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## The incidence of foot ailments in few districts of central and north karnataka with emphasis on management of lameness in large ruminants

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#### Abstract

The present study was undertaken with an objective to record the incidence of various foot ailments treated in various Veterinary Dispensaries (VD) of Gadag, Koppal, Vijayapur, Bagalkote, Kalaburgi and Davanagere districts of Central and North Karnataka, India. The pooled data reveals the occurrence of 1857 cases with hoof disorders out of which 48.73% were over grown hoof, 4.79% was cork screw hoof, 2.5% was sole ulcers, 1.8% punctured sole, 3.12% was foreign body in sole, 9.43% was interdigital hyperplasia, 0.2% was aseptic laminitis, 8.57% was hoof avulsion, hoof trauma and injury which are of non-infectious origin. The rest ailments correspond to infectious origin like 15.09 % foot rot in cattle and buffalo, 4.35% of sole haemorrhage and 1.42 % digital/ interdigital dermatitis. The breed wise distribution of hoof disorders revealed the highest incidence in H.F. crossbreds (24.32%) followed by Jersey cross (21.76%), Amruth mahal cross (19.35%) and Hallikar crossbreds (12.98). Similarly, among buffaloes highest breed incidence was recorded in Murrah cross (10.57%), followed by Surti cross (7.98%) and non-descript (3.04%). Foot lesions were observed to be greater in hind limbs with greater involvement of outer claw than in fore limbs with greater involvement of inner claw. Incidence of foot lesions was higher in animals on concrete floor with limited space and poor hygienic conditions. The animals which were left loose for exercise regularly had lesser foot problems than those reared on hard/concrete floor in stall feeding system. The incidence of foot ailment was more in cross bred than in the indigenous breed of cattle and buffalo.

**Keywords:** foot ailment, foot rot, sole haemorrhage, interdigital hyperplasia, crossbred and indigenous breed

#### 1. Introduction

Lameness is multifactorial disease of domesticated ruminants causing severe economic loss to dairy industry after mastitis and reproductive disorders. Inflammation of Laminae, the sensitive hoof-tissue-secreting portion of the hoof is termed as laminitis. Laminitis includes most of the hoof disorders that can lead to lameness. Laminitis can be hyper acute (hours), acute (day to days), or chronic (weeks to months). The most common condition is chronic, subclinical laminitis (Beteg *et al.*, 2007) <sup>[6]</sup>. It is followed by necrosis of corium tissue, haemorrhage and oedematous swelling of corium. The effects of laminitis include ridges along the foot wall; swelling at the coronary band; waxy, flaking solar horn tissue; false soles; haemorrhage in the sole; white line abscesses; and sole ulcers (Smilie *et al.*, 1996) <sup>[17]</sup>. Wherein, 99% of the lesions causing lameness occurred in the feet with 92% occurring in the rear feet. Of the lesions in the rear feet, about 68% were on the lateral (outside) claw, 12% on the medial (inside) claw, and 20% on the skin. The most common lesions (58%) were sole ulcer and white line disease. These are the direct result of insult or injury to the corium and are lesions we generally attribute to "laminitis" (Blowey R., 2007) <sup>[7]</sup>. Cow lameness results in poor performance and substantial economic loss. Nutrition and feeding, housing and environment, concurrent disease, genetic influences, and management factors all predisposes to lameness.

Foot rot in cattle is caused by *Fusobacterium necrophorum*, which may act alone, or in concert with a few other bacteria, including *Bacteroides melaninogenicus*, *Staphylococcus aureus*, *Escherichia Coli*, *Actinomyces pyogenes* and the newly blamed *Porphyromonas levii* (AABP, 2012 and White, 2010) <sup>[1, 18]</sup>.

Foot warts (Digital dermatitis) 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, is an infectious disease that most commonly causes lesions on the rear foot in the heel region beginning at the cleft. Most lesions are between 1 and 2.5 inches in diameter and are circular or oval. More advanced lesions may form papillae that give the wart a “hairy” appearance. The exact causative agent is not known, but evidence suggests that one or more species of spirochete of the genus *Treponema* is responsible. *Treponema* bacteria can be anaerobic or microaerophilic (require O<sub>2</sub> at less than atmospheric levels) and can be parasitic to humans and to animals causing a range of diseases (Thomas, 2015) [8].

