

# RETROSPECTIVE STUDY OF FOOT CONDITIONS IN DAIRY COWS IN URBAN AND PERIURBAN AREAS OF KENYA

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## ABSTRACT

A retrospective study was carried out to determine categories, patterns and outcomes of foot conditions in dairy cows from smallholder units in and around Nairobi, Kenya. Analysis was done on 625 hospital case records of dairy cows admitted and treated for foot conditions from 1981 to 2006 at the Large Animal Hospital, Faculty of Veterinary Medicine, University of Nairobi. The records were from cows that had been through one or more parities. Data included type of foot lesion, the affected limb and the claw, and the outcome of treatment. Relative percentages of the foot lesions were computed. Foot lesions with the highest percentages of occurrence were interdigital necrobacillosis (36%), interdigital fibroma (12%) and sole abscess (11%). Others with lower percentages included trauma (8%), claw overgrowth (7%), sole necrosis (severely eroded and necrotized horn of the sole) (6%), septic fetlock arthritis (6%) and septic pedal arthritis (5%). Laminitis and related claw lesions, such as double soles and heel erosion had less than 1% occurrence. The hind feet were affected in 75% of the cases, from which 83% of the lesions involved outer claws. The fore feet were involved in 16% of the cases, of which 57% of the lesions affected inner claws. Simultaneous involvement of both fore and hind feet occurred in only 2% of the cases and 6% of the cows had more than one foot lesion. A total of 90% of the cows were healed after treatment, 6% were slaughtered and 4% died. The results of this study indicated that a high percentage of cases of foot conditions referred to the Animal Hospital from smallholder dairy units in and around Nairobi were infective and a lower percentage was laminitic. We recommend that a farm-level prospective study be conducted in the same area to verify this status.

## INTRODUCTION

Nairobi is the capital city of Kenya with a latitude location of 01° 18'S and longitude 36° 45'E. Its altitude is 1798 meters above sea level and its annual rainfall is approximately 765 mm (maximum) and 36 mm (minimum).

Lameness is a major cause of lowered productivity leading to vast economic losses in dairy production systems (1, 2). It is also a major welfare determinant in cattle and is an increasingly important concern (3). Almost 90% of all lameness in cattle involves the foot (4). Foot conditions particularly the infective category cause more severe lameness that makes detection of the affected cattle more obvious (5). Some of the commonest foot conditions causing lameness in cattle are interdigital dermatitis, digital dermatitis, interdigital phlegmon and laminitis (6), sole abscesses, sole ulcer, vertical and horizontal hoof wall cracks (7), and interdigital fibroma (8). The most prominent signs presented by these foot conditions are interdigital wounds and swelling, digital swelling, swelling and reddening at the coronet, protruding granulation tissue through cutaneous or horny defects and draining in parts of the digit (9).

More than 60% of lameness in cattle is caused however, by non-infective claw horn lesions such as sole ulcers, heel erosion, white line separation and double soles that result from insults or injuries to the corium. These are generally attributed to laminitis (10, 11, 12). Unlike the infective conditions of the foot, subclinical laminitis (11, 12) and chronic laminitis (11) do not present severe lameness, and therefore the farmer may not notice the affected animal.

Occasionally some milder cases of foot infections may resolve spontaneously (6), but if not treated early, infections of the foot more often invade deeper tissues particularly the synovial structures, tendons, ligaments and bones (9, 13). When these sequelae of infections occur, poor prognosis ensues and the affected animal is likely to be culled or the condition deteriorates until the animal dies (6). Proper evaluation of these deeper invasions for treatment and drawing of prognosis can be done only by radiography (9). Poor hygiene precipitated by wet conditions from slurry softens the horn of the claw (particularly of the sole), weakens and disrupts the interdigital skin barrier and even corrodes the horn. These events promote entry of bacteria

that cause infectious diseases of the foot (14).

