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INFLUENCE OF FOOT DISEASES ON WELFARE AND ECONOMIC BALANCE IN SHEEP

INFLUENȚA AFECȚIUNILOR PODALE ASUPRA BUNĂSTĂRII ȘI BALANȚEI ECONOMICE LA OVINE

Bianca CSIZMADIA[1)], Iba ISDRARIU[1)], V. HERMAN[2),*)], Loredana VĂDUVA[1)], Cornelia PETROMAN[1)], I. PETROMAN[1)]

ABSTRACT | REZUMAT

Limb conditions have a significant impact on animal welfare and productivity and can have profound economic consequences. The paper aims to explore the influence of limb conditions on welfare and economic balance in sheep breeding practises. Prevention of foot diseases in sheep can significantly improve animal welfare, promote productivity, and reduce production costs, leading to increased profits and economic sustainability. The investigations were carried out for two years on two farms: Farm A, located in a hilly area in the NW of Caraș Severin County, with a herd of 300 sheep, 75 ewes (previous year's youth, TAP), and 120 lambs (current year's youth, TAC); and Farm B, located in the Arad Plain, with a flock of 350 sheep, 120 ewes (TAP), and 180 lambs (TAC). The presence of limb pathologies was assessed using a pain scale and facial expressions in response to pain. The study recommends regular monitoring of sheep using facial expression and pain scale analysis for early detection and management of hoof conditions.

Keywords: foot diseases in sheep, sheep welfare, control programmes

Afecțiunile membrelor au impact semnificativ asupra bunăstării și productivității animalelor și pot avea consecințe economice profunde. Lucrarea își propune să exploreze influența afecțiunilor membrelor asupra bunăstării și echilibrului economic în practicile de creștere a ovinelor. Prevenirea afecțiunilor podale la ovine pot îmbunătăți în mod semnificativ bunăstarea animalelor, pot promova productivitatea și pot reduce costurile de producție, ceea ce duce la creșterea profiturilor și a sustenabilității economice. Investigațiile au fost desfășurate timp de doi ani, în două ferme: Ferma A aflată într-o zonă de deal, din NV județului Caraș Severin cu un efectiv de 300 de oi, 75 de strămioare (tineret an precedent - TAP) și 120 de mioare (tineret an curent - TAC) și Ferma B situată în Câmpia Aradului cu un efectiv de 350 de oi, 120 de strămioare (TAP) și 180 de mioare (TAC). Prezența afecțiunilor de la nivelul membrelor a fost evaluată cu ajutorul unei scale de durere și a expresiilor faciale ca răspuns la durere. Studiul recomandă monitorizarea regulată a ovinelor cu ajutorul analizei expresiei faciale și a scării durerii pentru detectarea și gestionarea timpurie a afecțiunilor ongloanelor.

Cuvinte cheie: afecțiuni podale la ovine, bunăstarea ovinelor, programe de control

Limb pathologies significantly cause pain and discomfort in sheep, leading to reduced productivity, welfare problems, and negative consequences for farmers' economic returns (15, 18).

These sheep conditions, such as infectious pododermatitis, digital dermatitis, and interdigital phlegmon, have been reported on sheep farms worldwide (3, 14, 16, 19, 21) and are aggravated by various risk factors, such as the hygiene of the bedding, the high humidity of the grass, the rough terrain, and the lack of care of the ungulates. Limb pathologies in sheep can cause significant welfare problems, resulting in prolonged pain, reduced mobility, grazing difficulties, and social isolation. Limb disease in sheep is also an economic problem, resulting in higher costs associated with veterinary services, medication, prolonged treatment, and decreased productivity.

Further research is needed to understand the prevalence, risk factors, and impact of ungulate conditions on sheep welfare and costs. Sheep cannot directly communicate their pain and welfare issues, and therefore the assessment of pain and discomfort in sheep is difficult and often subjective.

