of 624 Holstein cows. Lesions were found in cows from all herds. On average per herd, 86% of the cows had at least one lesion, and 35% had severe haemorrhages and ulcers (Bell, 2004). This is more than double the percentage of animals affected by hairy

heel wart on the same farms – a condition often cited by producers as a significant problem.

Cows were more likely to have lesions if they had a low body condition score, so improved management for these more vulnerable cows may help reduce these injuries. Cows on farms with high steps or with imperfections in concrete floors such as holes or large cracks were most likely to have lesions.

These injuries can be assessed directly at hoof trimming. Our research group has been developing and delivering workshops that provide some practical tools for measuring and recording these hoof injuries. We encourage producers to work with their vets and hoof trimmers to ensure that good records are kept for the injuries affecting cows on their farms. With these records producers and the professionals they work with can track problems over time, and develop a plan for preventing these injuries.

Take home message: work producers to develop consistent ways of measuring and tracking hoof injuries and diseases on their farms. These measures can then be used to develop an appropriate strategy for treatment and prevention.

Behavioural assessment of gait abnormalities

Sometimes a direct assessment of injuries will not be possible, for example, between scheduled visits by the hoof trimmer, or for those injuries that cannot be seen during trimming (injuries still under the surface of the sole, or injuries further up the leg, such as arthritis in the hip). In these cases we need to look for other, indirect signs of the underlying problem. We all have some understanding of the obvious changes in the way cows walk when they are lame – a reluctance to bear weight on one limb, an arched back, bobbing of the head and short strides are some of the common signs. When these signs are exaggerated or combined, most of us would be able to recognize a cow as lame, but what about when these changes are subtle? Many of us, it seems, do not do well in picking out these cows. One recent study found that producers were able to correctly identify only one out of every four lame cows, showing that much needs to be done in improving the sensitivity and accuracy of how we assess changes in gait (Whay et al., 2003). One approach is to use more sensitive gait scoring systems. These can be thought of in the same way as body condition scoring, and provide us with ways of not just picking out the severely lame cows but also the intermediate cases.

For example, Sprecher et al. (2004) describe a five-point scale for assessing lameness, that takes into account such features as the flatness of the back, bobbing of the head, the degree that the rear feet track-up with the fore feet, abduction of the limbs, and of course any perceived reluctance of the animal to place weight on any of the feet. Our experience is that even observers with much cow experience need some training to become good at using these behaviours to identify animals at early stages of lameness. Our workshops also provide training in these gait scoring techiniques.

Take home message: develop better skills at measuring and tracking gait abnormalities of cows on your farm. These measures can then be used to better identify those cows that

require treatment.

Although these scoring systems can be useful for tracking problems on farms, we need more sensitive tools for research. More sensitive lameness scoring systems will help us to develop better on-farm tools for the future, and allow us to learn more about preventing and treating lameness at an early stage. One recent innovation is from the work of Ph.D. student Frances Flower. She has been using computer-assisted video analysis to quantify gait measures such as stride length and hoof velocity, and comparing these measures in animals with and without known hoof injuries. Another approach is being developed by student Sophie Neveux, who is using load cells to measure how cows favour certain legs when standing, and again relating these measures to hoof injuries. As part of our group's general interest in using behaviour as an early indicator of injury or disease, we have also used measures of standing and lying behaviour as indicators of injury. For example, Frances Flower has found that cows that spend more than 10 % of their time standing with only their front two hooves in the stall are more likely to have hoof injuries. In this case, more research is required to determine if cows stand this way because they have an existing injury, or if this standing actually predisposes cows to develop injuries. Much of our group's work on preventing lameness has been focused on creating better lying and standing environments for cows, as described below.

Preventing lameness – facility design and management

Several studies have now shown that standing on concrete flooring is an important risk factor for hoof injuries leading to lameness, especially if the surface is wet, and these problems are accentuated if the surface is poorly maintained (e.g. large cracks or holes), or poorly designed (e.g. high steps between walking surfaces)(e.g. Bell, 2004). Our group has concentrated on creating resting areas that promote lying in the stall (Tucker et al., 2004 a), and thus reduce standing outside of the stall (on what is likely to be wet concrete), as well as identifying better surfaces for walking and standing (Rushen et al., 2004).

Stall design and management

Lying surface in the stall. The freestall surface is one of the most important features of the resting area, and as chance would have it, this is often the aspect that is easiest to modify. Softer surfaces promote lying, such that rubber mats are better than concrete, mattresses better than mats, and bedded surfaces (e.g. sand or sawdust) better than bare mattresses. Several experiments by our research group have now shown that some stall surfaces, like deep-bedded sand or sawdust, can increase lying times by several hours a day. Other work by our group has shown that softer lying surfaces also help prevent leg injuries such as hock lesions and swollen knees (Mowbray et al., 2003).

