

Newsletter

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> SUMMARY

Laminitis is a disease in ungulates, and is most common in cows and horses. Lameness is one of the main causes of economic losses in dairy production, after mastitis and fertility problems. Financial losses are high, because one lame cow can cost between 200 and 300 Euros/lactation. The disease inflicts a huge financial and emotional burden on the horse industry.

A lot of factors can influence the prevalence and severity of laminitis (e.g. grain-based or pasture-induced carbohydrate overload, hoof/claw care, mycotoxins, amongst others). Most of them can be avoided by appropriate feed and health management strategies. Laminitis is an inflammation of the lamella tissue of the hoof/claw. The pathogenesis and trigger factors are still not completely identified. Endotoxins seem to play a role when they are absorbed into the bloodstream, together with other toxins, such as mycotoxins and exotoxins as well as histamine. If toxins reach the hoof/claw tissue, an inflammation process starts. Specific cells activate cytokines and enzymes, which weaken or even destroy the tissue.

Read the Special Newsletter to find out more about this devastating disease.

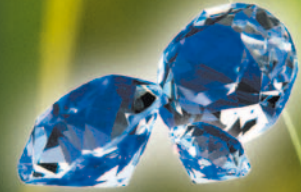
Enjoy reading!

Nicole Reisinger and Simone Schaumberger



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Endotoxins: substantial trigger factor for laminitis?

Laminitis

Laminitis is a disease in ungulates that is most commonly found in horses and cows. Laminitis is an inflammation of the lamella tissue of the hoof/claw. It is a painful disease for animals and leads to huge financial losses in the horse and dairy industry.

Economic relevance

Cows

One of the main causes for economic losses in dairy production after mastitis and fertility problems is lameness. In cows, the diagnosis of laminitis is difficult and its economic relevance is therefore related to all types of lame cows. The fact that about 90% of lameness is caused by claw-related diseases accentuates the impact of laminitis.

The average percentage of lame cows in herds differs, depending on country and stable management. Financial losses are high, because one lame cow can cost between 200 and 300 Euros/lactation. This means a financial loss of 4,000 to 6,000 Euros in a herd with 100 cows and an average lameness prevalence of 20%.

Horses

Laminitis inflicts a huge financial and emotional burden on the equine industry. It is one of the leading causes of death among horses. A survey in the US showed that about 7.5 to 15.7 percent of all lameness problems in horses are related to laminitis (USDA, 2000).

Economic costs consist of:

- Treatment costs (veterinary, medical costs, working time of the farmer)
- Decreased milk yield (up to 400 kg/cow for every 305 lactation days)
- Decreased body weight
- Lower reproductive performance
- Higher susceptibility to other diseases
- Increased involuntary culling rates

Factors that trigger laminitis

A lot of factors can influence the prevalence and severity of laminitis. Most of them can be avoided by appropriate feed and health management strategies.

The following are some of the most common factors influencing laminitis in horses and cows:

- Predisposing diseases in horses include colic, endotoxemia and/or septicemia, equine metabolic disease, Cushing's syndrome
- Predisposing diseases in cows include acidosis, mastitis, metabolic disease
- Extensive amounts of high energy feed (especially in high performance cows)
- Grain-based or pasture-induced carbohydrate overload
- Obesity (especially in ponies)
- Hoof/claw care
- Stable management (design, bedding material)
- Extensive exercise for horses (especially on hard surfaces)
- Presence of environmental toxins (endotoxins, mycotoxins, exotoxins)

Onset of laminitis

There are three different forms of laminitis: acute, subclinical and chronic laminitis.

Acute laminitis can be detected easily, because animals show lameness. In the worst cases, animals do not want to move, and avoid putting weight on the affected legs. Frequent and long periods of lying can be another sign of laminitis. The surface temperatures of the hoof/claw as well as digital artery pulse rate are increased.

The acute form of laminitis is common in horses, but not in cows.

Subclinical laminitis is difficult to identify, and damage therefore occurs before laminitis can be detected. Some of the

signs are: yellow discoloration of the sole, hemorrhages of the sole, separation of the white line, sole ulcer and other lesions. Subclinical laminitis is quite common in cows.

It is also possible that laminitis develops over a period of time resulting in structural changes, which is then called **chronic laminitis**. An arched back can be a sign of chronic laminitis in cows (*Figure 1*). The chronic form of laminitis is common in horses and cows.

What happens inside the hoof/claw?

Laminitis is an inflammation of the lamella tissue of the hoof/claw. Although a lot of research has been done in recent years, a lot of questions remain unanswered. The pathogenesis and trigger factors are still not completely identified. Most research has been conducted on horses and therefore, knowledge for bovine laminitis has mostly been based on equine research.