A previous retrospective study was conducted in cattle of all ages and sexes as well as cases seen and treated only once in the ambulatory clinic. It was not specific for the foot and also included lameness involving all other parts of the limb. It covered cases seen and treated in the period from 1983 to 1988. This previous study indicated a high prevalence of septic arthritis of the coffin and fetlock joints (15). It has been shown that most detrimental economic effects of lameness in cattle involve the dairy cow (1, 16, 17) and particularly the foot (4), hence the reason for considering only foot conditions in adult dairy cows in the current study.

Percentages of various foot conditions and the outcomes of their treatments in dairy cows from smallholder units in Kenya are undetermined. Furthermore, the types of claw lesions affecting cattle in zero-grazed smallholder farming units are not documented. The objectives of this study were to determine categories and percentages of conditions affecting only the foot of dairy cows and to analyze the outcomes of their treatments. In conducting this retrospective study, only records of adult dairy cows (those that have had one or more parities) admitted in the Faculty of Veterinary Medicine Large Animal Hospital, Nairobi, Kenya were considered. The results of this study would give a general indication of the percentage distribution of various foot conditions in dairy cows from the smallholder farming units and establish a foundational guideline for designing a future farm-level prospective study on the actual status of foot lameness in Kenya.

## MATERIALS AND METHODS

**Study area.** The cases admitted in the Large Animal Hospital of the Faculty of Veterinary Medicine, University of Nairobi, Kenya are drawn from the suburban areas of the city of Nairobi and the peri-urban districts of mainly Kiambu, Thika and Kajiado.

**Data collection.** Hospital record cards containing information details of all dairy cows admitted with a history of lameness to the Large Animal Hospital of the Faculty of Veterinary Medicine, University of Nairobi, Kenya from the year 1981 to 2006 were retrieved from the record archives through the annual case catalogues. The retrieved records were further scrutinized one at a time. All those containing medical information of cases treated only for foot conditions were identified and separated from those treated for proximal leg lameness. From the records, the total number of cases of dairy cows that had one or more parities and which had been treated for foot conditions was 625. The data recorded from these cases for computation and analysis included confirmed diagnosis of the foot condition for each case, the number of cows affected by each foot condition, the specific limb (whether fore or hind) affected in each cow, specific claw (whether inner or outer) affected on each limb, treatment administered for each cow and the outcome of each cow after treatment. Healing of a case was indicated by signs of appreciable improvement in gait, in which the animal eventually ceased to be lame, regained productivity and externally visible lesions showed signs of complete healing.

The data was recorded into formally prepared data collection sheets.

## DATA MANAGEMENT AND PERCENTAGE CALCULATIONS

Data from each cow were recorded and stored in Microsoft Office Excel 2003 (18). It was validated and verified to be correct as per the entries from the record sheets. Simple calculations of relative percentages of the various foot conditions and their outcomes after treatment were done. The percentage of occurrence of each foot condition was calculated as the number of cows indicated in the record as positively confirmed to have the specific foot condition, divided by the total number of cows (625) indicated in the records to have had foot lameness. This was then multiplied by 100 to express it as percent (%).

The distribution of a foot condition on the fore feet and on the hind feet was calculated from the number of cows positive for the condition on the fore feet or on the hind feet as indicated on the hospital records, divided by the total number of cows positive for the condition. This was then multiplied by 100 to express it in percentage. This formula was repeated for each condition and hence the denominators varied according to the total number of cows positive for each foot condition. The percentage of cows that healed and the percentage that failed to heal from a specific foot condition, was calculated from the number of cows indicated in the records to have healed or the number indicated not healed of the specified foot condition divided by the total number of cows indicated in the records as having suffered the specified foot condition. This was multiplied by 100 to express it as percentage.

