

Lameness in Dairy Cattle

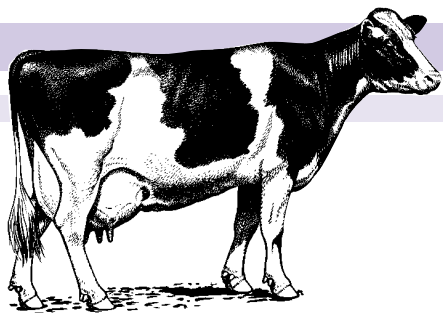
Gerald Stokka, Extension Specialist,
Beef Veterinarian

John F. Smith, Extension Specialist, Dairy

James R. Dunham, Extension Specialist,
Dairy Science

Travis Van Anne, K-State Veterinary
Medicine Student

K-State Research & Extension



Foot and leg problems are a major health concern for many dairy farmers. Cow lameness results in poor performance and substantial economic loss. Nutrition and feeding, housing and environment, concurrent disease, genetic influences, and management factors all predispose a cow to problems. The greatest incidence (90 percent) of lameness involves the foot, and of these, 90 percent involve the rear feet. The most frequent causes of lameness are: laminitis, claw disease, digital dermatitis, and foot rot. Since individual cows often have more than one cause for lameness at the same time, it is important to understand the different types of lameness as well as the treatment and prevention protocols.

Dairy Herd Improvement (DHI) numbers for the University of Florida Research herd in 1995 showed the incidence of clinical lameness in cows at 35 percent. Claw problems (sole ulcers and white line disease) accounted for 63 percent of the reported cases. Digital dermatitis and foot rot accounted for 20 percent, and 17 percent of the cases, respectively.

Tracking Lameness Problems

Record all lameness problems the dairy may encounter. Use a form provided by a veterinarian for proper evaluation and problem determination of each case. A case is considered new, even in a previously lame cow, if it occurs 28 days after a similar occurrence.

Economics

Economically, the results of foot disease are much greater than the treatment costs. Reduced milk yields, lower reproductive performance, increased involuntary cull rates, discarded milk, and the additional labor costs to manage these cows accounts for the largest monetary losses.

Studies in New York have shown why lameness is one of the most expensive health problems, at a cost of \$90 per cow. Cows with feet problems commonly may be the same cows being treated for mastitis, reproduction and other health problems at later dates. Keeping records on these cows and culling persistent problem cows may be advantageous.

Anatomy

Anatomical deformities can lead to an increased rate of lameness. Ideally, conformation of the cow's foot should be short, steeply angled, high in the heel, and even clawed. The sole should be somewhat concave with the majority of the weight placed over the hoof wall. Also, overly straight hocks, weak pasterns, sickle hocks, splay toes, or overlapping toes are commonly seen with an increase in the rate of lameness. Genetically, these traits are only .08 to .16 heritable for holsteins; so unless large numbers of offspring can be scored, it is not that reliable of a tool for selection. When possible, select sires based on progeny tests and that,

Figure 1. Claw Bones and Tendons*

Coronary Band: The coronary band is normally soft and shiny and may be pink in color. **Wall:** The wall is smooth and shiny. Faint ridges run parallel to the coronary band. The wall consists of very tough tubular horn. **Bulb:** The bulb is continuous with the coronary band and is composed of soft, rubbery horn.

