HAYGAIN®

Barefoot Sport Horses

IN THIS HORSE OWNER'S GUIDE WE'LL DISCUSS:

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BARE FEET IN EQUESTRIAN SPORTS: NOT ONLY POSSIBLE, BUT POSSIBLY THE BEST

The Swedish show jumping team won the gold medal at the 2020 Olympics in Tokyo, and two of the three horses jumped barefoot. Whether the fact that they were shoeless contributed to their performance remains to be confirmed through scientific studies. But what we do know is that the veterinary director of the Fédération Equestre Internationale (FEI) fully supported the riders' decisions to compete barefoot. And if the conditions are right, competing barefoot can be "absolutely optimal" for the horse *(Lesté-Lasserre, The Barefoot Equine Athlete: Big Shoes To Fill?, 2022)*.

When bare feet are trimmed properly, and the horse has the right nutrition, environment, and genetics for healthy bare feet, the dynamics of forces just work better without shoes. Loads are better distributed, and the horses' feet stay healthier and maintain better conformation with appropriate angles. Even soft tissue injuries higher up the leg become less common *(Lesté-Lasserre, The Barefoot Equine Athlete: Big Shoes To Fill?, 2022)*.

Bare feet probably also have better proprioception – the ability to give feedback to the central nervous system about where the foot is and what it's doing. While that feedback might not be as strong as what human feet provide, it's still useful for helping horses know where and how they're placing their feet during movement. The proprioceptive sensors in horses' feet are in the soft hoof tissue at their heels, where the walls move the most—especially if that movement isn't blocked by shoes *(Lesté-Lasserre, Horses Sans Shoes: The Facts on Bare Feet, 2019)*.

As a result, barefoot sport horses appear to be more cautious about the way they use their feet—resulting in better health and performance. They also seem to be

more aware of discomfort and will show signs of injury earlier, allowing for earlier intervention before the problem becomes worse, or even catastrophic. Shoes can mask pain and lameness for extended lengths of time *(Erhardsen, New Research on why Barefoot Horses remain Sounder than Shod Horses, 2022)*.

BIOMECHANICALLY SPEAKING, BARE FEET SEEM TO BE ABLE TO **CONTRACT AND EXPAND BETTER** WHEN THEY'RE **NOT CONSTRAINED BY SHOES**, AS SCIENTISTS ARE DISCOVERING MORE AND MORE SINCE THE SWEDES TOOK HOME THE OLYMPIC GOLD *(Erhardsen, New Research on why Barefoot Horses remain Sounder than Shod Horses, 2022).*

Even so, when grass is slippery—such as on a cross-country terrain—horses needs studs to grip the surface, to prevent falls. In that case, horses can be fitted with studded shoes, applied with with just four nails, shortly before competition. The shoes can then be removed immediately after competition.

Transitioning a horse from shoes to barefoot requires a careful and methodical process, based on scientific evidence, which allows the horse's feet to adapt to weight-bearing across the foot's surface again. This process can take 60 to 90 days, during which time the horse should be allowed to exercise freely in increasingly larger paddocks before finally being ridden again *(O'Grady, Various aspects of barefoot methodology relevant to farriery in equine veterinary practice, 2016)*.

Importantly, riding and competing barefoot is not what's best for every horse. Going shoeless must be a case-by-case decision depending on multiple factors, as we'll see in this book.

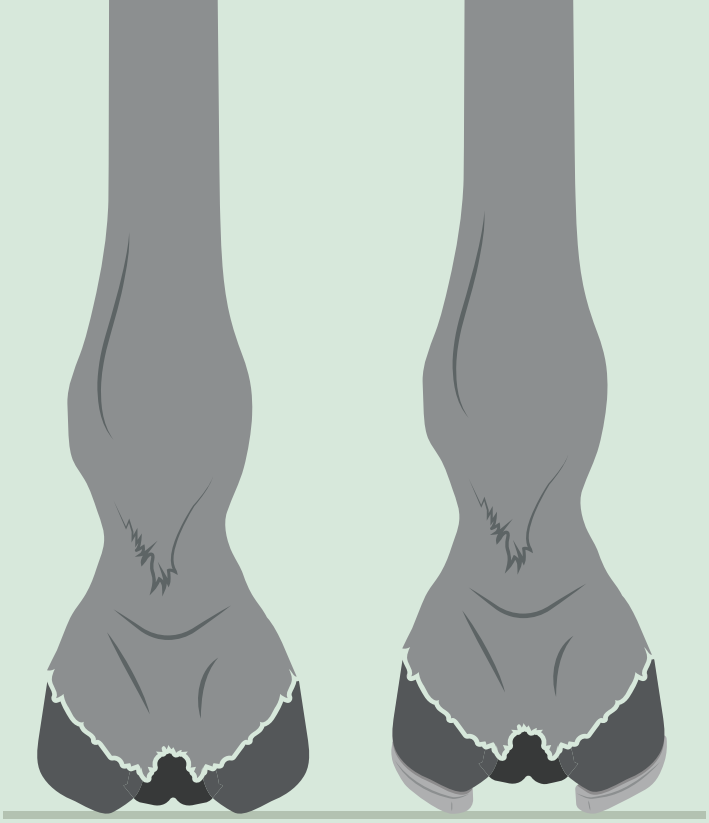
WHERE DO GROUND FORCES GO?