However, recent studies (12, 23) have shown that the use of facial expressions is a simple and promising method for assessing pain and well-being in sheep. Studies have suggested that the presence of certain facial expressions such as a wrinkled nose,ears turned with the ear funnel in a certain direction, and closed eyes, is associated with negative emotional states, pain, and discomfort in sheep.

1) University of Life Sciences "King Mihai I", Faculty of Management and Rural Tourism, Timișoara, România
2) University of Life Sciences "King Mihai I", Faculty of Veterinary Medicine, Timișoara, România
*) *Corresponding author: viorel.herman@fmvt.ro*

These facial expressions involve changes in ear position, mouth position, and eye closure, which are often involuntary and are triggered by certain physiological and psychological conditions, such as stress, pain, and fear. Identifying facial expressions related to pain and discomfort in sheep is crucial to ensuring proper diagnosis and treatment. Assessment of pain in sheep is necessary to prevent further welfare complications, reduce production losses, and promote animal welfare (1). By understanding these factors, effective management strategies can be developed, preventive measures can be implemented, and effective treatments can be designed to reduce the prevalence of foot diseases and their negative impact on sheep farms. It is essential to promote the development of welfare-based systems and adopt proactive approaches to prevent disease and promote animal welfare on sheep farms (5, 7, 12).

MATERIALS AND METHODS

Observations took place over two years on two farms. Farm A, located in a hilly area in the north-west of Caraș Severin County, with a herd of 300 sheep, 75 ewes (young previous year) and 120 lambs (young current year). The sheep on this farm had, in summer, access to alpine pasture. Farm B is located in Arad plain and has a herd of 350 sheep, 120 ewes (youngsters of the previous year), and 180 lambs (youngsters of the current year).

In both farms, in the first year, the body conditions of all sheep were analysed, after which a balance was made between the existing problems. In the end, the individuals were divided based on the foot conditions present, together with the description of the changes and the analysis of the pain score based on the facial changes. Depending on the severity of the pathology found at the level of the nail, different treatments were implemented in order to reduce pain and treat the current condition (Figs. 1, 2).

Fig. 1. Detecting pathologies at the hoof level
Fig. 2. Changes observed at the level of the hoof during the inspection

Depending on the severity of the damage to each nail, trimming was performed, and medicinal or hygienic treatments were applied. In order to analyse the evolution of the disease as well as the effectiveness of the treatment, photographs were taken both at the beginning of the treatment, during the treatment, and at the end of the treatment, with the aim of determining the degree of damage to the nail as well as the time required to remedy the clinical signs.

Facial photographs were also taken to determine if the facial changes were related to the pain experienced by the animal or were due to the stress of handling the sheep.

At the beginning of the present research on both farms, an economic balance of each farm was carried out, after which the possible necessary treatments were taken into account, An economic balance was carried out in terms of the economic resources that the farm must have to treat the herd of animals and the possible results after treatment in relation to the negative effects of maintaining the onychopathology without treatment. Finally, a comparative analysis was made between the two farms, respectively, of the different management methods and the number of individuals affected by different foot pathologies, as well as from an economic point of view.

