

SECTION 9.

VETERINARY SCIENCES

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INTEGRATED ASSESSMENT OF TRIGGER FACTORS OF DISTAL LIMB DYSFUNCTION IN CATTLE NECROBACTERIOSIS

Introduction

In recent years, lameness and necrobacteriosis in high-yielding dairy cattle have become major challenges in modern veterinary practice, particularly under intensive farming conditions. The widespread use of high-concentrate diets, reduced fiber intake, and total mixed ration feeding systems has significantly contributed to the increasing prevalence of these disorders.

Lameness is not a single disease but a clinical manifestation of various pathological processes affecting the distal limbs. Necrobacteriosis is a chronic infectious condition characterized by purulent-necrotic lesions of hoof tissues, primarily involving the distal parts of the limbs.

Current scientific understanding suggests that these conditions develop as a result of multiple interacting trigger factors, including nutritional imbalances, metabolic disturbances, housing conditions, and limited animal movement. These factors are closely interconnected and contribute to a cascade of pathological changes: imbalanced feeding → ruminal acidosis → laminitis → necrobacteriosis.

Despite numerous studies on individual risk factors, there is a lack of integrated approaches that allow the combined assessment of trigger factors and their cumulative effect on disease development. Therefore, a comprehensive evaluation of these factors is essential for understanding the pathogenesis and improving prevention and control strategies. However, there is limited information on the integrated assessment of trigger factors under field conditions.

Aim of the study

The aim of this study was to perform an integrated assessment of trigger factors contributing to distal limb dysfunction and necrobacteriosis in high-yielding dairy cattle.

Objectives of the study

To achieve this aim, the following objectives were defined:

- to identify the main nutritional, metabolic, environmental, and management-related trigger factors associated with lameness and necrobacteriosis;
- to evaluate the relationship between feeding systems, ruminal acidosis, and the development of laminitis as predisposing conditions;
- to assess clinical and morphological changes in the distal limb tissues of affected cattle;
- to analyze the combined effect of multiple trigger factors on disease development using an integrated approach;
- to determine the role of trigger factor elimination in reducing the incidence and recurrence of necrobacteriosis.

Materials and Methods

The study was conducted between 2022 and 2025 on three commercial dairy farms located in the Tashkent region. High-yielding Holstein-Friesian and Simmental cows were selected as the study population. A total of 480 animals were included in the clinical and laboratory examination.

The study aimed to perform an integrated assessment of trigger factors influencing distal limb dysfunction and the development of necrobacteriosis under intensive production conditions.

Clinical examinations were carried out using the Sprecher lameness scoring system. Functional and morphological assessment of hoof tissues was performed through visual inspection and palpation to identify pathological changes.

The rumen environment was evaluated using orally collected rumen fluid samples, and pH levels were measured with a portable pH meter. Values below 5.8 were considered indicative of subacute ruminal acidosis.

Feeding practices were assessed by analyzing diet composition, including the concentrate-to-fiber ratio and energy-protein balance.

Housing conditions, flooring type, moisture levels, and animal movement were evaluated based on predefined criteria as environmental and management-related trigger factors.

An integrated approach was applied to assess the combined effect of these factors. The factors were grouped and comparatively analyzed to determine their relative influence on disease development.

Statistical analysis was performed by calculating mean values ($M \pm m$), and

differences between groups were evaluated using Student's t-test ($p < 0.05$). Trigger factors were categorized into nutritional, metabolic, environmental, and management groups for integrated evaluation.

Results

The prevalence of lameness in the studied herds ranged from 12% to 58%. When the proportion of affected animals exceeded 15%, it was considered a herd-level problem indicating unfavorable management and environmental conditions.

An integrated assessment showed that 72–84% of lameness cases were associated with hoof pathologies. The most frequently observed lesions included sole hemorrhages, white line separation, hoof ulcers, interdigital abscesses, and heel erosions.

Laminitis prevalence varied from 11% to 57%, confirming its key role as a predisposing condition in the development of distal limb dysfunction.

Evaluation of the rumen environment revealed decreased pH values (below 5.8) in 48–53% of animals, indicating a high prevalence of subacute ruminal acidosis as a major metabolic trigger factor.

Clinical cases of necrobacteriosis ranged from 12% to 42% and were predominantly localized in the distal parts of the limbs.

The integrated analysis demonstrated that the simultaneous presence of multiple trigger factors—nutritional imbalance, metabolic disturbances, poor housing conditions, and limited animal movement—significantly increased the risk of disease development.

The combined presence of multiple trigger factors resulted in a significantly higher incidence of necrobacteriosis compared to single-factor exposure ($p < 0.05$). Animals exposed to multiple trigger factors showed a significantly higher incidence of combined hoof disorders.

Discussion

The obtained results confirm that lameness and necrobacteriosis in high-yielding cattle should be considered multifactorial conditions resulting from the interaction of several trigger factors rather than isolated pathological processes.

Feeding management was identified as a primary trigger factor, as high-concentrate diets promote ruminal acidosis. This condition leads to damage of the rumen epithelium and facilitates the translocation of microorganisms and toxins into the bloodstream.

Under acidic conditions, the breakdown of Gram-negative bacteria results in the release of endotoxins and vasoactive substances, which impair microcirculation in the hoof dermis. This process disrupts horn formation, weakens tissue integrity, and increases susceptibility to infectious agents, including *Fusobacterium*

necrophorum.

Laminitis represents an early stage in this pathological cascade, initially developing as an aseptic inflammation and later predisposing tissues to bacterial invasion. Consequently, necrobacteriosis should be regarded as a secondary infectious complication developing on the background of metabolic and structural disturbances.

The integrated assessment approach demonstrated that the combined effect of trigger factors plays a decisive role in disease progression, highlighting the importance of a comprehensive preventive approach.

These findings confirm that necrobacteriosis should be considered a multifactorial condition requiring a systems-based approach rather than isolated treatment strategies.

Conclusion

The results of this study demonstrate that distal limb dysfunction and necrobacteriosis in high-yielding dairy cattle are closely interconnected multifactorial conditions driven by the combined influence of multiple trigger factors.

Among these, feeding-related metabolic disturbances were identified as key initiating factors, leading to ruminal acidosis and laminitis, which subsequently create favorable conditions for the development of necrobacteriosis.

The integrated assessment approach confirmed that not a single factor, but the cumulative and interacting effects of nutritional, environmental, and management-related triggers play a decisive role in disease onset and progression.

These findings highlight that effective control of necrobacteriosis requires not only therapeutic interventions but also systematic identification and elimination of underlying trigger factors.

The proposed integrated assessment approach can be used as a practical tool for early risk prediction and disease prevention.

Practical Recommendations

Based on the results of the integrated assessment, the following practical measures are recommended for the prevention and control of necrobacteriosis in high-yielding cattle:

- optimize feeding strategies by increasing dietary fiber and maintaining an appropriate concentrate-to-forage ratio;
- implement regular monitoring of rumen function to prevent subacute ruminal acidosis;
- ensure systematic hoof care, including routine trimming and preventive hoof treatments;

- provide adequate animal movement to support normal microcirculation in hoof tissues;
- apply timely veterinary interventions based on early detection of lameness and associated hoof disorders;
- implement an integrated approach aimed at identifying and eliminating trigger factors to reduce disease recurrence.

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