

A Horse Owner's Guide to Pasture-associated Laminitis

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Key points of this publication

- Laminitis is a painful yet preventable disease capable of afflicting all hoofed animals but commonly seen in horses. Laminitis is the inflammation of the laminar structures of the hoof. Horses with laminitis develop temporary or chronic lameness.
- Pasture-associated laminitis is the most-reported laminitis in the U.S. It is the result of excess consumption of grass high in nonstructural carbohydrates, which are starches and sugars.
- Pasture-associated laminitis is preventable.
- Obesity and laminitis result from improper grazing management, high-calorie diets and insufficient exercise.
- Hay low in nonstructural carbohydrates is the preferred feed for horses.
- Early symptom detection and aggressive treatment are critical to stopping the progress of laminitis.



Pasture-associated laminitis, an inflammation of the laminar structures of the hoof, is the result of excess consumption of grass high in nonstructural carbohydrates.

Credit: Adobe stock image

Introduction

As the saying goes, *No hoof, no horse*. Every horse owner is concerned about hoof problems and lameness in horses. This comes as no surprise, as 13% of U.S. horse owners report issues with laminitis. Of those cases, 4.7% result in death or required euthanasia. Laminitis was described as early as 350 B.C. Two thousand years later, horse owners still search for a cure.

Horse owners often use the traditional term *founder* interchangeably with the word *laminitis*. However, these conditions are not the same. Laminitis describes the sudden initial attack of pain and inflammation of the laminae. By contrast, founder is a chronic condition in the animal's hoof, in which the coffin bone has rotated or sunk toward the sole of the hoof.

Horses may have a laminitic episode and fully recover. However, anything beyond a slight rotation of the coffin bone may become a long-term and chronic condition of founder.

Responsible horse owners are knowledgeable about the equine digestive system, the nutritional content of feedstuffs and the rate of passage of feeds through the digestive system. More processed and less fibrous feedstuffs such as pelleted grain move through the digestive tract more rapidly than unprocessed hay. When horses eat too much grain, processed feeds, lush pasture or hay bred for increased sugar content, the stomach and small intestine (foregut) may be unable to process the large influx of carbohydrates. Undigested starch and sugars quickly pass from the foregut into the hindgut, overwhelming digestive microbes. The resulting digestive imbalance can result in colic or laminitis or both. By contrast, fibrous feeds move more slowly through the digestive tract, allowing sufficient time for complete digestion. Equine nutritionists recommend a diet consisting primarily of unprocessed forages high in fiber.

Pasture grazing: pros and cons

Excessive consumption of fast-growing, lush pasture is responsible for 46% of the reported cases of laminitis in the U.S. Historically called *grass* or *pasture founder*, the condition is now called pasture-associated laminitis. Horses and ponies 8 years to 18 years old are most likely to suffer from this type of laminitis. Metabolic complications from obesity, including inflammation, insulin resistance and hyperinsulinemia, are referred to as *equine metabolic syndrome*. These complications predispose horses to laminitis. Certain horse breeds known to be “easy keepers,” such as miniature horses and donkeys, are commonly afflicted with pasture-associated laminitis. Inadequate exercise is a significant risk factor for pasture-associated laminitis.

Horses evolved in low-nutrient rangelands. They ate many small meals throughout the day and grazed for 16–17 hours. They traveled miles in search of forages that were typically high in fiber and low in sugar content. By contrast, modern pasture forage species have been bred to produce higher sugar content and lower fiber. These traits increase palatability, encourage greater intake and result in weight gain. Modern forages benefit livestock grown for meat and milk production but can be problematic for horses. Proper grazing management must be imposed because horses do not control their dietary intake. They continue to graze after their nutritional needs are satisfied. People who care for horses must limit their animal's time on pastureland or use a grazing muzzle.

Proper grazing management includes:

- Limited time on the pasture.
- A diet of low-quality, high-fiber forages.
- Limited supplemental grain.
- Consistent exercise to manage weight gain.
- A grazing muzzle for some horses.

The mechanics of hoof failure

Horses are susceptible to laminitis because of their physical structure. The evolution and purposeful breeding of horses have created an animal that can run with speed and agility. The delicate legs and hooves support a comparatively heavy upper body. Approximately 60% to 65% of the horse's weight, including the weight of the neck and head, is supported by the front feet. As the horse runs, the legs must withstand tremendous force from impact on the ground.