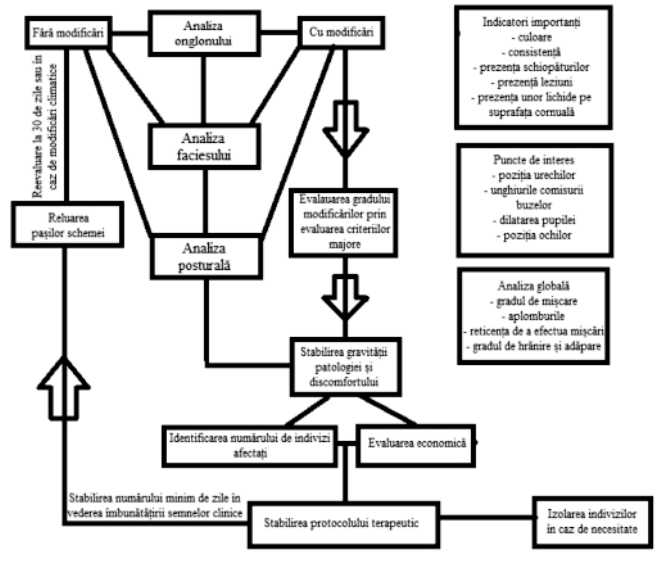

Fig. 3. Decision tree

To determine if there is a correlation between these systems and the presence of pathologies, the geographical area, if it is a determining factor, and finally, when it is the opportune moment to institute a treatment without having negative effects from an economic point of view and an increased success rate depending on the prevailing pathology. To design an effective management plan, we started with a decision tree (Fig. 3). Based on this, a standard protocol was established for the isolation and treatment of affected indi-

viduals, after which possible occurrences in cases of infectious pathologies or relapses were taken into account if the season was a predisposing one.

RESULTS AND DISCUSSION

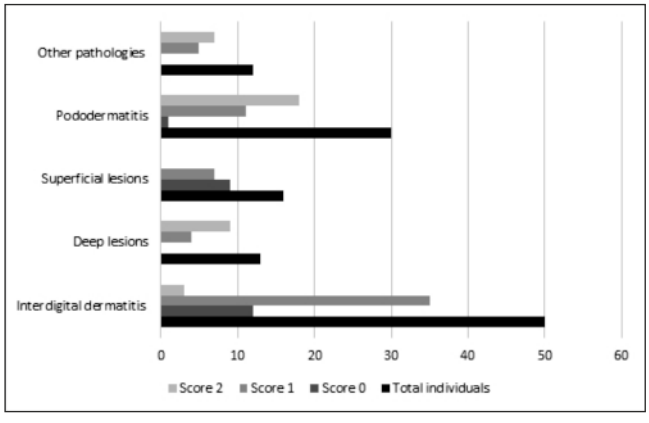

Fig. 4. Pathology distribution within farm A and pain score

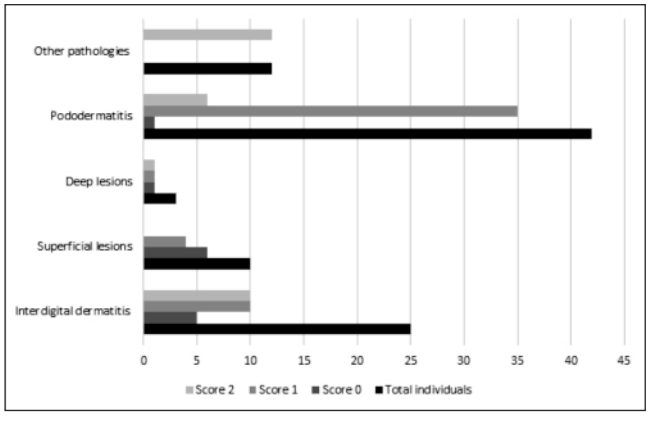

Fig. 5. Pathology distribution within farm B and pain score

Regarding Farm A (Fig. 4), the mean pain score for interdigital dermatitis was 1, while the mean score for infectious pododermatitis was 1.5. The difference in pain scores between the two conditions was statistically significant ($p < 0.05$). The study found that farm environmental factors such as temperature, altitude, and humidity did not significantly contribute to the difference in pain scores. The results of this study show that despite the fact that interdigital dermatitis has a higher prevalence in Farm A, it causes less pain than infectious pododermatitis.

The results (Fig. 5) indicated that pain scores were significantly higher in Farm B sheep with infectious pododermatitis than in those with interdigital dermatitis. This finding suggests that there are specific factors associated with infectious pododermatitis in Farm B sheep that contribute to higher pain levels than other conditions.