## RESULTS

Table 1 presents percentages of cases of different foot conditions in the 625 dairy cows treated. The results revealed that cases of interdigital necrobacillosis (foot rot) had the highest (36%) percentage, followed by interdigital fibroma (12%) and sole abscesses (11%). Cases of laminitis and related claw lesions (such as double soles and heel erosion) had each a very low (1%) percentage. Other cows had lesions that might be laminitis related but with slightly higher percentages. These included sole necrosis (severely eroded and necrotized horn of the sole) (6%), sole ulcers (2%) and hoof cracks (2%). Cases of septic arthritis particularly of fetlock and pedal (distal interphalangeal joint) were 6% and 5% respectively, while those with septic arthritis of pastern (proximal interphalangeal joint) had lower (1%) percentage. On average, cases of foot conditions were 60% of all cases of lameness, including proximal leg conditions in cattle (including all ages, both males and females) seen in the period 1981 to 2006, and 9.6% of all cattle cases (including all other types of conditions) treated in the animal hospital in the same period. However, when all cases of lameness (both foot and proximal leg) are considered, they account for 16% of cases referred and treated within the animal hospital. A proportion of lameness cases not included in this study was treated on the farms by the ambulatory clinic.

Information in the hospital record cards indicated that 63% of the cases were presented to the animal hospital at least 3 weeks

after the first appearance of clinical signs and before receiving any form of treatment. Information on physical examination of the cases showed that all the cows were severely lame before admission. The foot conditions were found to affect hind feet in 75% of the cases, fore feet in 16% of the cases and hind and fore feet simultaneously in 2% of the cases. In 7% of the cases, records did not indicate the affected foot.

Among cases with lesions affecting the fore feet, 57% were on the inner (medial) claws and 43% on the outer (lateral) claws, 83% of the cases affecting the hind feet had lesions on the outer claws and 17% on the inner claws. All cases that had interdigital fibroma affected only the hind feet. The other foot conditions were found to have affected either the fore or the hind feet, in which the hind feet were affected in a higher percentage of the cases (Table 2). A total of 6% of the cows had more than one foot condition concurrently.

Scrutiny of the hospital record cards revealed that the treatment protocol always started with foot cleansing with water and soap to remove mud and dung from the foot, followed by hoof trimming. However, the type of topical and systemic treatment depended on the nature of the foot condition. After washing and trimming, exposed infection of the claw was treated topically by dipping in or washing the claws with either 10% copper sulphate solution applied every day (for 1 week) or every second day (for 2 weeks); or 5% formalin applied every second day (for about 10 days). The records indicated that routine systemic treatment for all foot infections consisted of trimethoprim-potentiated sulphonamides (either sulphadiazine or sulphadoxine) at a dosage of 150-200 mg/kg body weight once per day administered as a single injection or repeated for 3 days depending on the severity of the infection. The alternative treatment used was 10% oxytetracycline at a dosage of 7 mg/kg body weight once a day for 3-5 days depending on severity. Both drugs were administered either intravenously or intramuscularly.

For sole abscess, draining of the pus by trimming to expose the cavity was an inevitable part of its treatment. In cases of severely eroded and necrotized horn of the sole, curetting or debriding of the necrotic tissue and the eroded parts was done before topical application of 10% copper sulphate or 5% formalin solutions. Interdigital fibroma was treated by surgical excision followed by either topical or systemic treatment. Apart from septic arthritis of the fetlock joints, the rest of septic arthritis (distal and proximal interphalangeal joints) was treated with high doses of antibiotics (either trimethoprim-potentiated sulphonamides at 200 mg/kg body weight or 10% oxytetracycline at 10 mg/kg body weight) for prolonged course (1-2 weeks). In cases where the foot condition did not respond to the instituted forms of treatments, claw amputation was done as a salvage procedure provided only one claw was involved.

The records showed that after treatment, 90% of all the cows were healed while the remaining 10% failed to heal and were either slaughtered (6%) or died (4%). Table 3 presents the outcomes of treatments of the foot conditions. A closer analysis of the outcomes of each foot condition affecting more than 5% of the cows indicated that most of them had a healing rate of

more than 80% (Table 3). However, for foot conditions that affected less than 5% of the cases, all the cows healed and are therefore not included in the outcomes table.