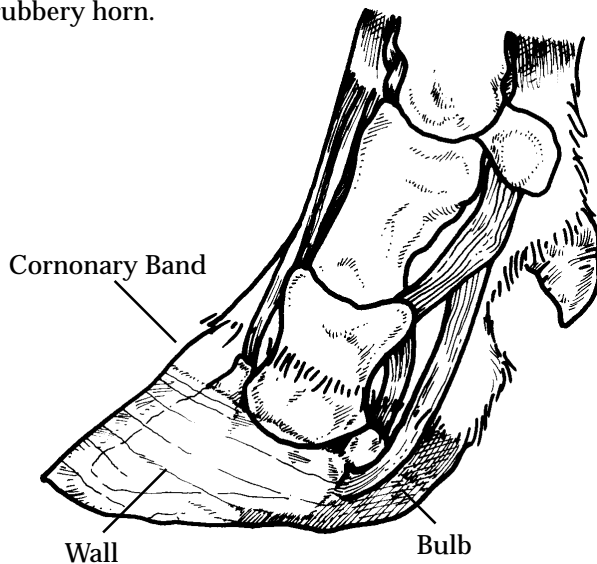
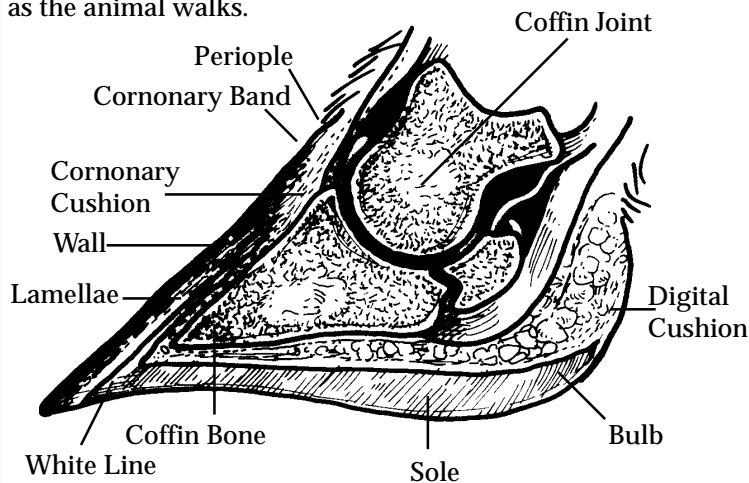


Figure 2. Cross Section of Claw*

Coronary Cushion: Beneath the coronary band is the coronary cushion, a mass of elastic tissue and veins. When the animal exercises, the cushion pumps blood through the foot and back into the body. **Lamellae:** The lower part of the inside wall covers hundreds of tiny ridges (lamellae). Strong fibers attach these ridges to the coffin bone. **Coffin Bone:** The triangular bone at the end of the digit. **Sole:** The sole is thicker towards the heel, slopes away from the outside wall, and is concave. **Digital Cushion:** Inside the bulb is the digital cushion. The cushion functions as an elastic shock absorber. It also may work as a pump to force blood back up the limb as the animal walks.



* Figures provided by Zin pro ®

phenotypically, the bull himself is structurally correct to increase longevity in the herd.

Outside claws, of the cow's rear legs, bear the burden of the continuously changing weight load and this may be the reason they are more often damaged. The front feet are different in that they bear weight changes more evenly, and when problems do occur, the inside claw usually is affected. The cow's foot is protected by the hoof and its outer structures which do more than just bear weight (refer to Figure 1 and 2). The hooves are the first line of defense against foreign objects and pathogens entering the area beneath the hoof, which is the nerve and blood-rich area called the corium (quick), or (dermas) that produces the hoof horn (wall). The health of the corium establishes the quality of the hoof horn produced. Laminitis, which impairs the health and function of the corium tissues, reduces the quality of the hoof horn formed and, thus, impairs its function. The coffin bone (P111), sometimes affected by laminitis, is suspended within the corium and when damaged, leads to other problems. The hoof wall is formed at the coronary band (a pink line near the top of the hoof that may appear soft and shiny) and grows at a rate of 5 millimeters/month. The area where skin meets hoof is called the periople and in the back of the hoof makes up the horn of the heel. The sole is a separate structure made up of underlying corium (touching the ground), and where the sole meets the hoof wall is called the white line. This line may not always appear white

but does separate sensitive from non-sensitive hoof with the area nearer the center being sensitive. This white line also is an important landmark because it is soft and can easily be penetrated by foreign objects. Refer to Figures 1 and 2 to aid in finding anatomical structures.

Hoof Trimming

Hooves should be trimmed or evaluated once or twice a year to improve comfort and performance. One of the trimmings should be scheduled early in the dry period. Proper weight bearing on the hoof wall of the inside claw of the front feet and the outside claw of the back feet is especially important. Hoof trimming is stressful to cows. A 10 percent reduction in milk yield may be seen directly after trimming. However, regular claw trimming may increase the longevity by one lactation.

Nutrition

Proper nutrition management can lower the number of foot problems. Most lameness problems occur within the first 100 days postpartum. Furthermore, laminitis and other causes of lameness can depress feed intake and predispose cows to ketosis, abomasal displacement, and other metabolic disorders. Laminitis often is a result of a wide range of factors which include metabolic and digestive disorders; stress associated with parturition; mastitis; metritis; hard or poorly bedded stalls; too little exercise; excessive bodyweight; and poor nutritional management.

