

# **HAPPY FEET**

## **The Art of Nourishing the Equine Hoof**

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Sound hooves are the result of many things. Age, breed, metabolic rate, environmental moisture, illness, shoeing and exercise all influence horse hoof health, and the most important factor may simply be genetics. While the intricacies of the equine foot are clearly multifactorial, one thing is certain: the quality of the hoof always has a nutritional component. Inadequate nutrition can be the difference between having the potential for a hoof problem and actually developing one. Providing the dietary nourishment that the hoof needs can optimize health and provide the essentials needed to reach its potential. Because the hoof is in a continuous state of growth, dietary changes can positively or negatively affect its overall integrity. A balanced, forage-based diet is the foundation for all areas of equine health, and the hoof is no exception. Horses on well-balanced diets are much less likely to have foot problems. The balance of vitamins and minerals, the balance of net calories, the balance of activity level and the stage of life of the individual animal makes nutrition as much of an art as it is a science.

### **Anatomical Masterpiece**

The basic anatomy of the horse hoof is familiar to most people. At the very top of the hoof is the coronary band, which is the primary source of growth and nutrition for the hoof wall. The hoof wall is the hard, outer layer of the hoof capsule that runs from the coronary band down to the ground and gives the entire foot its rigidity and weight-bearing strength. The hoof wall itself is actually made up of three layers that include the outer periople, a middle layer and an inner layer. When viewed from the bottom, the hoof can be divided into three main sections: the heel, quarter and toe. The hoof wall can also be viewed from the bottom of the hoof as the outer most layer that runs into the white line separating the hoof wall and the sole. The sole, which makes up the majority of the undersurface of the hoof, is softer than the wall due to more natural moisture and protects the sensitive structures within the hoof. The main role of the bars is to bear weight; they are the

part of the wall that have turned inward from the heel to surround the frog. The v-shaped portion of the hoof that separates the heels is the frog, and it serves multiple functions. Because of its higher moisture content, the frog is more elastic and is a natural shock absorber. It aids in traction and heel expansion as well as circulation by pumping blood back to the heart.

What may be less familiar is the unseen hoof. The living, breathing, sensitive tissues underneath these familiar parts are charged with much of the growth, circulation and nourishment of the entire hoof. Analogous to the quick of the human fingernail, the corium is the part of the hoof that produces new hoof growth, or the hoof horn and contains an intricate network of blood vessels and nerves. The laminar corium (sensitive laminae) is laminae engorged with blood vessels. It attaches to the innermost layer of the hoof wall, in a Velcro-like way on one side and firmly attaches to the pedal bone on the other side. The solar corium (sensitive sole) contains hair-like laminae also teeming with blood vessels. It attaches to the sole and the frog and supplies nutrients for growth. The digital cushion resides on top of the frog and behind the pedal bone, viewed on the outside of the hoof as the bulbs of the heel. It is a tough yet elastic structure that reduces concussion to the foot and supports heel expansion as well as assisting in circulation. Lateral cartilages, the pedal bone and the navicular bone also make up the inner structure of the amazingly tough yet also delicate hoof.

The dread that accompanies words such as “foot abscess,” “quarter crack” and the insidious “laminitis” reinforces the incredible importance of the health of the hoof, as well as the fact that a compromise of it debilitates the entire horse. The health of the hoof is essentially an extension of the health of the horse, and nutrition provides a critical component in its well-being. Mark Silverman, DVM, MS of Sporthorse Veterinary Services, notes the harmonious marriage of nutrition and hoof health. “Good nutrition and a properly-functioning gastrointestinal system are critical to good hoof health. Having access to good quality nutrition is as important as regular hoof care,” says Dr. Silverman. There is a difference between providing adequate nutrition and good or therapeutic nutrition. Energy intake, protein and amino acids, fats and fatty acids, vitamins, minerals, along with clean water, are the specific nutritional areas that provide the integral foundation for hoof health, as well as the means for optimizing hoof health.

## **Common Problems & Nutritional Support**

Hoof problems range from superficial to debilitating. Consulting your veterinarian and farrier is the best approach for hoof care and critical if the horse is experiencing duress. There are different methods to offer support for hoof issues that include corrective shoeing, topical treatments, wrapping, etc. Providing specific nutrients through the diet can be used as a preventative measure and therapeutically to decrease inflammation, support normal circulation and ensure the hoof tissue has the necessary building blocks to heal and rebuild.