Although deep-bedded systems provide many benefits for cattle, these systems are arguably more difficult to maintain. Bedding levels decline quickly after filling, and especially without regular raking, stalls begin to look like bathtubs, and cement curbs, brisket boards, and stall partitions all become obstacles for the cow. A recent study by undergraduate researcher Michelle Drissler and visiting scientist Marek Gaworski found that cows lie down 1-2 hours less every day when new bedding has not been added over

the past week. Another important aspect of facility management is stocking density (freestall-to-cow ratio). Although overstocking is often recommended to reduce capital costs, there are likely hidden costs (e.g. lost milk production due to lameness) of providing less space per animal. For example, work by visiting researcher Jose Fregonesi has shown that overstocking pens by 50 % can lead to a decline in lying time of over 2 hours per day – time that cows otherwise spend standing on concrete outside of the stall. More modest levels of overstocking also resulted in reduced lying times.

Stall dimensions. We have also found that other aspects of freestall design can affect standing and lying times. Stall size can be important, particularly freestall width. We have shown that increasing stall width from 45" to over 48" can increase the time cows spend lying down by approximately 1 hour a day (Tucker et al., 2004 b). Perhaps more importantly in terms of lameness, the narrow stalls result in more time spent with only the front two hooves in the stall. Another stall feature that increases this risky standing behaviour is the placement of the neck-rail. Placing the neck rail too low, or too close to the entrance of the stall prevents cows from standing completely on the stall surface. Although to some this might seem like an advantage (as it prevents cows from defecating in the stall), it forces cows to stand on concrete and may increase the risk of hoof problems and lameness. In this way, it is important to recognize that the stall provides a suitable location for cows to both lie down and to spend time standing on a non-concrete surface.

Take home message: well-designed and managed freestalls can improve lying times, and thus keep cows off the wet concrete flooring known to increase risk of hoof injuries and disease. Well-bedded and well-maintained stalls are particularly important.

Designing and managing surfaces for standing

Even with well-designed and managed freestalls, cows still spend almost half of their time outside of the stall. The development of better standing and walking surfaces is another important research area for our group. We have found that the dairy cattle spend close to 6 hours per day standing in front of the feed bunk, so this is an obvious area for improvements (DeVries et al., 2003).

Some producers have now started to look for alternative flooring and walking surfaces for cows, such as rubber mats and conveyor belts. In one recent study we tested the effect of rubber belting on the floor in front of the feed bunk (Fregonesi et al., 2004). We found that cows spent slightly more time standing at the feed bunk when provided the rubber surface compared to concrete, although there was no difference in time spent eating. This type of rubber belting represent what is likely just the first generation of alternative flooring for dairy cows. We have also been examining some more innovative surfaces, and found that some composite (soft felt covered with textured rubber) flooring surfaces can provide both good comfort and good traction for cattle. In addition to the next generation of flooring surfaces, another new idea is to install 'feeding stalls' in freestall barns. These stalls are raised above the alley floor and can provide a comfortable, dry surface for cows to stand on while they are eating. Undergraduate researcher Barb DeCook found that cattle using such stalls show a clear preference for standing on softer

feeding-stall surfaces. More work is needed to determine the longer-term effects of these alternative-standing surfaces on injuries and gait.

Another approach to reduce the amount of time spent standing on concrete flooring is to improve management of the feed bunk. One obvious factor is the amount of space each animal has available to feed, as overstocking also means that cows have to wait to access the feed. For example, Ph.D. student Trevor DeVries has found that reducing stocking density allowed all cows better access to the feed bunk, likely reducing the amount of time cows spent standing waiting to eat (DeVries et al., 2004). Moreover, Trevor found that aggressive interactions among cows reduced by more than half, likely reducing the risk of hoof injuries that can occur when animal slip. Sabine Dipple, a visiting researcher from Germany, is now studying these effects of overstocking on the development of lesions and other hoof problems, especially early in lactation when many animals first develop these injuries.

In other work we have been examining the effects of summer grazing periods on recovery from certain hoof problems. Visiting researcher Luis Carlos Pinheiro Machado Filho and M.Sc. student Lorna Baird have found that a period of access to pasture during the summer months has little effect on hoof injuries when cows come back into the freestall at the beginning of lactation (Baird, 2004), although longer periods of pasture access have been shown to provide advantages. Also, other work by visiting researcher Omar Mendo is suggesting that access to pasture can improve the gait of lame cows.

Take home message: New research projects at the UBC Dairy Centre are helping to identify flooring surfaces and management practices that can help prevent injuries and disease leading to lameness. Results to date suggest that cows benefit from using softer flooring surfaces with good traction. Management practices that reduce the time cows spend standing on wet concrete should be favoured.

Acknowledgements
We thank the many students and visiting researchers that have participated in the projects described above. We are also grateful to the dairy industry for their support of this research, through funding to the Animal Welfare Program by the Dairy Farmers of Canada, the BC Dairy Foundation, the BC Milk Producers, Westgen, members of the BCVMA and many others listed at www.agsci.ubc.ca/animalwelfare.

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