Role of endotoxins

Endotoxins are parts of the cell wall of Gram-negative bacteria, and are released when bacteria multiply, lyse and die. Sources of endotoxins are in the environment as well as in the rumen and gut. If an excessive amount of carbohydrates is ingested, they cannot be digested in the foregut, and are digested in the hindgut. This leads to an imbalance in the bacteria population in the gut. Gram-positive bacteria (e.g. *Streptococcus bovis*) proliferate rapidly, which consequently results in the death of Gram-negative bacteria (family *Enterobacteriaceae*). As endotoxins are released when bacteria die, the amount of endotoxins can dramatically increase during carbohydrate overload. In addition to the release of endotoxins, acidity is increased and affects the gut permeability. Endotoxins are absorbed into the bloodstream, together with other toxins, such as mycotoxins and exotoxins as well as histamine. This worsens the blood supply of the lamella tissue, and increases the blood pressure in the feet.

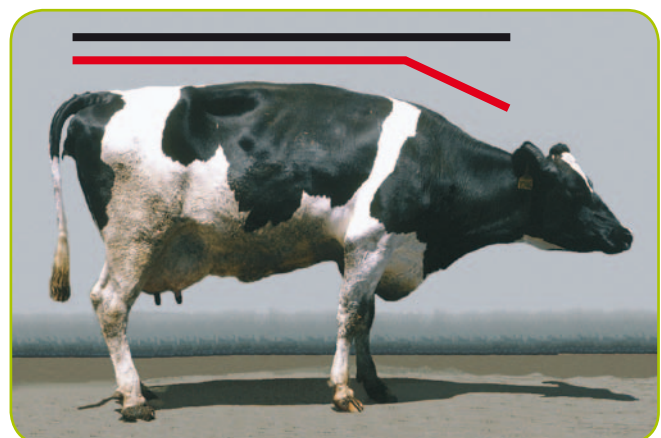


Figure 1. Cow with an arched back, which can be a sign of pain in the claw/lameness as a result of laminitis. Black line indicates normal position; red line indicates position during laminitis (©Copyright: ZINPRO)