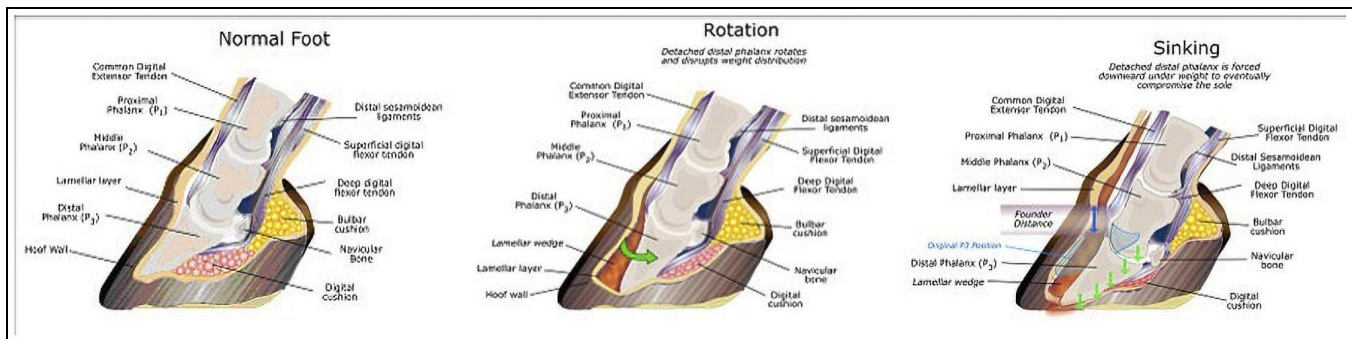


Figure 1: A comparative anatomy of the normal, rotated and sinking equine hoof.

Credit: Horse Community Journals Inc.

The distal phalanx, or *coffin bone*, is a wedge-shaped bone suspended within the hoof capsule by interconnective tissues called *laminae*. Laminae can be sensitive or insensitive. The sensitive laminae surround the coffin bone; the insensitive laminae cover the inner wall of the hoof. These tissues interlock and form a strong bond that secures the coffin bone in place. This laminar connection is critical in the function of the equine hoof. The laminae support a significant portion of a horse's weight. Additionally, the laminae absorb much of the impact with the ground.

An extensive blood supply delivers nutrients and oxygen to the laminar tissues. The onset of laminitis interferes with blood flow to these tissues. When this blood supply is disrupted, the laminae within the hoof become inflamed, swell, weaken and die. The bond between the sensitive and insensitive lamina fails and separates with the death of laminar tissue. As the bond fails, the coffin bone begins to separate from the hoof wall. As separation progresses, the coffin bone may rotate towards the sole of the hoof, sink or both. Sinking is the result of the complete failure of the laminar bond around the coffin bone. Rotation is due to the pull of the deep flexor tendon on the coffin bone.

Causes of laminitis

Horse owners think of laminitis strictly as a hoof disease. In reality, it is a complex, whole body event, reflecting changes in multiple organ systems. Over 10 different systemic diseases develop into laminitis. Conditions or events that trigger laminitis include:

- Excessive intake of nonstructural carbohydrates from lush pastures.
- Overconsumption of grain.
- Obesity.
- Equine metabolic syndrome.
- Sepsis due to colic, pneumonia or other infections.
- Retained placenta or uterine infection.
- Colic sepsis due to colic, pneumonia or other infections.
- High fever.
- Hormonal imbalance (Cushing's disease).
- Stress.
- Supporting limb laminitis.
- Contact with black walnut shavings.
- Excessive impact on hard surfaces.
- Overconsumption of cold water by an overheated horse.

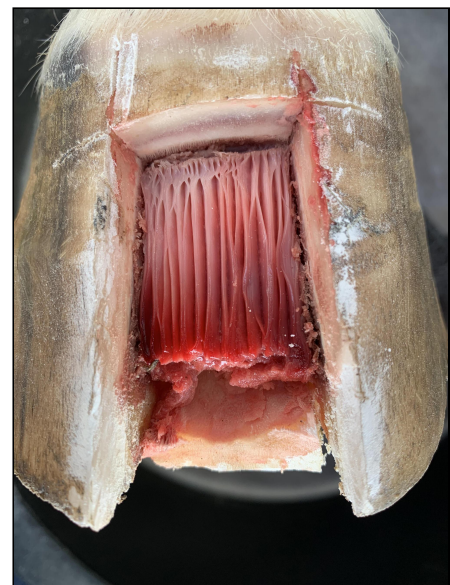


Figure 2. A resected hoof showing laminae.

Credit: Dr. Jennie Ivey, University of Tennessee

Symptoms of laminitis

In the initial stages of the disease, the symptoms of laminitis may be subtle. Horse owners must be observant. Look for these symptoms:

- Eyes glazed with pained facial expression. (See sidebar.)
- Lameness — easiest to observe when the horse is trotting in a circle.
- Reluctant or hesitant gait.
- Prefers lying down; hesitant or reluctant to stand.
- Sawhorse stance: the front feet are stretched out to alleviate pressure on the toes. The horse appears to be rocked "back" on its hindquarters.
- Excessive heat in the hooves.
- Increased digital pulse in the feet.
- Pain in the toe region when applying pressure with hoof testers.
- Increased heart and respiratory rate.



