

Review Article

Economic Importance of Claw Health Problems in Ethiopian Dairy Cows: Causes and Methods of Improvement

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Abstract: Even though a claw health problem is underestimated by many dairy producers in Ethiopia, it is widely regarded as one of the major productivity, health and welfare issues for dairy cows. Its negative impacts are many; decreased milk yield, lowered reproductive performance, increased involuntary cull rates, discarded milk, and the additional labor costs to manage these cows accounts for the largest monetary losses. Nutrition and feeding, housing and environment, concurrent disease, genetic influences, and management factors are all predispose a cow to claw health problems. Laminitis, claw disease, digital dermatitis, and foot rot are the most frequent causes of claw health problems. Since claw health problems have substantial economic losses to dairy producers, it is important to alleviate its negative impacts. Therefore, proper hoof trimming, providing appropriate nutrition, improving housing and environment, good management practices and awareness creation are among the best improvement strategies of claw health problems in dairy cows in Ethiopia.

Keywords: Claw Health, Causes, Dairy Cow, Economic Importance, Ethiopia

1. Introduction

In Ethiopia investing in development interventions to the dairy sector will contribute to poverty alleviation by increasing the income of smallholder dairy producers and creating employment and transforming the existing largely subsistent type of milk production to commercial level [1]. However, there were various constraints of dairy production like claw health problems (lameness) [2]. Claw health is considered to be among the most important health problems in dairy production in many parts of the world in general and in Ethiopia in particular. Lameness is one of the greatest constraints to productivity, health and welfare of dairy cattle. It causes significant financial losses to animal breeders, because cow lameness results in poor performance and substantial economic loss.

Hazards to claw health and cow mobility can take many different forms. For instance, many aspects of the cow environment such as housing type, flooring quality and

cubicle design can put claw health at risk (Haskell, et al., 2006 cited by [3]). Moreover, claw health problem could be due to the information on individual cows (hock lesions, claw length, parity, days in milk, and milk production), management practices (floor and stall cleaning routine, bedding routine, and footbath practices), and facility design (stall dimensions, stall base and bedding type, width of feed alley, flooring type, and slipperiness) that were hypothesized to be risk factors for lameness [4].

Evidence for loss of productivity due to lameness through premature culling, treatment costs and milk loss is important to persuade a reluctant farmer to consider changing the environment. In Ethiopia, despite the importance of the information about the extent and possible effects of lameness on production indices, little has been known about improvement claw health in dairy cows and it has not been reviewed earlier and well- documented. Therefore, it is important to review the aspect thoroughly and bring minor details into focus to have better understanding of improvement

claw health in dairy cows in Ethiopia.

2. Concept of Lameness

Lameness is a multi-factorial disease, and is typically a symptom of infectious disease, such as foot rot and digital dermatitis (DD), and non-infectious disease, such as sole ulcers, sole haemorrhages or white line lesions [5]. Lameness may also be associated with feeding and nutrition, housing conditions, environmental factors, management practices, or a combination of any or all of these [6]. Claw disorders associated with chronic subclinical laminitis are primary causes of lameness in most herds, followed by digital dermatitis and foot rot. Lameness is, by its frequency and its economic importance, the 3rd disease in dairy herds, after mastitis and reproductive issues [7]. It is a serious dairy health issue which results in multiple problems including pain, reduced body condition, reduced milk yield, and reduced dry matter intake, reduced fertility and an increased likelihood of culling.

3. Causes of Claw Health Problems

Typically claw health problem in dairy cow is resulted as a consequence of many predisposing factors. Nutrition and feeding, housing and environment, concurrent disease, genetic influences, and management factors all predispose a cow to claw health problems.

3.1. Foot Lesions

Most lameness originates from lesions of the feet. Bovine foot lesions can be divided grossly into laminitis related-lesions, infectious lesions and lesions caused by physical and (or) chemical damages [8]. Moreover, foot lesions are commonly categorized according to their etiology into infectious and non-infectious lesions [9].