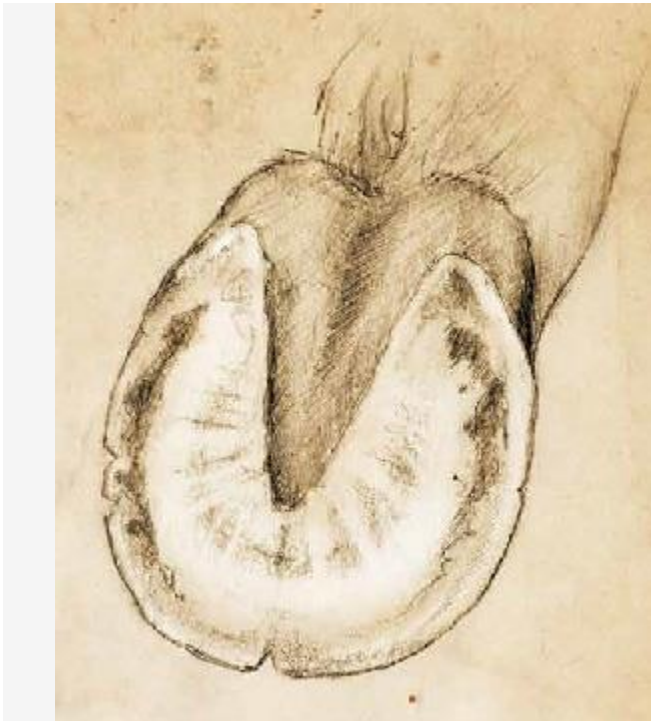
- **Navicular Syndrome**

Navicular syndrome, often called navicular “disease,” is a group of related abnormalities affecting the navicular bone and associated structures in the foot. Usually seen in both front feet, it most commonly describes an inflammation and progressive degeneration of the navicular bone and its surrounding tissues. It can lead to significant and even disabling lameness. It is more prevalent in competition horses with a tendency to affect Quarter Horses, Thoroughbreds and Warmblood breeds between the ages of 7 and 14. Conformation may also be a predetermining factor. The exact cause is not known, but damage to the navicular bone may occur due to a lack of blood supply or trauma to the bone. Damage may also occur to the deep flexor tendon, navicular bursa or navicular ligaments, which may all result in inflammation, pain and lameness. If navicular disease is suspected, contact a veterinarian who will likely perform flexion tests and nerve blocks and may use x-ray or MRI for diagnosis. The veterinarian and farrier may also use corrective shoeing to improve blood flow and lift and support the heel for comfort.

- **Laminitis**

Laminitis is the most serious disease of the equine foot and causes pathological changes in anatomy that may lead to long-lasting, crippling changes in function. Laminitis is inflammation of the sensitive structures in the hoof called the lamellae, which holds the coffin bone tight within the hoof horn. This inflammatory condition is extremely painful and can lead to rotation of the coffin bone known as founder. There are multiple causes of laminitis. Nutritionally, it can be related to a high intake of sugar and starch, primarily from a high intake of grain mixes with cereal grains and molasses. Additionally, overconsumption of rich, lush pasture grass, particularly when a horse is unaccustomed to it can cause laminitic changes. Diets should provide enough

energy to promote growth of the hoof wall and maintenance of an ideal body condition score between 4 to 6 out of 9. Excessive weight should be avoided to help prevent complications from obesity and insulin resistance, which can be associated with laminitis. Equine rations that provide a high concentration of non-structural carbohydrates from sugar, starch or fructans should be avoided because these dietary carbohydrates can also lead to complications from laminitis. If laminitis is suspected, contact your veterinarian and farrier for a diagnosis and treatment plan.



- **White Line Disease**

White line disease, also called seedy toe, is a widespread problem affecting the equine foot. Multiple causes have been proposed including excessive moisture, which softens the foot, as well as excessively dry hooves, which may form cracks or separations. Both of these scenarios allow an avenue for pathogens to invade. Another logical cause of the disease is mechanical stress due to an excessively long toe, poor general hoof conformation and several hoof capsule distortions. It is most commonly found by the farrier during routine hoof care and is characterized by a progressive separation of the inner zone of the hoof wall, beginning at the sole. The white line is the junction of the hoof wall and the sole. The separation occurs in the non-pigmented horn at the junction between the two main layers of the hoof horn. The disease process occurs secondary to a hoof-wall separation. Opportunistic and infectious bacteria and

fungi may invade the separation and cause or compound disease. Field studies suggest that a higher dietary level of iodine, an anti-fungal, may offer support to resolve white line disease over a period of weeks.



- **Hoof Abscess**

Caused by bacteria getting trapped inside the hoof, abscesses are a very common cause of acute lameness in horses. Trauma to the hoof sole caused by a puncture (nails, glass, etc.) may lead to bacteria and debris having access to the inner hoof and resulting in an abscess. Excess moisture may cause the hoof wall to soften and allow bacteria access through gaps in the white line. Conversely, extremely dry hooves may lead to brittleness and cracking of the hoof wall also lending access to bacteria. The hoof itself does not allow room for swelling, so as excess pressure builds up from foreign bacteria, it causes an extreme amount of pain resulting in severe lameness, often times seeming to occur overnight. In most circumstances, a veterinarian will be able to drain the abscess, with pain relief being nearly immediate and allowing rehabilitation to begin.