Interdigital/ superficial dermatitis (Hairy hoof warts, Slurry Heel, Stinky Foot, Stable Foot rot) comprises of All kind of mild dermatitis around the claws that is not classified as digital dermatitis. A superficial infection of the skin between the claws. This can create a pocket in the interdigital skin that accumulates slurry, stones and leads to infection caused by the *Dichelobacter nodosus* and *Fusobacterium necrophorum* bacteria (Anderson, 2001) [2]. Interdigital phlegmon (Foot rot, Foul in the foot, Interdigital necrobacillosis) is symmetric painful swelling of the foot commonly accompanied with odorous smell with sudden onset of lameness.

According to Pedro Nogueira, 2008 [12], the Non-infectious lameness comprises of ulcers, laminitis, heel erosion, white line disease. Wherein he explains, Ulceration as a painful hoof lesion of the sole area specified according to localization (zones) such as bulb ulcer, sole ulcer, toe ulcer, toe necrosis. Laminitis is an inflammation of the soft tissue between the outside of the claw, and the pedal bone within the claw. Double sole (Underrun sole) is seen in two or more layers of under-run sole horn. Heal horn erosion (Slurry heel, *Erosio ungulae*) is caused due to the erosion of the bulbs, in severe cases typically V-shaped, possibly extending to the corium. Interdigital hyperplasia (Corns, Tyloma, Interdigital fibroma) occurs due to interdigital growth of fibrous tissue. While, in case of Thin sole, horn yields (feels spongy) when finger

pressure is applied. White line disease is the separation of the white line with or without purulent exudation. There are 2 types wherein, White line fissure is separation of the white line which remains after balancing both soles and White line abscess is necro-purulent inflammation of the corium.

Sheep Foot rot is caused by the coexistence of two gram-negative, anaerobic bacteria, *Fusobacterium necrophorum* and *Dichelobacter nodosus* (also referred to as *Bacteroides nodosus*). Several different strains of *D. nodosus* affect both sheep and goats, and can also be carried by cattle, deer, and horses. In general, sheep are affected more severely than goats (Pezzanite *et al.*, 2009) [13]. Contagious ovine digital dermatitis is highly contagious and spreads quickly through the herd, often affecting over 40 percent of the animals. First symptoms occur at the coronary band rather than the interdigital space. The cause of this disease is not yet understood, however many bacteria, including *Treponema spirochaetes* (strains similar to those found in cows) have been identified. There is little that can be done to prevent this disease other than keeping flocks in dry pastures or housing. Lameness is also a major health and welfare problem in sheep and goat herds (NADIS, 2003). As with cows, it creates pain for the animal and economic losses for the farmer due to decreased herd performance. Lamé sheep and goats have a lower body condition, a lower wool value (sheep), a decrease in milk let down, reduced growth rates in the young and a lower fertility rate. Effective management of hoof health in these animals is difficult but should be based on good nutrition, good management, preventive measures, accurate diagnosis, hoof trimming and prompt treatment where necessary (Gerald, 2015).

The present study was proposed with the objective to record the incidence of various foot ailments treated in different Veterinary Dispensaries (VD) of Gadag, Koppal, Bagalkote, Vijayapur, Kalaburgi and Davanagere districts of Central and North Karnataka, India.

**Table 1:** Infectious and non-infectious type of lameness in ruminants (NADIS 2003 and Pedro Nogueira, 2008) [12]

Animals	Infectious	Non infectious
Large Ruminants (Cattle and Buffalo)	Foot rot Digital dermatitis Interdigital dermatitis Heel warts Interdigital phlegmon Sole haemorrhage	Sole ulcers White line disease Laminitis/ Aseptic laminitis Avulsion of hoof Cork screw claws Swelling of coronet bulb/ Coronitis Interdigital hyperplasia/corns Over grown hoof Punctured sole Foreign body in sole Joint and upper leg trauma/ deformity Hoof wall cracks Double sole Heel horn erosion
Small Ruminants (Sheep and Goat)	Foot rot Scalds (interdigital dermatitis) Contagious Ovine Digital Dermatitis (CODD)	Shelly hoof Foot abscess Arthritis



Fig 01: Examination of cattle, buffalo herd and sheep flock for lameness during health camp.