When a hoof makes contact with the ground — during a step at any speed — a multitude of different forces occur. Both the foot and the ground move, stop, and vibrate. The hoof gets hit with pressures in all three dimensions in every part of every phase of the stance, from the time the foot first touches the ground until it lifts off again *(Lesté-Lasserre, New Insight on How Surfaces Impact Horses' Limbs, 2016)*.

Generally, when the ground is soft, the footing molds to the bottom of a bare foot — which makes the telltale tracks of a barefoot horse in packed soil with the shape of the frog visible. When that happens, the horse's foot is distributing much of the force of impact across the bottom of the foot, including the hoof wall, the frog, the sole, and the digital cushion at the back of the foot *(DeFee Mendik, 2022)*.

When the horse is shod, however, the frog and sole are higher up off the ground. The shoe makes contact with the ground and sends forces up through the hoof wall. As such, the shoe usually changes the ground-foot reaction force on soft ground, with greater loading on the walls than when horses are barefoot *(O'Grady, Various aspects of barefoot methodology relevant to farriery in equine veterinary practice, 2016)*.

On hard footing, like a road or dry path, the frog and sole get little contact with the ground — even without shoes — because the foot doesn't sink into the ground. The hoof wall gets the vast majority of the impact force for both barefoot and shod horses. When the horse has shoes, the heels rub against the back of the shoe — where it's not usually attached — and that friction causes greater wear at the heel than along the rest of the hoof wall. This can eventually lead to an unnatural shape of the foot *(O'Grady, Various aspects of barefoot methodology relevant to farriery in equine veterinary practice, 2016)*.



BAREFOOT

- The ground is able to mold to the hoof, with better contact with the sole and frog.
- Force is distributed evenly across the hoof.

SHOD

- The frog and sole are higher off the ground meaning less ground contact.
- Can cause uneven wearing as the heel rubs against the back of the shoe.

Another aspect of force loading is the way the walls and heels stretch. Even though hooves look hard and rigid, they actually are slightly elastic. In barefoot horses, the walls and heels stretch and expand during a step, absorbing some of the shock of the impact. That doesn't happen if the horse is wearing most kinds of steel or aluminum shoes, though, because the shoes block and maintain the shape of the foot *(Roepstorff, 2001)*. An exception is the split-toe metal shoe, which is made up of two disconnected halves that meet at the toe, which gives the heels the chance to move and spread like in a barefoot horse *(Brunsting, 2019)*.

COMPRESSIVE FORCES ON THE HOOF CAPSULE CAN REACH **MORE THAN TWICE THE HORSE'S WEIGHT** DURING HIGH-SPEED MOVEMENT.

Compressive forces on the hoof capsule can reach more than twice the horse's weight during high-speed movement. If the foot can't deform under these forces as it naturally should, it can lead to a compromised frog, an atrophied digital cushion, and other anomalies. This can then create a vicious cycle of the horse being able to handle even less force. That might partially explain why veterinarians tend to see fewer soft tissue injures around the lower leg joints in well-trimmed barefoot sport horses *(Lesté-Lasserre, The Barefoot Equine Athlete: Big Shoes To Fill?, 2022).*

Given all these forces and the natural hoof dynamics of dealing with them, why even put shoes on horses at all?

Essentially, it comes down to a question of pros and cons for each individual horse. An important con to consider is how much the horse's foot is wearing down, primarily through use. When the horse has walls and soles so worn that he can't walk anymore without being footsore, he needs shoes. (Even so, diet and management may help him grow more resistant feet, as explained in later chapters of this book.)