3.2. Laminitis and Associated with Claw Disease

Laminitis is an aseptic inflammation of the sensitive lamina (corium) of the foot [10]. Lesions of the claw horn, which include sole hemorrhage, sole ulcer and white line disease, are very common causes of lameness in dairy cattle and have traditionally been referred to collectively as “laminitis” [11]. White line diseases are areas of hemorrhage and necrosis of the corium which are often most noticeable and severe in the white line region of the sole caused by laminitis. Sole ulcers are usually associated with clinical manifestations of laminitis. As a general rule of thumb, if 10 percent of a herd has documented sole ulcers, the herd should be suspected for laminitis. However, there are other factors that can predispose cows to sole ulcers such as moisture and manure, excessive wear, and poor hoof trimming [12].

Laminitis can occur in three phases: acute, subclinical and chronic type. Acute laminitis may occur due to feeding diets too high in concentrates so that a condition called acidosis can be resulted which leads the release of chemicals gradually destroy the vessels supplying the hoof tissue with blood.

Subclinical laminitis is the most common form of laminitis found in modern dairy operations. This phase can result from physical injury to the hoof or from damage sustained during acute laminitis. During the chronic phase of laminitis, the mechanical damage occurring within the hoof becomes permanent. In severe cases, the tip of pedal bone may actually come through the sole or entire pedal bone may sink down to the level of sole (Erin, 2000 cited by [13]). Laminitis can result in long, overgrown and deformed feet or toes by which the highest incidence of laminitis often occurs during the first 100 days postpartum [12]. Laminitis also is associated with other diseases. Double soles, heel erosion, horizontal grooves and fissures, and vertical fissures (sand cracks) can cause problems to cows [14].

3.3. Digital Dermatitis

Digital dermatitis (papillomatous digital dermatitis, hairy heel warts, and foot warts) of cattle has been identified as a major cause of lameness in dairy cattle in many countries [15, 16]. 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. It accounts for 62% of the lameness in bred heifers and 49% of the lameness in cows [17]. In bovine, digital dermatitis can be caused by bacterial or viral infections, parasitic infestations, or by various physical or chemical factors [8]. Lameness due to digital dermatitis (DD) is most commonly seen in first- and second-lactation cows, usually after entry into the milking string [15]. Large herds, herds with predominately Holsteins, herds with corral housing in winter (muddy conditions prevail at this time) and herds not using footbaths were risk factors. In the acute phase it is painful when touching and results in lameness [18].

3.4. Foot Rot

Foot rot (Sore foot) is a contagious, infective disease seen most often in confinement cattle. It is characterized by necrotic lesion in the interdigital skin (between the claws) which may extend into the soft tissues of the foot causing swelling and lameness. The main organism responsible for foot rot (*Fusobacterium necrophorum*) originates in the gastrointestinal tract and is shed into the environment by feces [15]. The organism enters into the deeper tissue when mechanical injury or softening and thinning of the interdigital (between the toes) skin by puncture wounds or continuous exposure to wet conditions are there since normal healthy skin will not allow the bacteria involved in foot rot to enter the deeper tissues [19]. Another environmental risk factor for lameness associated with foot rot is cows to walk through or stand in manure slurry for extended periods [20]. Cattle with foot rot show lameness, usually on one leg only. The foot swells above the coronet and the toes spread. Cracks and fissures develop in the interdigital space [12].

3.5. Hygiene

Cow hygiene may be affected by stall design and

management, stage of lactation and feeding. Cows with dirty hind legs were more likely to have hairlessness of hocks. Cows were dirtier during the housing period and that nonorganic, high yielding cows were less likely to have a low hygiene score, meaning they were dirtier [21]. [22] found that cows with dirty hooves had a higher prevalence of claw lesions at spring trimming. Cleanliness of cows is a good general indicator of hygiene status and thus hygiene is considered as the second area of extrinsic risk for lameness. Dry feet have greater integrity than wet, the hoof horn and the barrier of the skin between and above the claws is intact reducing the chances of bacteria invading the tissue [23].

4. Risk Factors Associated with the Prevalence of Claw Health Problem in Dairy Cattle

Typically lameness is consequence of disturbed morphological and functional integrity of musculoskeletal system of locomotors apparatus. Locomotors apparatus diseases in dairy cattle have complex multi causal etiology, referring to certain classical and many other specific factors in intensive production. Season, gestation and stage of lactation, previous disease and parity were some of intrinsic and unavoidable risks for lameness [6]; also with some genetic determined intrinsic risk for development of lesions [24]. The predisposing causes of lameness are considered to be genetic, nutritional and environmental [25]. In general, increased lameness prevalence is associated with solid concrete flooring, decreased lying times due to the discomfort, slippery walking alleys, uncomfortable and dirty barns, and increased degree of dirtiness in cows' legs, free-stall sheltering and the lack of biotin supplementation in lactating cows [26].