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## 2. Materials and methods

The present study comprised of clinical cases presented to various Veterinary Dispensaries of Gadag, Koppal, Vijayapur, Bagalkote, Kalaburgi and Davanagere districts of Central and North Karnataka, India. The flock of sheep and goats presented to VD were also analysed for hoof diseases. Most of the flocks were migratory and was difficult to trace the history. However, Sheep foot rot was noticed in few flocks and CODD was difficult to diagnose in Goats. Hence, the present study concentrates on large ruminants. The current study records the cases presented to different VD (Cases from farmers, organised dairy farms as well as free grazing

animals). Those animals presented with lameness and reduced physical performance were subjected for detailed clinical examination, which revealed the presence of various foot ailments such as foot rot, laminitis, interdigital dermatitis coronitis, avulsion of hoof and hoof injury. Preliminary history regarding age, sex, aetiology, duration and development of persisting hoof ailments were collected from cattle owners. Animals were restrained and hoof trimming was done to confirm the hoof ailments. Necessary antimicrobial treatment, wound debridement was provided to clinical cases and advised for functional trimming of hoof.



Fig 02: A herd of young Bulls presented with one case reported for hoof deformity; after detailed examination it was found to be over grown hoof with deformity.

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## 3. Results

The clinical cases presented to various VD of above mentioned districts of Central and North Karnataka have been recorded and cases with hoof ailments were taken for analysis (table no. 2). The pooled data reveals the occurrence of 1857 cases with hoof disorders out of which 48.73% were over grown hoof, 4.79% was cork screw hoof, 2.5% was sole ulcers, 1.8% punctured sole, 3.12% was foreign body in sole, 9.43% was interdigital hyperplasia, 0.2% was aseptic laminitis, 8.57% was hoof avulsion, hoof trauma and injury which are of non-infectious origin (Pie diagram no 1). The rest ailments correspond to infectious origin like 15.09 % foot

rot in cattle and buffalo, 4.35% of sole haemorrhage and 1.42 % digital/ interdigital dermatitis (Pie diagram no 2). The breed wise distribution of hoof disorders revealed the highest incidence in H.F. crossbreds (24.32%) followed by Jersey cross (21.76%), Amruth-mahal cross (19.35%) and Hallikar crossbreds (12.98). Similarly, among buffaloes highest breed incidence was recorded in Murrah cross (10.57%), followed by Surti cross (7.98%) and non-descript (3.04%). Foot lesions were observed to be greater in hind limbs with greater involvement of outer claw than in fore limbs with greater involvement of inner claw. Incidence of foot lesions was higher in animals on concrete floor with limited space and

poor hygienic conditions. The animals which were left loose for exercise regularly had lesser foot problems than those reared on hard/concrete floor in stall feeding system. The

incidence of foot ailment was more in cross bred than the indigenous breed of cattle and buffalo as observed by Bagate *et al.*, 2012 [5].

**Table 2:** Case wise distribution of hoof ailments in large ruminants.

S. No.	Non-infectious hoof ailments	No. of cases diagnosed	Percent
01	Over grown hoof	905	48.73%
02	Cork screw hoof	088	4.75%
03	Sole ulcers/wound	046	2.50%
04	Punctured sole	033	1.80%
05	Foreign body	058	3.12%
06	Interdigital hyperplasia	175	9.43%
07	Aseptic laminitis	004	0.20%
08	Hoof avulsion	160	8.57%
	<b>Infectious hoof ailments</b>	<b>No. of cases diagnosed</b>	<b>Percent</b>
09	Foot rot	280	15.09%
10	Sole haemorrhage	082	4.35%
11	Inter digital dermatitis	026	1.42%
	<b>Total</b>	<b>1857</b>	