Rations that lead to acidosis are followed by laminitis, but this is difficult to manage

when the largest percentage of diets for dairy cattle contain carbohydrates. To feed carbohydrates correctly, fiber levels must be measured using neutral detergent fiber (NDF), and acid detergent fiber (ADF) values. Fiber also must be in high enough concentration and have the right physical form and particle size. Increased particle size increases cud chewing and, therefore, increases saliva production and aids in efficient digestion. Silage should be chopped so that 25 percent of the particles on a weight basis are over 2 inches long.

Depending on the grain source, the non-structural carbohydrates should not exceed 40 to 45 percent of the ration. Grains also must be properly processed to reduce ruminal upsets and maximize starch digestion. Feeding low NDF percentage levels (below 27 percent of the ration dry matter) can predispose cows to lameness, metabolic disorders, and overall poor performance. At the very least, ADF should be fed at 21 percent of the dry matter. Feeding mature hay may be beneficial during times of high risk because immature forages often do not provide enough fiber.

Having two feeding groups of dry cows can help implement transition rations. Cows expected to calve within three weeks should be changed to a new diet to help alleviate ruminal stress at parturition. When cows freshen, do not make too quick of a transition to a high grain diet. Even though the cows are in a negative energy balance, make the transition gradual. All cattle should have rations balanced for calcium, phos-

phorus, and vitamins A and D for good bone and tissue health as a preventive measure. Other helpful nutrient supplementation can come from zinc, copper, molybdenum, manganese, vitamin E and biotin.

Further preventive measures to reduce acidosis and periparturient diseases include:

- High energy rations should include a buffer (especially in early lactation).
- Allow 2 feet per cow at the feedline.
- Provide a continuous supply of fresh feed to prevent slug feeding.
- Provide a comfortable environment to encourage cows to lie down a minimum of 10 to 12 hours per day.
- Limit time cows spend standing in holding pens to three hours or less per day.

Nutrition plays a significant role in foot disorders, and changes in the normal pattern of ruminal fermentation tremendously influence claw health. Feed a total mixed ration (TMR) to regulate concentrate-to-forage ratio. Closely observe changes in forage moisture content and modify rations accordingly. Successful feeding programs will maximize feed intake, minimize acidosis, while maximizing energy intake during early lactation.

Housing and Environment

Dairy cattle confined to concrete may have more feet and leg problems. Properly designed and bedded freestalls will encourage cows to lay down and curb height over 6 inches should be avoided. Cows lying down 10 or more hours are more content with their environ-

ment and have fewer claw problems. To encourage laying down, cows should have 10 percent more free-stalls than total number of cows. Notice behavioral changes due to heat stress and flies and implement measures to reduce the effects of heat stress and flies.

Providing time for cows to be on dirt or pasture may reduce lameness problems.

Movement of cows at the manager's pace on rough or hard surfaces increases the incidence of lameness. Allow cows to go single file at their pace to reduce foot problems. Wet concrete is 83 percent more abrasive than dry and new concrete is more destructive than old, so special care should be taken when cows are on these surfaces. Grooving smooth concrete may be worth the cost in reducing lameness. Rubber mats placed in feedlines and traffic lanes also may prove beneficial.

Laminitis and Association With Claw Disease

Confinement on hard surfaces can contribute to laminitis and claw disease especially if a recent environment change has taken place, such as going from dirt or pasture to concrete. The outside (lateral) claw of the rear feet, and the inside claws of the front feet, are most often effected by laminitis. Laminitis or founder, is caused by a disturbance in blood flow in the corium which leads to a breakdown of the dermal-epidermal junction of the hoof. This is followed by laminar separation and allows the coffin bone in the foot to become misplaced which compresses soft tissues and sets the stage for sole or toe ulcers (perfora-

tions). Laminae is the sensitive, hoof-tissue-secreting portion of the hoof which becomes inflamed, hence the name laminitis. Cell death of the corium tissues (necrosis), hemorrhage (bleeding), and edema (swelling) especially of the corium, follow laminitis.