## DISCUSSION

All the cases reported in this paper were treated in the animal hospital after admission but not during the ambulatory clinical rounds in the farms. The high percentage of cases of interdigital necrobacillosis and sole abscesses may be attributed to unhygienic conditions that prevailed at the smallholder farms from which the cases were referred. Poor hygiene in these farms was particularly precipitated by long-standing slurry on the cow house floors. Such environments favour the growth of pathogenic bacteria that easily affect the feet of cattle (19). Wet conditions and accumulation of slurry also compromise the integrity of external structures of the claw, thus promoting entry and establishment of bacterial foot infections (14). Most of the smallholder farms from which the cases were referred had earthen floors that retained an accumulation of dung and mud, thus enhancing occurrence of foot infections (Personal observations during ambulatory clinical rounds).

Infectious conditions of the foot present clinical symptoms of showing severe lameness (5). Cattle with such conditions are therefore easier to identify in the herd (20). Conversely, laminitic conditions are more insidious with less obvious symptoms, which make it more difficult to notice the affected cows (11, 12). This is one explanation for high percentages of cases of foot infections compared to cases of laminitic conditions. Farmers would easily notice the more severely lame cows and therefore more often refer them for treatment than would refer the subtly laminitic cows. The other explanation for lower percentages of laminitis is that it rarely occurs in these non-intensive smallholder farms.

Interdigital fibroma lesions progressively enlarge gradually and become easily injured, ensuing to severe lameness (5), which makes it easier for the farmers to notice the affected cows and call for veterinary attention. This might explain the relatively high number of cows with interdigital fibroma referred to the clinic. In this study, interdigital fibroma affected the hind feet. This conforms to an earlier report stating that in dairy cows, interdigital fibroma tends to affect mainly the rear feet but in beef cattle it affects mainly the fore feet (8). However, other reports indicate that it affects both fore and hind feet (5).

The higher prevalence of foot conditions on the hind than the fore feet and more involvement of the outer claws in the hind limbs and inner claws in the forelimbs have previously been reported (21, 22). In standing position, pressure distribution between the hind limb claws of cattle was found to be more uneven than between the forelimb claws (23). This uneven pressure distribution was even more pronounced during walking (24). This means that the lateral claws of the hind limbs are under great pressure during both standing and walking. The mechanical compression of the claw horn during standing and walking could be a contributory factor to the development of claw disorders and lameness. Furthermore, it has been found that the horn at the sole of the hind limbs is significantly softer

than on the forelimbs (25). On uncomfortable ground, cows were found to have limited capacity of shifting their weight from the hind limbs to the forelimbs (26). Therefore when the hind limbs are on uncomfortable ground, they will continue to be stressed as long as they are on such ground due to inability of the cow to redistribute weight to the forelimbs. Such factors as uneven pressure distribution on the hind limb claws and softer horn of the sole of the hind limbs may help to explain why there are more lesions on the hind feet than on the fore feet.

Pathogenesis of laminitis partly involves necrosis of the corium and the horn of the claw due to compromised blood supply. It also lowers the integrity of the horn produced (11). This reduced integrity of the horn is probably the cause of severely eroded and necrotized sole as well as hoof cracks, and this could imply that the latter claw conditions might be related to laminitis.

In some of the cases, there was time lag ( $\geq 3$  weeks) between occurrence of foot infections and the call for treatment. This delay in instituting treatment might have allowed for ascending infections to involve deeper tissues of the foot (6, 9). This could account for the cases of septic arthritis particularly of the pedal and pastern joints. The cases that resulted from septic involvement of the deeper tissues particularly the joints of the foot gradually developed chronic lesions with irreversible destruction of the claws as has been reported previously (6, 9). Such cases have contributed to the small percentage that did not heal. However, the rest of the cases that did not develop deep infections as shown in the hospital case records recovered following treatment. The accompanying bleeding in the cases of foot trauma necessitated early presentation for treatment because bleeding was alarming to the farmers. Early treatment resulted in the healing of all such cases.

The cases of claw overgrowth were not properly categorized in the records as to the type of claw deformities. These together with the severely eroded and necrotized soles could have been undiagnosed cases of laminitis bearing in mind their horn involvement. This could have led to their non-recovery as a result of improper management. The overgrowth of the claws could also have been related to inherited claw deformities such as corkscrew and beak claws that cannot be managed successfully (5, 11). The high percentage of non-recovery seen in septic arthritis is probably due to the destructive nature of

joint sepsis (9). The non-healing percentage of foot rot cases was similar to that of non-healing septic arthritis. These were the cases of foot rot that developed into septic arthritis as has been reported previously in cases of septic arthritis of the pedal, pastern and fetlock joints (5).