**Table 3:** The breed wise distribution of hoof disorders.

H. F. Cross	450	24.32%
Jersey cross	404	21.76%
Amrut mahal	360	19.35%
Hallikar cross	241	12.98%
Murrah cross	197	10.57%
Surti cross	149	7.98%
Non-descriptive	056	3.04%
<b>Total</b>	<b>1857</b>	



**Fig 03:** A case presented with lameness suspected with bleeding from hoof; upon detailed examination, it was found to be Sole Hemorrhage



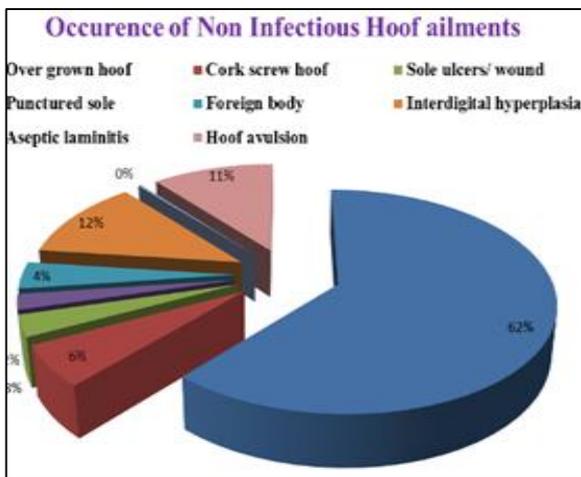
**Fig 04:** Bull reported with Lameness for more than a three months; after detailed inspection, it was confirmed with Interdigital hyperplasia. Image copyrights: Dr. Sindhu K.



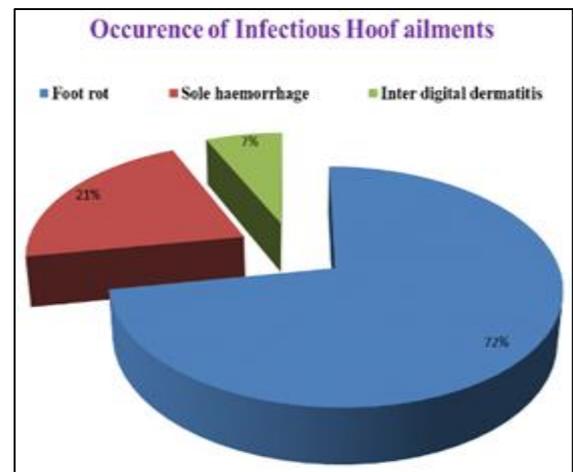
Fig 05: A case with foot rot, treated with antibiotics and advised for foot bath treatment with 2% formalin. Image copyrights: Dr. Sindhu K.



Fig 06: A case with multiple deformity in stifle, hock, fetlock, pastern & coffin joints. Image copyrights: Dr. Sindhu K.



Pie dia 1: pooled data of occurrence of non-infectious hoof ailments in large ruminants.



Pie dia 2: pooled data of occurrence of infectious hoof ailments in large ruminants

Locomotion score chart	
1.0	<b>Normal with flat back</b> Cow stands and walks with a level back. Gait is normal
2.0	<b>Mildly lame</b> Cow stands and walks with a level back, but develops an arched back to walk. Normal gait.
3.0	<b>Moderately lame</b> Arched back is evident while standing and walking. Walk with a short lame stride.
4.0	<b>Lame</b> Arched back is always evident and gait is one deliberate step at a time. Cow favours one or more legs/hooves.
5.0	<b>Severly lame</b> A three-legged cow which demonstrates an inability or extreme reluctance to bear weight on one or more limbs/hooves.

Source (adpted from): Steven L. Berry, DVM, MPVM; Univ. of Davis, CA, and Zinpro® Corporation 1997, in J Hulsen, Cow Signals

#### 4. Detection and diagnosis of Lameness

Knowledge levels and the ability to detect and diagnose lameness and its causes can vary greatly between veterinarians, scientists, advisers and farmers. Various manual aids exist to help identify lame cows, including locomotion scoring and hoof scoring. The extent of a farm's lameness problem can also be graded according to how many cows are

affected at any one time (Argaez *et al.*, 1997)<sup>[4]</sup>.