Inflammation due to laminitis has many causes such as metritis and mastitis but acidosis is the leading predisposing factor by disrupting the blood supply and its contents to the foot. Clinical signs can be seen in calves fed too high of a concentrate diet at 6 months of age—this opens the door for more severe laminitis as the animal grows older.

Cattle with chronic laminitis (slipper foot) usually have overgrown, disfigured hooves. The coronary band is covered with a rough fringe of horn and the hoof appears rippled. Since the outside claw of the rear foot is most often affected, cows tend to stand cow-hocked. Abnormal growth in chronic cows can lead to abnormal wear which predisposes the cow to many other lameness problems such as sole ulcers, white line disease and abscesses.

Sole ulcers, the result of necrosis, expose the corium and can debilitate a cow. Maturity of the lesion may determine the ulcer's appearance. Together, excessive hoof-horn formation, movement of the coffin bone, and the production of softer sole horn predispose the outside claw to tremendous weight bearing and wear. The lesion happens due to the increased pressure placed on the heel and cows often are seen standing with their legs further back than normal.

The pain and pressure of the ulcer can be helped with footblocks or shoes applied to the good claw. Remember to never bandage or cut the ulcer or apply anything that will burn the granulation tissue and delay healing. If an ulcer is found in one outside hind claw it is likely that the other hind foot contains an ulcer, too. The incidence of sole ulcers can be reduced with regular foot trimming because even weight distribution on the claws is maintained. Toe ulcers are a rupture of the white line due to the toe bone (coffin) rotating. A ridge may be seen on the wall several months after change to a high concentrate diet. Animals with toe ulcers should not be used for breeding purposes and will be impaired for life.

Hemorrhage and necrosis of the corium are seen most often in the white line, the weight bearing region of the sole or claw. The hemorrhage is not visible until it rises to the surface of the sole after a few weeks which indicates subclinical laminitis. Subclinical laminitis often is not noticed until after repeated episodes have occurred and it reaches the chronic form. If greater than 10 percent of the mature cows are showing some signs of lameness in a 12-month period and foot rot or digital dermatitis have been ruled out, then subclinical laminitis may be present. Also, if 5 percent or more of the cows are experiencing sole ulcers in a time frame of 12 months or less, subclinical laminitis may be present.

Animals may also get what is called by many "white line disease" or subsolar abscesses which can cause acute lame-

ness. Most of the time with white line disease an abscess will occur in the heel leading to severe destruction of the joints and tendons. This is many times confused with foot rot but the swelling is confined to the heel of single claw not both claws as in foot rot. Often, acutely lame cows show pain in all feet and stand with their front or hind feet extended forward. Abscesses are more commonly caused by laminitis, because the white line is more penetrable because it is widened and softer.

Laminitis also is associated with other diseases. Double soles, heel erosion, horizontal grooves and fissures, and vertical fissures (sandcracks) can cause problems to cows. As one can see, conditions leading to laminitis should be avoided.

Prevention of laminitis can best be accomplished by reducing ruminal acidosis and controlling periparturient diseases such as metritis and mastitis (see Nutrition section). There is no specific treatment for laminitis but non-steroidal, anti-inflammatory drugs are used to control the pain. Hoof over-growth is treated by continuous trimming. Ulcers and abscesses are treated by digging out the damaged area and allowing drainage.

Digital dermatitis

Footwarts are known by a variety of names including: hairy heel warts; digital warts; strawberry foot; raspberry heel; verrucous dermatitis; digital warts; interdigital papillomatosis; Mortellarl or Mortellaro's disease; and digital dermatitis, which is the most accepted. Though a disease

associated with infection, predisposing factors are unknown and the incidence has been increasing worldwide making this a difficult health problem to control. There are still some closed herds that have never developed the disease.

The earliest lesion detectable as digital dermatitis is a reddened circumscribed area typically on the bottom of the pastern (just above the division of the toes around the heels) on the rear feet and may have hairs matted or erect around the edges to form a rim. This extremely painful disease can occasionally be seen in the front feet or on the front of the rear feet. Cows may stand on their 'tip toes' while trying to relieve the pain of weight on the heels. Purchased cattle (especially bulls) should be examined thoroughly, and if diagnosed, treatment should be immediate.