Sheep from Farm B with infectious pododermatitis were shown to exhibit a distinct and more severe lameness pattern than those with interdigital dermatitis. This suggests that the intensity of pain associated with infectious pododermatitis in Farm B sheep is more significant, significantly affecting performance and leading to serious consequential problems such as weight loss and reduced productivity.

It was found that 60% of the sheep (from both farms) had moderate to severe scores, indicating a high level of pain. Most of the sheep showed changes in ear retraction and pupil dilation. Dilation of the nostrils and changes in the angles of the commissure of the mouth were rarely observed.

Superficial lesions can be unpleasant, and if neglected, they can progress to more severe problems (9, 22). However, the study found that when multiple conditions are combined, the pain score is much higher. The statistical analysis of this study shows that sheep with multiple lesions had significantly higher pain scores than those with only superficial lesions.

According to the findings, the average pain score for sheep with numerous illnesses was 2, whereas lambs with superficial lesions had a score of 0. This finding suggests that when multiple conditions affect sheep, the impact is much greater than in the case of individual conditions (Fig. 5).

Statistical analysis was performed to determine whether there was a significant difference in pain scores between the two conditions, and multiple logistic regression models were constructed to identify the most important factors causing the difference.

Pododermatitis in the sheep of Farm B causes severe pain and discomfort and has a homogeneous pain score (Score 1), compared to interdigital dermatitis, which has a score of 1 or 2, resulting in similar pain severity but with a smaller number of affected individuals. The difference in pain scores between these two circumstances might be attributed to a number of variables, including the type of bacteria that caused the infection, the severity of the lameness pattern, and intrinsic environmental factors (4, 14).

Infectious pododermatitis is a more severe condition characterised by inflammation of the skin and tissues surrounding the toenail, which can lead to swelling and severe pain. On the other hand, interdigital dermatitis is a mild skin infection that causes the development of lesions and discomfort, but has less severe symptoms, as seen in infectious pododermatitis (2, 14, 21).

The reasons for the difference in pain severity between interdigital dermatitis and infectious pododermatitis are multifactorial. One possible cause may be that the bacteria associated with the two conditions differ. For example, *Dichelobacter nodosus* is known to cause infectious pododermatitis (4) and has been a-

ssociated with more severe symptoms (5, 6). In contrast, interdigital dermatitis is commonly caused by *Fusobacterium necrophorum*, which mainly causes mild skin infections (8, 10, 16).

Pain is an important welfare issue for sheep with foot disease (1). Sheep are social animals, and pain associated with foot conditions can affect their ability to move, interact with other sheep, and engage in normal activity, which can impact their overall quality of life. Pain can also cause behavioural changes and changes in lameness ratings, making determining the severity of the ailment and the efficiency of treatment approaches challenging (1, 7, 13, 23).

The analysis found a statistically significant difference between the two groups ($F = 8.7$, $p < 0.01$), indicating that the level of pain experienced in Farm B was statistically significantly higher. Clinical signs in sheep from Farm A were milder and improved after 14 days of treatment, while clinical signs in sheep from Farm B improved after 60 days, and no clinical signs were observed after three months. Your test revealed a statistically significant difference between the two groups ($t = -3.1$, $p < 0.01$), indicating that clinical signs were more severe in Farm B sheep.