- A (a good target) would indicate that around 9 percent or fewer animals are affected
- B (tolerable) indicates 9–20 percent are affected
- C (problem) indicates that 21–36 percent are affected
- D (considered a major problem) indicates over 36 percent animals are affected.

#### 4.1. Locomotion scoring

Locomotion scoring was developed to simplify the task of identifying affected animals. It is a simple way of evaluating an animal's back posture, both standing and walking, by assigning a qualitative score as an index of their ability to walk normally. Various scoring systems are available but in 5-point system (Amstel *et al.*, 2005) [3], cows are visually scored from 1 (cow with a normal posture and gait) to 5 (cow is severely lame, often only bearing weight on three legs). It assists in early identification of potential claw disorders before they become painful, as cows with claw abnormalities change their back posture and the movement of their feet and legs to offset pain. The objective is to identify cows scoring 2 or above as candidates for corrective trimming or treatment, and to assess the prevalence of herd lameness (Zinpro®, 2005). Scoring should be carried out on a flat surface, free of obstacles and debris, with cows walking at a normal pace. Around 25–50 percent of the herd should be scored every two to four months to assess if lameness is becoming more or less prevalent and to determine if measures to decrease lameness are effective. Locomotion scoring does not identify why a cow is lame, it only serves an indicator of which cows may be lame. Bear in mind that a poor locomotion score may not always be due to a problem with the hooves or legs, but could also indicate conditions such as acidosis or a displaced abomasum. This type of scoring system can also be used to assess the extent of an expected reduction in dry matter intake and milk yield due to lameness and thereby to calculate potential revenue loss.



Fig 07: Cow with locomotion score 1.0; Normal with flat back.

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#### 4.2. Claw trimming procedures

Foot care and claw trimming have an important role in the management of lameness conditions, various experience has shown that on occasion claw trimming can be a cause for lameness. Corrective trimming removes excess horn growth and returns the claw to its normal shape, ensuring that weight is distributed evenly across the claw's load-bearing structures. One of the most common errors in claw trimming is over-trimming. Therefore, it is important to know what constitutes normal claw size and conformation (Shearer, 2000) [15]. The hoof tends to grow at a rate of about 5 mm per month. The shape of the hoof is a result of a balance of growth and wear. The primary purpose of the claw capsule is to protect the corium. When excess claw horn has been removed and the sole is no longer able to properly support the cow's body weight, the underlying corium becomes subject to damage from bruising. Thin soles in dairy cattle represent one of the most difficult foot problems to manage. Most cows will need

to be trimmed 1-2 times per year. Cows with problems may need to be trimmed more often. Heifers should be trimmed about 2 months before calving to help shape the claws for the first lactation (Blowey R., 2007) [7]. Most producers on a regular hoof trimming program trim cows at dry off. Most cows could also use a mid-lactation trimming or at least an evaluation to determine if trimming is necessary

The following 6 procedures by Toussaint Raven, 1989 [14] describes functional and corrective trimming where rear claws are trimmed first. Trimming the front claws would be done in the reverse order (lateral claw first) since when lameness occurs on the front feet it is more often the medial claw that is involved. Trimming occurs in 6 steps; the first 4 steps are corrective and the last 2 steps are therapeutic or curative.

**Step 1:** With rear feet trimming begins with the inside claw. The front wall of the medial (inner) claw should be 3 inches long (from just below the coronary where the hard horn starts to the tip of the toe). This length of 3 inches (7.5 cm) is taken as the correct front wall length for the average Holstein-Friesian cow. Thickness of the sole should be a minimum of a 1/4 inch. The bearing surface (sole and wall but not the heel) is "stabilized" on the inner hind claw. A proper front wall length (at least 3 inches) will ensure adequate sole thickness particularly at the toe where sole thickness of at least a 1/4 of inch (5-7 mm) is required. The sole in this area should not "give" under pressure. If it does it may indicate that the sole has been trimmed too thin.