Figure 3. Older horse with Cushing's disease. Notice the long coat the horse was unable to shed.

Credit: Scott Duggan, @ Oregon State University

Identifying and treating pasture-associated laminitis

Early detection of the symptoms combined with aggressive treatment is critical to stop the disease from progressing. If you observe any of these signs in a horse, call a veterinarian immediately. Minimize the animal's movement until a veterinarian arrives to reduce the opportunity for damage to the inner hoof.

The veterinarian will evaluate the horse, identify the stage of the disease and develop a treatment plan. The progress of laminitis may be divided into four stages (Table 1). Not all horses will go through every stage. Recovery depends on open lines of communication among the owner, veterinarian and farrier. See Table 1 for the symptoms of laminitis organized by its four stages.

Common treatments may include cold compresses to the hooves, a mineral oil purge or nonsteroidal anti-inflammatory drugs (NSAIDs).

Table 1: Symptoms of laminitis and its stages

Stage	Time	Potential symptoms
Developmental	24–60 hours	Slight discomfort, reluctance to turn or move, minimal shifting of feet. Slight lameness in the front feet may appear at end of this stage.
Acute	24–72 hours	Horse is lame, stilted gait, shifts weight from front to hind legs, excessive heat in hooves, bounding digital pulse, visibly in pain and constant weight shifting. Horse may prefer to lie down and be reluctant to stand.
Subacute	72 hours or more	No structural failure incurred during acute stage. Minimal injury to laminae; horse can make full recovery. Chronic cases skip this stage.
Chronic	9–12 months or longer	Persistent lameness, separation of laminae, coffin bone rotation, dished hoof, widening of white line and chronic pain.

Laminitis in the developmental stage does not always result in rotation of the coffin bone and chronic founder. Mild cases may occur with rapid recovery and no long-term issues.

Horses progressing to the chronic phase have suffered a rotation of the coffin bone and mechanical collapse in the hoof. Recovery from the chronic stage only occurs with stabilization of the coffin bone. The chronic phase can last 9–12 months or longer.

The advice and service of a knowledgeable farrier experienced with founder are essential for the horse to recover functional use of its feet and legs. Corrective trimming of the hoof and application of a heart bar, egg bar or other specialty shoes or foam pads will relieve pressure to the sole and the laminar region at the toe. In severe cases, the deep digital flexor tendon may be surgically cut to relieve the pressure or pull on the coffin bone. Unfortunately, even with surgical intervention, some horses never completely recover. The horse’s feet may be permanently disfigured.

Severe coffin bone rotation causes severe pain and suffering. The coffin bone can only stabilize if laminar attachments heal completely. In some cases, euthanizing the horse may be the most humane course of action.

Prevention of pasture-associated laminitis

The best cure for laminitis is prevention. Pasture grazing is both economical and mentally and physically beneficial for the horse compared to stall confinement. With careful management, horses can safely graze on pastures.

Consider these management techniques to prevent pasture-associated laminitis, founder or both.

- Make ration changes slowly, so that the digestive microbial community can adjust from hay to fresh forage. This is particularly important in the spring.
- Limit initial turnout time to 15 minutes. Increase turnout time by 15 minutes every three to five days. Continue feeding hay low in nonstructural carbohydrates as part of the daily feeding routine.
- Allow horses to fill up on low nonstructural carbohydrate hay before turnout. Do not turn out horses on an empty stomach.
- Continue to offer hay low in nonstructural carbohydrates, even when the grass is growing well.
- Confine horses to dry lots or use a grazing muzzle when pasture forages are high in nonstructural carbohydrates.
- Confine horses from 10 a.m. to 10 p.m., when forage sugar content is highest.
- Best turnout times when nonstructural carbohydrate levels are lowest occur from 3 a.m. to 10 a.m.
- Do not graze pastures for several weeks after the first freeze in the fall.
- Do not allow horses to graze freshly cut grass stubble. The lower three inches of the grass plant are where sugars are stored.
- Most recreational horses require only good-quality hay and a mineral supplement to stay healthy.

Table 2: Relative fructan (sugar) levels in common pasture species

Grass type	Sugar level
Perennial ryegrass	
Kentucky bluegrass	
Bentgrass	
Timothy	
Tall Fescue	
Orchardgrass	
Alfalfa and clovers	

Sources: Downing and Gamroth, 2007; Fransen and Hudson, 2006; Holechek and Galt, 2004; Shewmaker et al., 2006; Volenec, 1986; Watts, 2008.