5. Economic Importance of Claw Health

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. Cows with foot 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.

6. Ways of Claw Health Improvement

6.1. 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. Since hoof trimming is stressful to cows and may

leads reduction in milk yield, regular claw trimming is crucial because it may increase the longevity by one lactation.

6.2. 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 [1, 2]. Rations that lead to acidosis are followed by laminitis, to feed carbohydrates correctly, fiber levels must be measured using neutral detergent fiber (NDF), and acid detergent fiber (ADF) values. Depending on the grain source, the non-structural carbohydrates should not exceed 40 to 45 percent of the ration.

6.3. Improving Housing and Environment

6.3.1. Cow Comfort on Floors

Flooring in cubicle housing systems needs to be durable, comfortable and provide good claw and leg health. It should have the right friction to avoid accidents and to assure that the wear on the claw is not too much or too little. The floors must also be easy to clean, dry and hygienic. Concrete flooring, solid or slatted, is the most common solution in cubicle housing systems. Concrete flooring can be made less slippery if grooved. It can also be stamped with for example hexagon patterns. Asphalt flooring, mastic asphalt, is non-slippery but may be too rough and abrasive. Rubber flooring can be applied both on solid and slatted concrete floors. Rubber slatted flooring in the rear of tie stalls was found to improve claw health compared to solid rubber floors, apparently because of improved hygienic conditions [27]. Cows preferred to walk and stand on slatted or solid rubber mats rather than slatted or solid concrete floors [28].

6.3.2. Cow Comfort in Cubicles

Lying areas for dairy cows should be clean, soft and dry. Cubicles must provide comfort when lying down and rising and be large enough for cows to lie comfortably and naturally. However, the cubicle should not be too large that the cow can lie diagonally or defecate in the cubicle [29].

Rubber mats and mattresses are commonly used in cubicles. Mats and mattresses need litter to absorb moisture and reduce abrasions. Straw, sawdust, wood shavings, sand, dried manure and peat are common used litter materials alone in a deep bed or a thinner layer on mats and mattresses. Cows were spending more time lying in the cubicles with comfort mats compared to the other bedding materials, and that the preparation time for lying down was shorter [30]. Peat has a great absorption capacity and may even absorb airborne ammonia. Hock lesions decreased when using peat compared to deep straw. The cows where cleaner and cow comfort was better when using peat [31].

6.3.3. Management

“If you don’t measure it, you can’t manage it. The key to preventing lameness is to keep feet *clean and dry*” [14].

Management is essential to prevent and treat lameness, but may not be applied due to a lack of time or labour, inadequate hoof-trimming facilities or cost [32]. Locomotion scoring should be frequently carried out on every cow; the Dairy Co 4-point Mobility Scoring System is an example of a standard, easy to use system. To be scored accurately, cows should walk on a flat, even surface, in a straight line or around a corner, and ideally by an impartial person. Cows identified as lame should then be promptly diagnosed and treated, as early detection and treatment improves the likelihood of recovery [33]. Hoof trimming, such as Dutch 5-step trimming [34], should be practiced when necessary to treat and prevent lameness. Anti Inflammatory Drugs (NSAIDs) should be considered during treatment for lameness, as procedures such as hoof trimming can be painful, and used routinely for claw horn disease [35]. Further measures to prevent and treat lameness include regularly using a footbath, ideally daily after milking (depending on the chemical used); keeping housing areas clean and dry; good nutrition and providing a comfortable recovery area for lame cows [14].

7. Conclusion and Recommendations

In Ethiopia, in many dairy farms (intensive or extensive dairy farms) claw health problem is underestimated by many dairy producers. However, there is reasonable evidence to suggest that claw health problems are a major concern and economic importance for dairy producers. Because, it affects the productive and reproductive performance and overall health condition of the dairy cows. In order to enhance claw health problems in dairy cows and thereby improve the livelihood of dairy producers, the housing should prevent wounds on and between claws by providing clean, dry and coarse floors without uneven surfaces. Moreover, optimize feed rations to prevent ruminal acidosis, as this has an adverse effect on claw health and keeping the production environment in hygienic condition also prevents bacteria from infecting claws and surrounding skin. Therefore, clip claws regularly and awareness creation on the impact of lameness in dairy industry is needed.