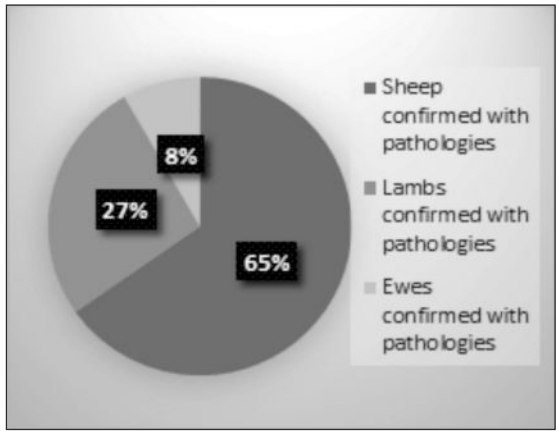

Fig. 6. The percentage of affected individuals Farm A

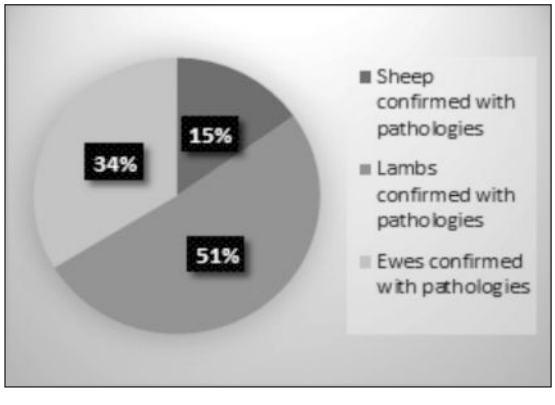

Fig. 7. The percentage of affected individuals Farm B

The results (Fig. 6, Fig. 7) reveal that adult sheep were more affected in Farm A than in Farm B with a prevalence of 65%. In the case of farm B, ewes had the highest percentage of diagnoses (51%), followed by ewes with 30% and adult sheep with 15%. In Farm A only 8% of the 121 sheep diagnosed with diseases were young.

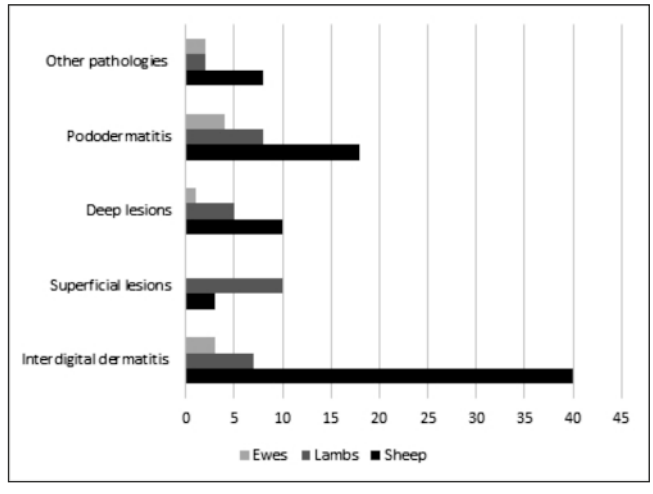

Fig. 8. Prevalence of cases by pathology and category, Farm A

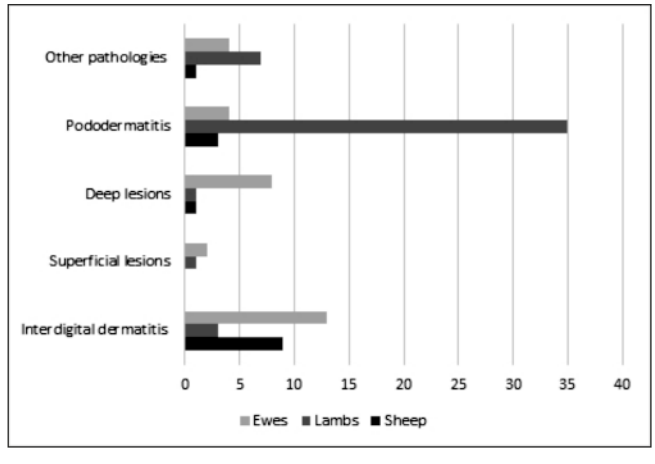

Fig. 9. Prevalence of cases by pathology and category, Farm B

The dispersion in disease prevalence between the two farms could be due to several factors (Fig. 8, Fig. 9). Breeding system and management practices could influence the incidence of foot diseases differently in the two farms. In Farm A the higher prevalence of disease in adults could be attributed to the larger body size of the sheep, which could introduce more stress on the legs and load-bearing structures of the limbs. Farm B practices an active system with more walking and climbing, which could cause more trauma to the legs, thus leading to a higher incidence of minor injury-type conditions. On the other hand, in Farm B, the higher prevalence of diseases in the pigs could be caused by

the husbandry and management practices used. In addition, the humid and overcrowded conditions at Farm A could be contributing factors.