**Step 2:** Using the medial claw just trimmed as a guide, trim the toe of the outer claw (rear foot) to the same length. Next, pare the weight-bearing surface (of the sole) of the outside claw to the same level as that of the medial claw. The outer claw is trimmed to the same level as the inner claw both at the toe and at the heel. When complete, the weight-bearing surfaces should be flat at the toe.

**Step 3:** Shape and slope the sole so that the innermost back portion of the sole slopes toward the centre of the claws. Care should be taken to avoid paring away important weight-bearing surface at the toe. Excessive cupping or sloping of the sole should be avoided because it reduces the weight-bearing surface area to the outside walls. Overgrowth of the sole which occludes the interdigital space causes dirt and manure to be entrapped between the claws. This increases the likelihood of interdigital disease.

**Step 4:** Balance the heels. Weight-bearing surfaces should be flat at the toes, along the walls, and across the heels. This assures an appropriate distribution of weight within and between the claws and completes the trimming process in feet where further corrective trimming procedures are unnecessary.

Steps 5 and 6 are characterized as "therapeutic and curative trimming procedures". They are applied as needed.

**Step 5:** Pare the damaged claw lower toward the heel to increase weight bearing on the healthy claw. In most cases the damaged claw will be the outside claw of rear and the medial claw of front feet. Specific indications for this trimming procedure would include conditions in which overgrowth has led to overloading (i.e. hemorrhage at the sole ulcer site) or excessive weight-bearing on the claw. Lowering the damaged claw reduces weight-bearing and thereby permits recovery

and eventual return to normal function and health. In some cases, it is necessary to apply a claw block to the healthy claw in order to reduce weight-bearing in the damaged claw.

**Step 6:** In the presence of hoof horn lesions, further corrective trimming is necessary. Remove all loose and dead or decaying horn irrespective of how extensive it is (sole separation). It is also necessary to pare away hard ridges, such as observed in heel horn erosion. Only healthy hoof horn should be left in place.

Precautions to be followed during trimming:

- i. Avoid digging holes in the sole.
- ii. Always slope horn away from the lesion. For example, trim the area around sole ulcers and slope to the inside.
- iii. Always remove the lateral wall and slope horn to the outside when trimming out white line lesions.
- iv. Avoid damage to the corium (i.e. stop when trimming leads to bleeding of the corium).

## 5. Conclusion

Lameness is a multifactorial disease which is directly related to dairy management practises. The first step towards decreasing lameness is the ability to recognise a problem, determine the incidence, level of severity and cause and then decide how best to alleviate the associated pain. The causes and predisposing factors are many and include: nutrition and feeding; housing and environment; concurrent disease; management factors; and genetic influences. The majority of lameness (90%) occurs in the foot (Guard, 1995)<sup>[10]</sup>. Prompt identification and antibiotic treatment are crucial to achieve successful therapeutic outcome

Although many foot ailments seem exotic, lack of awareness about hoof ailments, negligent attitude of farmer towards hoof diseases, lack of proper diagnosis and reporting by professionals made these foot ailments a neglected aspect in veterinary practise. In field conditions, commonly encountered hoof diseases include foot rot, sole haemorrhage, digital/ interdigital dermatitis, ulcers, over grown hoof, cork screw condition, interdigital hyperplasia, hoof avulsion, hoof trauma and injury. Synoder<sup>®</sup> is herbal remedy used for the treatment of foot rot in ruminants. As a part of ethno veterinary practise by some traditional healers of Kerala, combination of barks of *Carreya arborea*, *Syzygium cumini* and *Pterocarpus marsupium* in equal proportion is spread on the mud floor of cattle shed as a pedicure management practise (Sindhu *et al.*, 2015)<sup>[16]</sup>. Pedicure/ Regular foot trimming (at least one to two times per year) reduces the number of crevices where bacteria can live, removes infectious agents of hoof and exposes the organism to air and to prophylactic medications. Prevention and early treatment, along with good overall management programs are essential to decrease the incidence and economic loss due to hoof ailments.

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