References

- [1] Yilma, Z., Guernebleich, E., Sebsibe, A. and Fombad, R. (2011): A review of the Ethiopian dairy sector. Addis Ababa, Ethiopia: FAO Sub Regional Office for Eastern Africa (FAO/SFE).
- [2] Abebaw, M., Guadu, T., Negash A., Zemene, M., Alene, B., Girma, G., Tilahun, M. and Demelash, K. (2016): Assessment on Challenges of Dairy Production and Marketing in Gondar town, North West Ethiopia. *Nature and Science*, 14.
- [3] Mishamo Sulayeman and Abebe Fromsa. (2012): Lameness in Dairy Cattle: Prevalence, Risk Factors and Impact on Milk Production. *Global Veterinaria* 8 (1): 01-07.
- [4] Solano, L., Barkema, H. W., Pajor, E. A., Mason, S., LeBlanc, S. J., Heyerhoff, J. Z., Nash, C. G. R., Haley, D. B., Vasseur, E. and Pellerin, D. (2015): Prevalence of lameness and associated risk factors in Canadian Holstein-Friesian cows housed in freestall barns. *Journal of dairy science*, 98: 6978-6991.
- [5] Keyserlingk, M. A. G., Rushen, J., de Passille, A. M. and Weary, D. M. (2009) Invited review: The welfare of dairy cattle – key concepts and the role of science. *Journal of Dairy Science*, 92, 4101-4111.
- [6] Hristov, S., Stankovic, B., Zlatanovic, Z. and Plavsic, B. (2011): The most significant predisposing factors and causes of lameness of dairy cows. Proceedings of International Scientific Symposium of Agriculture" Agrosym Jahorina. Pp. 82-89.
- [7] Centre National Interprofessionnel de l'Économie Laitière (2018) Boiteries des bovins Available at: <http://boiteries-des-bovins.fr/>. Accessed 31 August 2018.
- [8] Manske, T., Hultgren, J. and Bergsten, C. (2002): Topical treatment of digital dermatitis associated with severe heel-horn erosion in a Swedish dairy herd. *Preventive veterinary medicine*, 53: 215-231.
- [9] Potterton, S. L., Bell, N. J., Whay, H. R., Berry, E. A., Atkinson, O. C. D., Dean, R. S., Main, D. C. J. and Huxley, J. N. (2012): A descriptive review of the peer and non-peer reviewed literature on the treatment and prevention of foot lameness in cattle published between 2000 and 2011. *The Veterinary Journal*, 193: 612-616.
- [10] Refaai, W., Van, Aert, M., El-Aal, A. A., Behery, A. E. and Opsomer, G. (2013): Infectious diseases causing lameness in cattle with a main emphasis on digital dermatitis (Mortellaro disease). *Livestock Science*, 156: 53-63.
- [11] Greenough, P. (2007): Infectious diseases and other conditions affecting the interdigital space. Bovine Laminitis and Lameness. 1sted, WB Saunders/Elsevier, Philadelphia, PA. Pp. 199-220.
- [12] Ishler, V., Wolfgang, D. and Griswold, D. (1999): Prevention and control of foot problems in dairy cows. Department of Dairy and Animal Science and Department of Veterinary Science, College of Agricultural Sciences and Cooperative Extension. Pennsylvania Dairy Health and Biosecurity Manual. Pp. 1-20.
- [13] Mulatu, W., 2018. Epidemiological Investigation Of Lameness In Selected Dairy Farms Of Sululta Town, Central Ethiopia, MVSc Thesis, Addis Ababa University, Ethiopia.
- [14] DCWS (2012) Interactive Workshops: Cramer, G. And McDowell, G. A. Lameness Lesions and Management; Nash, C., Main, A., Villettaz Robichard, M., On-farm assessments to improve cow comfort, The First Dairy Cattle Welfare Symposium 23-26 October 2012, Guelph, Ontario, Canada.
- [15] Berry, S. L. (2001): Diseases of the digital soft tissues. *Veterinary Clinics of North America: Food Animal Practice*, 17: 129-142.
- [16] Hillström, A., and Bergsten, C. 2005. Digital dermatit- en tickande bomb i svenskalösdrifter, *Svenskveterinärtidning*, 57, 15-20.
- [17] Krull, A. C. (2015): Bovine Digital Dermatitis: Natural lesion development and experimental induction. Iowa State University.