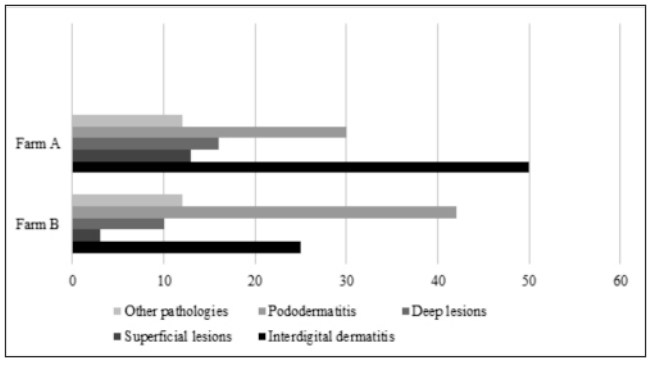

Fig. 10. The differences between the results of the two farms

It was observed that interdigital dermatitis was more common in sheep from Farm A, while infectious pododermatitis was more common in sheep from Farm B (Fig. 10). The analysis showed that 54% of sheep diagnosed with conditions at Farm A had interdigital dermatitis, compared to 38% at Farm B. In contrast, 62% of sheep diagnosed at Farm B had infectious pododermatitis, compared to 46% at Farm A. The chi-square test revealed that the prevalence differences between the two farms were statistically significant ($p < 0.05$). The study also found that the other foot conditions diagnosed in sheep on the two farms were similarly distributed. Superficial lesions were diagnosed in 30% of sheep in Farm A and 36% in Farm B. Deep lesions were diagnosed in 8% of sheep in Farm A and 12% in Farm B, while multiple conditions were diagnosed in 8% of sheep in Farm A and 14% in Farm B.

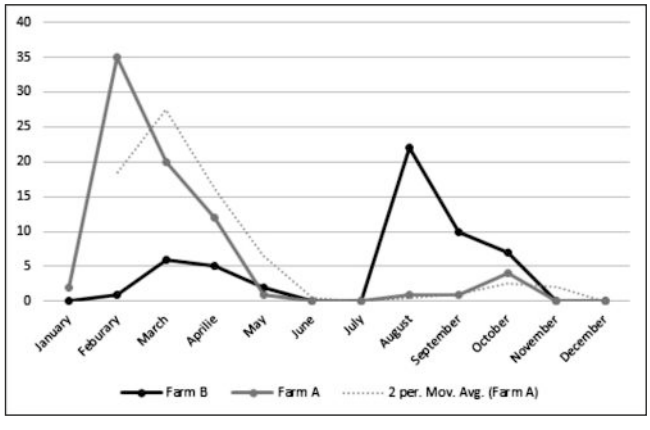

Fig. 11. Dispersion of pathologies during the first year of study

First, we need to consider the environment in which the sheep on Farm A live. Plain areas are usually prone to moisture retention. This means that the soil at Farm A is more likely to be wetter, softer, and more conducive to the growth of bacteria, which is a significant cause of infectious pododermatitis. Mud can also form in the winter, which can contain harmful microorganisms and lead to infectious pododermatitis (11, 14).

Farm B, on the other hand, is located on high ground with a different grass type and slope than Farm A. This means that the soil is more likely to be drier in mountainous areas than in the plains. The sheep at Farm A are usually kept in closed structures that are often poorly ventilated. Closed spaces, together with increased humidity, create an ideal environment for the development and transmission of bacteria, which increases the risk of pathologies (11, 16, 17).