- Overweight horses and horses prone to laminitis should receive a diet containing less than 10% nonstructural carbohydrates.
- Maintain horses at a body condition score of 4 to 6. Overweight horses and ponies may require a grazing muzzle whenever they are turned out on pasture.
- Reduce soluble sugar content in hay by 30%–35% by soaking it in lukewarm water for 60 minutes. Drain, rinse and air-dry prior to feeding.
- Exercise your horse as much as possible! If that is not a viable option, consider building an exercise track around your field. Find resources in the References section of this document.
- Confine to a dry lot any horse showing foot soreness or a thickening or hardening of the crest until the condition improves.
- Discuss your management approach with your veterinarian and farrier. Determine their experiences with laminitis or founder. Consider input from every perspective to keep your animals healthy.

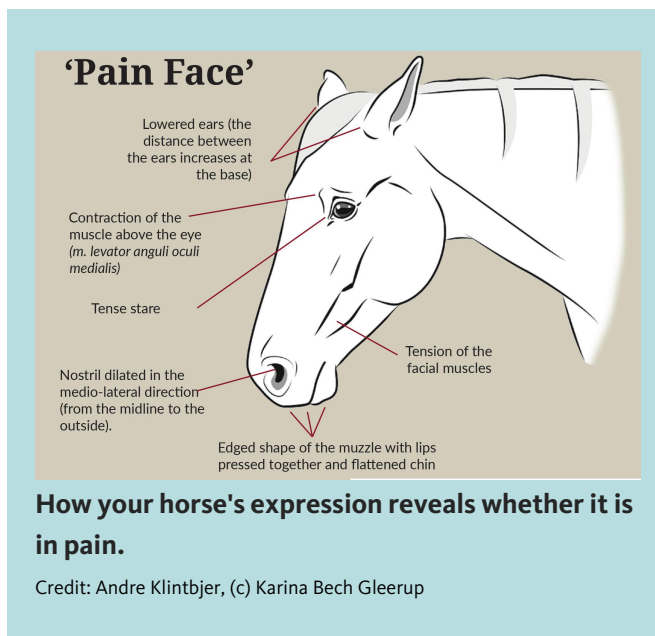
Exercise horses a minimum of three to five times per week. With quality nutrition, frequent exercise and good pasture management techniques, your horse will avoid laminitis and have good health. The best cure for laminitis is prevention.

Modern forages bred for high sugar content have made lush pastures more dangerous to horses. Green and inviting spring pasture can inflict the pain, stress and expense of laminitis on the horse and its owner. Pasture-associated laminitis is a preventable disease that experienced horse owners avoid. Proactive grazing management and consistent exercise are the foundations of horse care. By feeding hay low in nonstructural carbohydrates and limiting grazing time, horses may safely graze pasture without risking laminitis. Through careful observation, exercise and nutritional care, your horse can live a long and healthy life.



Figure 4. Pony with the beginning stages of cresty neck.

Photo: Scott Duggan @ Oregon State University



Nonstructural carbohydrates

Nonstructural carbohydrates include simple sugars, starches and fructans. Rapid fermentation of these carbohydrates in a horse's hindgut (cecum and colon) may cause intestinal disturbances, triggering a chain of events that culminates in laminitis. Hay that is low in sugar, starch and fructans is referred to as nonstructural carbohydrate hay. Here are some key points to remember:

- Nonstructural carbohydrate hay that contains less than 10% sugars, starches and fructans is considered safe for horses with pasture-associated laminitis.
 - The amount of nonstructural carbohydrates in pasture and hay depends on the time of day forage is consumed or harvested, weather, the growth stage of the grass and environmental stressors on plants, such as drought and frost.
 - Nonstructural carbohydrate levels are highest in modern forage species, particularly ryegrasses, and should be avoided for equine pastures. When seeding a pasture, choose species that are low in nonstructural carbohydrates.
 - Grasses store sugars in the lower 3 inches of the plant. Avoid overgrazing pastures.
 - Research indicates that nonstructural carbohydrate levels in grasses are lowest from 3 a.m. to 10 a.m.
 - Cold- or drought-stressed grasses and legumes may be higher in nonstructural carbohydrates than the same forage species not stressed.
 - Test hay before purchasing.
 - Test pasture for nonstructural carbohydrate content prior to grazing and periodically throughout the growing season.
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Additional resources

- [Paddock Paradise](https://www.aanhcp.net/pages/welcome-to-paddock-paradise) (<https://www.aanhcp.net/pages/welcome-to-paddock-paradise>): An excellent website with ideas on building your own track.
- [Paddock Paradise Track System for Horses](https://sam.extension.colostate.edu/topics/pasture-range/paddock-paradise-track-system-for-horses/) (<https://sam.extension.colostate.edu/topics/pasture-range/paddock-paradise-track-system-for-horses/>)

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