- [18] Klitgaard, K., Boye, M., Capion, N., Jensen, T. K. 2008. Evidence of Multiple *Treponema* phylotypes involved in bovine Digital Dermatitis as shown by 16S rRNA gene analysis and fluorescence in situ hybridization. *Journal of Clinical Microbiology*, Vol 46, 3012-3020.
- [19] Wohlgenuth, K. (1987): Foot rot in cattle: Oklahoma Cooperative Extension Fact Sheets. ANSI-3355. Division of Agricultural Sciences and Natural Resources. Oklahoma State University.
- [20] Shearer, J. (2005): Laminitis-more than how you feed your cows (laminitis, claw disorders, and infectious foot diseases). *Proceedings 2nd Florida Dairy Road Show College of Veterinary Medicine University of Florida*, 8.
- [21] Ellis, K. A., Innocent, G., Grove-White, D., Cripps, P., McLean, W. G., Howard, C. V., Mihm, M. (2006). Comparing the Fatty Acid composition of Organic and Conventional Milk, *Journal of Dairy Science*. 89, 1938-1950.
- [22] Manske, T. 2002. Hoof lesions and lameness in Swedish dairy cattle; prevalence, risk factors, effects of claw trimming and consequences for productivity. PhD Thesis, Sverigeslantbruksuniversitet, Skara. pp 140.
- [23] Mulling, C. K., Green, L., Barker, Z., Scaife, J., Amory, J. and Speijers, M. (2006): Risk factors associated with foot lameness in dairy cattle and a suggested approach for lameness reduction. *World Buiatrics Congress*, 24.
- [24] Koenig, S., Sharifi, A. R., Wentrot, H., Landmann, D., Eise, M. and Simianer, H. (2005): Genetic parameters of claw and foot disorders estimated with logistic models. *Journal of dairy science*, 88: 3316 - 3325.
- [25] Manson, F. A. and Leaver, J. D. (1988): The influence of concentrate amount on locomotion and clinical lameness in dairy cattle. *Animal Science*, 47: 185-190.
- [26] Konig, K. Q. (2009): Perception of lameness in Dairy Cattle (Master's Thesis). Faculty of Health and Medical Sciences. University Of Copenhagen.
- [27] Hultgren, J., and Bergsten, C. (2001). Effects of a rubber-slatted flooring system on cleanliness and foot health in tied dairy cows. *Preventative Veterinary Medicine*. 52, 75-89.
- [28] Telezhenko, E., Bergsten, C., Magnusson, M., Nilsson, C. 2009. Effect of different flooring systems on claw conformation of dairy cows. *Journal of Dairy Science* 92, 2625-2633.
- [29] Irish, W. W., and R. O. Martin. 1983. Design considerations for free stalls. In: *Dairy Housing II*, National Dairy Housing Conference. 108-121.
- [30] Herlin, A. H., and Drevemo, S. 1997. Investigating locomotion of dairy cows by use of high speed cinematography. *Equine Veterinary Journal Suppl.* 23, 106-109.
- [31] Andersson, K. 2007. Peat litter to Swedish dairy cows, Degree project 250, Department of Animal Nutrition and Management, Swedish University of Agricultural Sciences pp 62.
- [32] Whay, B. (2012) Management of Lameness and Other Health problems for Dairy Cattle Welfare. The First Dairy Cattle Welfare Symposium, 23-26 October 2012, Guelph, Ontario, Canada.
- [33] Dairy Co (2013a) Available at <<http://www.dairyco.org.uk/technical-information/animal-health-welfare/lameness/husbandry-prevention/mobility-scoring/>> Last accessed 06/08/13.
- [34] Nadis (2009). Lameness control in Dairy Herds. Available at <<http://www.nadis.org.uk/pdfs/Foot%20Trimming.pdf>> Last accessed 06/08/13.
- [35] Laven, R. (2012) Assessment of the Effect of Treatment with Long-Acting and Short Acting Non-Steroidals on the Pain Responses Associated with Lameness in Dairy Cattle. The First Dairy Cattle Welfare Symposium, 23-26 October 2012, Guelph, Ontario, Canada.