Understanding the causes of laminitis in your dairy herd

After mastitis and fertility problems, lameness is the third most important source of economic losses in dairy production. Roughly 90% of lameness cases are caused by claw-related diseases. Laminitis – a disease characterised by inflammation of the lamella tissue of the claw – leads to pain for animals, greater susceptibility to other diseases, higher treatment costs, lower performance and lameness.

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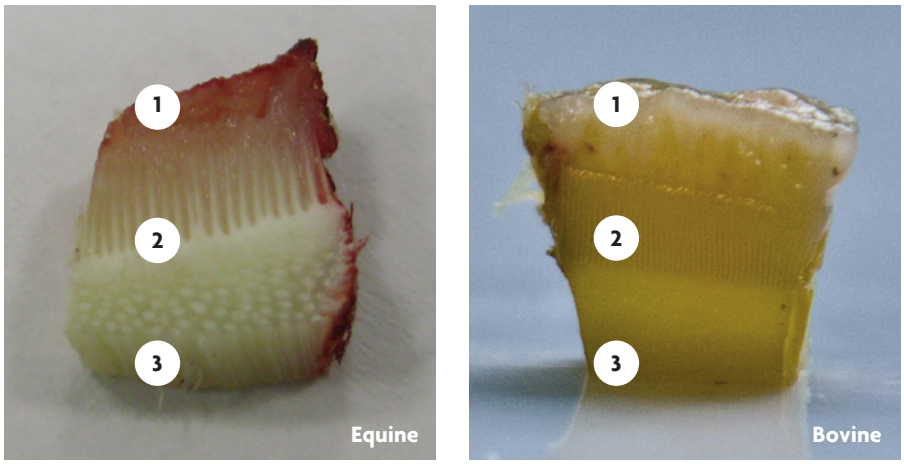

Explants of about 5 x 5mm contain all three important layers of the hoof/claw. 1: connective tissue to the pedal bone, 2: lamellae tissue, 3: the inner hoof/claw wall.

However, the pathology of laminitis is still not fully understood. As it is a multi-factorial disease, several substances and toxins such as endotoxins are discussed as possible trigger factors. Endotoxins, or lipopolysaccharides, are cell wall components of Gram-negative bacteria that are released when bacteria multiply, lyse or die.

During bacterial imbalance in the rumen, endotoxin concentration can rapidly increase. Once endotoxins have reached the blood flow through an impaired rumen barrier, they can reach the hoof tissue and have a negative impact on tissue integrity through different mechanisms, inflammation, in which specific cells activate cytokines (TNF-alpha, IL-6) and enzymes (for example matrix metalloproteinases) that weaken or destroy the tissue.

In severe cases, the connective tissue of the pedal bone completely separates from the lamellar tissue – causing the rotation and sinking of the pedal bone. This irreversible process causes considerable pain.

Benefits of the ex vivo/in vitro laminitis model

Animal experiments are associated with pain and stress for the animal. In addition, they are very time and cost extensive. An ex vivo/in vitro model offers an alternative way to investigate the role of different trigger factors during laminitis without the need for animal trials, and at lower costs.

From a research perspective, it allows scientists to evaluate different toxins and concentrations in one trial and to evaluate the interaction of different toxins and other trigger factors.

Furthermore, this model mimics the in vivo situation quite well, as all affected tissue layers are involved. The practical application aspect is also important, as it allows for the evaluation of nutrition strategies to prevent laminitis.

Recent scientific papers have shown that endotoxins and fumonisins have the capability to aggravate the severity of laminitis (Table 1).

Table 1. Recent Biomin Research Center findings on laminitis (Reisinger et al).

Species	Tested toxins	Effects	Year
Cow	Endotoxins	Significantly decreased separation force after 24 hours	2017
Horse	Mycotoxin Fumonisin	Significantly decreased separation force after 24 hours Increase of fumonisin biomarkers (Sphinganine to sphingosine ratio)	2016
Horse	Endotoxins	Significantly decreased separation force after 24 hours	2015
Horse	Endotoxins	Significantly increased number of separated explants after 24 and 48 hours	2014

Prevention tips

Our understanding of the causes of laminitis continue to advance and there are several steps you can take to reduce the risk of laminitis in your herds, including the following:

- Appropriate feeding management: avoid excessive amounts of carbohydrates.
- Proper and sufficient bedding material.
- Good hygiene management.
- Regular hoof/claw trimming.
- Mineral supplementation.
- Proper mycotoxin risk management.
- Endotoxin prevention and counteracting strategies, for example binding and bioprotection. ■