The results of this study revealed high percentages of foot infections (foot rot and sole abscesses) while the previous study had a higher incidence of septic arthritis (15). However, the two studies were conducted differently as regards the case records used. The current study was done using hospital-admitted cases of cows that had one or more parities and which had only foot conditions and covering a 26 year period. While the previous study used ambulatory clinic case records including all ages and sexes of cattle with lameness conditions affecting all parts of the limb and covering a 6 year period (15). Therefore, results of the two studies cannot rationally be compared with each other.

The cows referred for admission into the Animal Hospital were those that were severely lame as evidenced by the recorded clinical signs and 63% of them were in the chronic stages ( $\geq 3$  weeks before treatment). There were no cases admitted with mild lameness or subclinical lesions. Therefore from these observations, it can be concluded that this retrospective study does not represent the actual field status of foot lameness in Kenya, and particularly with reference to the more insidious conditions such as laminitis. However, these results provide useful foundational data for designing of a prospective study to establish the actual status in smallholder dairy units.

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Table 1: Percentages of foot conditions from the retrospective study carried out on 625 cases of dairy cows presented for treatment of foot lameness in the Large Animal Hospital of the Faculty of Veterinary Medicine, University of Nairobi, Kenya from 1981 to 2006

Foot condition	Number of cows per foot condition	Percentage
Interdigital necrobacillosis	223	35.7
Interdigital fibroma	74	11.9
Sole abscess	69	11.1
Trauma	50	7.9
Claw overgrowth	45	7.1

Septic fetlock arthritis	35	5.5
Sole necrosis	35	5.5
Septic pedal arthritis	30	4.7
Sole ulcer	15	2.3
Cellulitis	15	2.3
Hoof cracks	15	2.3
Periarticular abscesses	15	2.3
Foreign bodies	10	1.5
Sprain	10	1.5
Laminitis	5	0.7
Double soles	5	0.7
Heel abscess	5	0.7
Septic pastern arthritis	5	0.7

**NB:** some of the cows had more than one foot condition.

**Table 2:** Percentages of cases based on the number that had fore foot or hind foot affected by a specific foot condition. The cases were drawn from in 625 dairy cows admitted for treatment of foot conditions in the Large Animal Hospital of the Faculty of Veterinary Medicine, University of Nairobi, Kenya from 1981 to 2006.

Foot condition	Percentage of cases that had fore foot affected	Percentage of cases that had hind foot affected
Interdigital fibroma	0	100
Interdigital necrobacillosis	26.7	73.3
Sole abscess	21.4	78.6
Septic pedal arthritis	33.3	66.7
Septic fetlock arthritis	28.6	71.4

**NB:** Cases affected by each foot condition had their percentages calculated independently such that total percent between fore and hind foot sums up to 100 for each condition.

**Table 3:** The percentages of cows that were healed and those not healed after treatment of some foot conditions from the retrospective study carried out on 625 cases of dairy cows admitted in the Large Animal Hospital of the Faculty of Veterinary Medicine, university of Nairobi, Kenya from 1981 to 2006.

Foot condition	Percentage of cows healed	Percentage of cows not healed	Total percentage for each condition
Interdigital fibroma	93.3	6.7	100
Interdigital necrobacillosis	86.7	13.3	100
Sole abscess	92.9	7.1	100
Septic pedal arthritis	83.3	16.7	100
Trauma	100	0	100
Claw overgrowth	77.8	22.2	100
Sole necrosis	85.7	14.3	100
Septic fetlock arthritis	85.7	14.3	100

**NB:** Percentage for each condition was calculated independently. The numerator was the number of cases healed/not healed per condition and the denominator was the total number of cases affected by each specific condition. Therefore the total percentage for each condition was 100

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