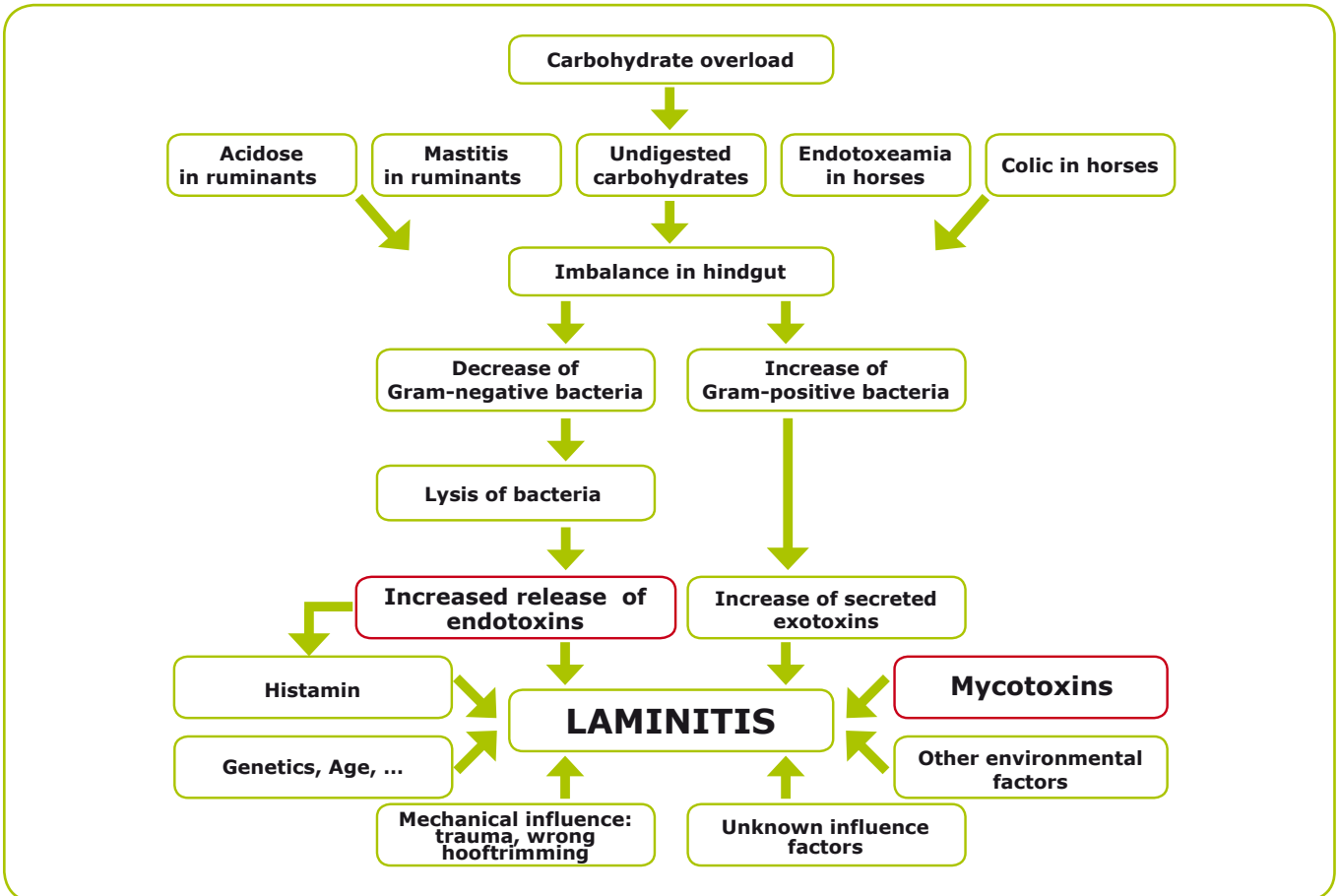


Figure 2. Flow chart of the possible development of laminitis in cows and horses

Processes in the hoof/claw

If toxins reach the hoof/claw tissue, an inflammation process starts. Specific cells activate cytokines (e.g. TNF-alpha, IL-6) and enzymes (e.g. matrix metalloproteinases), which weaken or even destroy the tissue. In the worst cases, the connective tissue of the pedal bone completely separates from the lamellar tissue, which causes the rotating, and eventually, the sinking of the pedal bone (Figure 3 and 4). This process causes a lot of pain, and is irreversible.

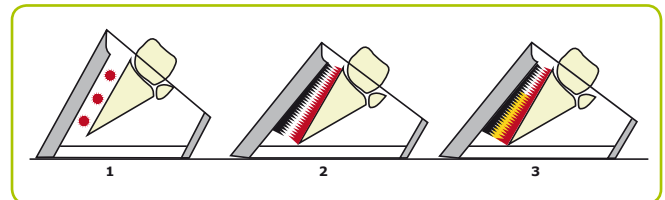


Figure 4. Schematic overview of the process of laminitis. **1:** Inflammation of the tissue **2:** Separation of the connective tissue from the lamella and sinking of the pedal bone. **3:** Structural changes remain and scar tissue is built up
Diagnose Hufrehe - Kstanze Rasch (2010)

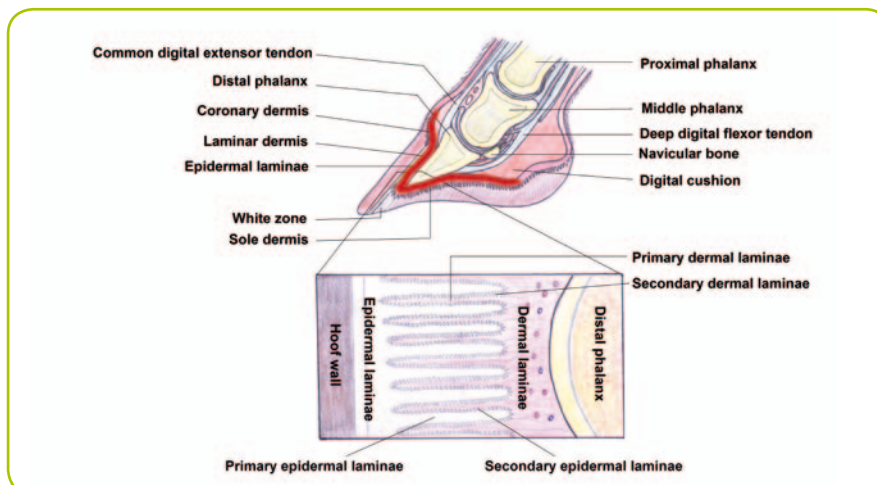


Figure 3. Structure of the bovine claw. The tissue which plays a major role in laminitis is marked in red

Treatment and prevention

It is important to note that the best treatment is prevention!

In acute cases, non-steroidal anti-inflammatory drugs, vasodilators and pain killers are given to the animal. Furthermore, claws/hooves can be trimmed to minimize the pressure on the affected tissue.

In addition, foot baths and cooling of the claws/hooves can be helpful. The animal needs to rest on deep and soft bedding material until it has recovered. In the worst cases, the animal has to be euthanized.

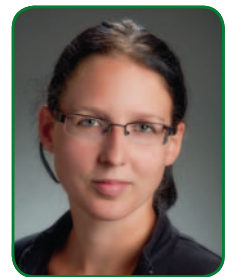
To minimize the trigger factors, and therefore reduce the risk of laminitis, some points have to be considered:

- Appropriate feeding management: avoid excessive amounts of carbohydrates
- Bedding material
- Good hygiene management
- Regularly hoof/claw trimming
- Grazing management (especially in horses)
- Avoid obesity in horses
- Supplementation of minerals
- Application of proper mycotoxins and endotoxins risk management

References are available upon request

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