Analysis of farm A reveals that the highest prevalence of conditions occurred in late winter and spring, representing 107 cases out of 121 diagnosed cases (Fig. 11). In the first year, 67 cases were diagnosed between February and April, while in the second year, 35 cases were diagnosed between February and May. In contrast, analysis of farm B showed that the highest prevalence of conditions occurred in late autumn and winter, accounting for 71 of the 93 diagnosed cases. In the first year, 39 cases were diagnosed from August to October, while 33 cases were diagnosed from August to December. The chi-square test revealed statistically significant variations in prevalence between farms ($p< 0.05$). It was confirmed that the incidence was significantly different depending on the season ($p < 0.05$).

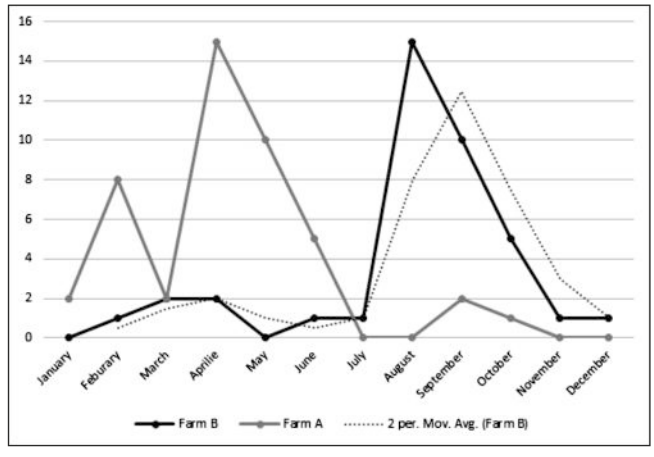

Fig. 12. Dispersion of pathologies during the second year of study

The differences in the seasonal distribution of diseases in Farm A and Farm B could be attributed to two main factors: the rearing system and the environmental conditions. In Farm A, sheep were mostly kept indoors in late winter and spring when the prevalence of foot diseases was higher (Fig. 12). Damp and overcrowded conditions could have led to the spread of bacteria and other pathogens and thus resulted in an increased number of cases during the stalling period (8, 12, 13, 20, 21).

Farm B had a more extensive cropping system that in-

volved grazing over a longer period of time, resulting in greater exposure to rough terrain that could cause limb trauma, resulting in a higher prevalence and high number of foot lesions in late autumn and winter. The seasonal patterns observed in this study can be used to inform management practises to prevent and treat foot diseases. For Farm A, measures to improve hygiene practices in indoor shelters in late winter and spring could help reduce the incidence of hoof disease For Farm B, measures to reduce leg trauma during grazing on rough terrain in late autumn and winter could help prevent foot lesions. From an economic point of view, Farm B has a high prevalence of infectious pododermatitis, with visible lesions. The farm manager decided not to treat the affected animals, citing the high costs associated with veterinary services and medication. Within two years, the farmer loses 20% of the affected animals to premature slaughter due to severe ringworm injuries, resulting in significant financial loss. The farmer also experiences a reduction in productivity and reproductive performance, further reducing profits. Farm A, has a moderate prevalence of interdigital dermatitis. The farmer recognises the importance of early treatment and promptly calls a veterinarian at the first clinical sign. Over a two-year period, the farmer treats all infected animals with antibiotics and maintains adequate hygiene measures to prevent the spread of the disease. The farmer loses only 5% of his livestock to lameness, avoiding the need for premature slaughter and minimising the economic impact of the disease.

CONCLUSIONS

In conclusion, foot diseases in sheep have a major impact on both welfare and farm economics. If left untreated, foot diseases can cause severe pain and discomfort, affect sheep mobility, and lead to reduced milk and meat production. In addition, the costs associated with managing and treating the conditions can be significant, leading to economic losses for farmers. Therefore, it is essential to implement preventive measures such as adequate nutrition,good hygiene, and regular hoof trimming to maintain the health of the sheep's feet, or in the case of changes in the hoof, it is necessary to implement some treatment actions as quickly as possible to minimise costs and reduce the animal’s pain.

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