Topical sprays are the least expensive treatment; can be applied directly; have less chance for contamination; and have less chance for residue but may be less effective than other treatments. It is helpful to clean the area before topical sprays are applied as the antibiotic is less effective if manure and other debris are not removed. Antibiotics used in this fashion are an extra label use, consult with a veterinarian for specific implications. To control the disease keep the herd as closed as possible. Footbaths are somewhat effective but incidence of the disease is much more common in new cattle than in existing cows. This indicates that some immunity may exist for animals formerly exposed to the disease.

Foot rot

Foot rot is a contagious, infective disease seen most often in confinement cattle. It is characterized by a necrotic lesion in the interdigital skin (between the claws) which may extend into the soft tissues of the foot causing swelling and lameness. The organism responsible for foot rot (*Fusobacterium necrophorum*) originates in the gastrointestinal tract and is shed into the environment by feces. The bacteria can live freely in the soil or in the internal environment of the animal. A new, more severe form of the disease recently has been observed that may reach the upper leg and, if not treated immediately, has grave prognosis for infected animals.

Reducing foot rot can be accomplished by housing cattle in dry, manure-free pens that have no debris. Other preventive measures include: footbaths, feed additives, and/or vaccines. Damaging factors which can lead to foot rot include: stubble fields, small rocks, abrasive surfaces, and high temperatures with high humidity. Isolating infected cattle may reduce the spread of the bacteria to the environment.

Treatment with injectable antibiotics has been successful with or without topical treatment of the wound. Other causes are likely present if three days of treatment have been administered and the animal has not responded. The lesion should not be covered or bandaged and the animal should be housed in a dry, clean environment to promote healing.

Other diseases associated with infection besides digital dermatitis and foot rot include infection of the coffin joint and interdigital dermatitis (stable foot rot, Scald).

Conclusion

Foot problems are a major concern for dairies and care should be taken to avoid promoting these problems. Preventive measures, with the aid of a veterinarian, must be followed if the problem is expected to be controlled. Feet should be trimmed or at least examined one to two times per year. High concentrate diets should be fed carefully to avoid acidosis. Cows should have limited time standing on concrete and should not be rushed when walking on any abrasive surfaces. Cows need a clean, comfortable environment to lay down in. Lamé cows need treated early and records should be kept on all cases.

References

- Grant, R., 1996. Dietary factors that influence hoof health: the link between nutrition and sore feet. In: Proc. of the 1996 Heart of America Dairy Management Conference. pp 110–118, Kansas City, Mo., April 29 and 30.
- Greenough, P.R., Schugel, L.M., Johnson, A.B., 1996. Cattle lameness. Zinpro Corporation's Illustrated Handbook. Zinpro Corporation, USA.
- Guard, C., 1995. Laminitis in dairy cattle: recognition of the disorder and management of the causative factors. In : The Bovine Proceedings—No 28 pp 71–74. San Antonio, Texas. September 14–17.
- Guard, C.G., 1994. Recognizing and managing infectious causes of lameness in cattle. In : The Bovine Proceedings—No 27. pp 80–82, Pittsburgh, Pennsylvania, September 22–25.
- Maas, J., 1996. Fact sheet no. 5: footrot. Internet. <http://www.uocp.edu/anrhome/coop-ext/Uccelr/vet5.html>.
- Morrow, D., 1990. Dairy cows: rumen burn-out what causes it and why it hurts performance. Large Animal Veterinarian. September/October. pp 24–28.
- Shearer, J.K., 1996. Physiology of a healthy and an unhealthy foot: keeping cows on their feet at the feedbunk. In: Proc. of the 1996 Heart of America Dairy Management Conference. pp 94–108, Kansas City, Mo., April 29 and 30.
- Verner, M., 1996. Hairy heel warts, foot rot, founder: the enemies. Dairynew list. Internet. varner@umd5.umd.edu.
- Wren, G., 1994. Getting to the root of dairy laminitis. Bovine Veterinarian. September. pp 38–44.



Kansas State University Agricultural Experiment Station and Cooperative Extension Service

MF-2070

January 1997

Issued in furtherance of Cooperative Extension Work, acts of May 8 and June 30, 1914, as amended. Kansas State University, County Extension Councils, Extension Districts, and U.S. Department of Agriculture Cooperating, Richard D. Wootton, Associate Director. All educational programs and materials available without discrimination on the basis of race, color, national origin, sex, age, or disability.

File Code:Dairy Science-4

1-97-1M