- **Hoof Cracks**

There is a wide spectrum of hoof cracks and the severity of the crack depends on location, depth and site of origin. Grass cracks and sand cracks tend to be superficial flaws caused by the environment. Heel cracks, bar cracks and toe cracks are capable of causing extreme pain. Quarter cracks, in particular, are painful, difficult to manage and have a variety of causes. Quarter cracks involve the coronary band and grow downward. They are more likely than other types of cracks to bleed and become infected, leading to extreme pain and lameness. For all cracks, the farrier should be involved in assessment and will determine the best plan for repair and stabilization.

### **Think Positive: Energy Balance**

Total energy or caloric intake directly correlates to growth rate of hooves. Ensuring that a horse is in a positive energy balance means that his total intake exceeds his output; the horse is maintaining or gaining weight. The diet should provide enough energy to promote growth of the hoof wall while maintaining an ideal body condition score between 4 to 6 out of 9. Overall energy balance is higher than maintenance requirements in several classes of horses, including those that are growing, lactating, breeding, working or exercising. If a horse has very poor quality hooves, consider total energy intake first. A horse in a negative energy

balance will utilize protein to compensate for energy needs for maintenance or growth, etc. This may create a secondary protein or amino acid deficiency that will directly impact hoof quality. Research has shown that hoof wall growth was 50 percent greater in growing ponies that were in positive energy balance when compared with ponies on restricted diets with a reduced body growth rate. It is a common observation that when horses gain weight on lush, spring grass, they also grow hoof faster, highlighting that the perfect food for horses truly is fresh, green grass. The recommendations for total digestible energy for a 1,100-pound horse at maintenance is between 15.3 and 18.2 megacalories (Mcal), dependent on the individual horse's metabolism. A rough estimate of forage by weight needed per day is about 2 percent of the total body weight or 22 pounds for a 1,100-pound horse; 22 lbs of "good" grass hay contains approximately 17.6 Mcals. This is an oversimplified example but a good demonstration that energy requirements for horses at maintenance can easily be met with forage alone.

### **The Importance of Protein**

Protein is the core of a solid hoof. From the Greek word proteos, meaning "of primary importance," protein makes up over 90 percent of the hoof wall on a dry matter basis. Protein deficient diets lead to general poor hoof quality as shown by reduced hoof growth and splitting or cracking of the hoof. Hoof tissue contains many amino acids, which are the building blocks of protein, and these amino acids are what actually affect the metabolism of the hoof and must be available in appropriate amounts in the diet. Digestible and high-quality protein supplies the horse with the amino acids essential for hoof growth. The availability and balance of the amino acids are more important than the general crude protein intake. For example, the amino acids, lysine and methionine, may be deficient even if the total crude protein in the diet is adequate. Both lysine and methionine are essential for hoof growth as they are necessary for producing all body proteins, including keratin. Keratin is an extremely strong specialized type of skin cell and is the major structural protein for the hooves, as well as skin, teeth, mane and tail. Keratin is responsible for the outer protective layer of the hoof wall as well as structural support. Keratin, keratin-associated proteins and the intercellular cementing substance are all made from amino acids, which are used to synthesize these structural proteins in the hoof wall.

The sulfur-containing amino acids, cystine, cysteine and methionine, play a key role in the development of the "cellular envelope," also known as the marginal band, which protects horn cells against protein-degrading enzymes. Cystine and cysteine can actually both be manufactured internally from methionine. The



pathway that converts methionine to cysteine is thought to be imperative in the production of a quality hoof. Methionine is a diet-dependent amino acid since it cannot be manufactured from other amino acids as is the case for several others. Methionine is necessary for integrity of the white line and along with lysine, is essential for hoof growth; both are necessary for producing all body proteins. As a primary constituent of keratin, methionine stimulates strong, healthy hoof growth and is essential to prevent cracked, brittle hooves.





### **Fats for Feet**

Fats play a pivotal role in a healthy hoof as they retain the natural moisture and pliability of the hoof wall, resist the absorption of water from the environment and prevent bacteria and fungi from entering the hoof horn. Hoof tissue has 3 to 6 percent total fat, which works to bind cells together and aids in repelling water. Fatty acids are important nutrients for healthy hooves as they help in connecting hoof horn cells and sustain a permeability barrier. In grass, the ratio of omega-3 fatty acids to omega-6 fatty acids is between 4:1 to 6:1, which is ideal for the horse. However, the fragile anti-inflammatory omega-3 fatty acid content drops quickly and dramatically when grass is cut and cured to make hay. Omega-3 fatty acids will undoubtedly need to be supplemented back into the diet if the horse is on a hay-only diet. If grains are provided in the diet, omega-3 fatty acids will need to be added to balance the pro-inflammatory omega-6 fatty acid content from the grains, especially if the horse does not have access to pasture. Deficiency of fat can be seen in skin and hoof problems, which is a reason many horses with dry, splitting feet that do not respond well to other vitamin/mineral-specific supplements improve when supplemented with a formula that provides a good source of omega-3 fatty acids.

Platinum Protocol: [Platinum Performance® CJ, Platinum Hoof Support](#),