A good compromise can be flexible shoes, which expand with the foot and are attached with acrylic adhesives, or flexible boots which can be attached only when necessary — such as when working on harder or more abrasive footing *(Thomas, Horse Hoofwear Innovations, 2021).* Many high-level equine athletes — including the Swedish show jumpers — wear Scoot Boots, for example, when training outside their soft arenas in order to protect the walls from excessive wear *(Fredericson, 2021).*

Of course, shoes can also be critical as a therapeutic tool to help redistribute forces differently in certain pathological cases, such as angular deformities, white line disease, and laminitis. These situations require very specialized shoeing, and owners who refuse the shoes on the grounds of wanting to keep their horses barefoot are exposing the animals to serious risks to their health and welfare. Often, however, therapeutic shoeing can be considered temporary — even if it frequently lasts for a year or more (DeFee Mendik, 2022).

GETTING A HEALTHY BAREFOOT TRIM

A barefoot horse is not a horse left without foot care. Contrary to popular belief, wild and, especially, feral horses — which descended from abandoned or escaped domestic horses — do not generally have healthy feet shaped by evolution and a natural environment. Their feet are often in poor condition, with unhealthy angles, deformations, and even laminitis, all of which can cause lameness and interfere with movement and gait *(Hampson, 2013)*. A general lack of predators in areas where wild horses roam may prevent natural selection for healthy feet.

In domestic horses, of course, natural selection doesn't exist. Plus, the quality of unshod hooves is rarely a breeding goal. But even if it were, bare feet simply do not wear down naturally in a way that optimizes health or performance. The expert trimming skills of a qualified, well-trained farrier practicing techniques based on

scientific evidence are essential for good foot health in all horses, including those kept barefoot.

Barefoot horses — especially barefoot sport horses — need very regular trimming to help keep the shape that offers the healthiest load distribution and movement. A foot that grows without farriery and just wears down from use might develop angles that could be unfavorable for ridden work *(DeFee Mendik, 2022)*.

Barefoot trimming is very different from the trim prior to the placement of a shoe. The bottom of the hoof — the sole — should be left intact so that the horse continues to place pressure on it when stepping. It should be brushed briskly with a wire brush, with no use of the hoof knife except to remove any extra, peeling horn from the frog *(O'Grady, Various aspects of barefoot methodology relevant to farriery in equine veterinary practice, 2016)*.

The wall needs to be left about 3 to 5 millimeters longer than when trimming for shoe placement, to offer as much protection as possible. Any excess hoof wall needs to be nipped off at a 45-degree angle, the lowest point starting at the outer side of the white line, with the aim of beveling the bearing surface of the wall. The heels of the hoof capsule should be rasped horizontally across the frog in order to get these structures on the same plane. If the sole is strong enough, the farrier can encourage better breakover at the toe by beveling the surface between the frog and the hoof wall so that a credit card can be slipped underneath the toe of the standing foot *(O'Grady, Various aspects of barefoot methodology relevant to farriery in equine veterinary practice, 2016)*.

Farriers should refer to the more detailed technical barefoot shaping instructions available on the professional website of Stephen O' Grady at www.equinepodiatry.com *(O'Grady, Various Aspects of Barefoot Methodology)*.

Inappropriate barefoot trimming can be detrimental to horse health and welfare. When people lack the skills or follow misguided information about how to trim a barefoot horse, their trims can damage the feet, which can then affect the way the horse moves and ultimately its entire musculoskeletal system, leading to pain, lameness, asymmetry, and poor performance. Bad trims can lead to legal consequences under welfare protection acts, which can include fines, imprisonment, and bans from working with hooved animals *(Lesté-Lasserre, The Barefoot Equine Athlete: Big Shoes To Fill?, 2022)*.

With good shaping through skilled trimming, feet should take on the ideal form for ridden barefoot horses: a wider frog, a thicker digital cushion as confirmed via radiographs, higher heel angles that more closely paralleled with the dorsal wall, more sole concavity, and easier breakover *(Lesté-Lasserre, Horses Sans Shoes: The Facts on Bare Feet, 2019)*.

THE HEALTHY BAREFOOT DIET

Bare feet need to be solid yet malleable, resistant yet elastic. The building blocks for that kind of constantly growing structure come from the food the horse ingests.

Hoof tissue — known as horn — grows through a complex process in which epithelial cells develop into different sorts of specialized cells within the hoof. And the success of that process relies on certain nutrients like amino acids, vitamins, and minerals. There are abundant amino acids in hooves, and some of the most important ones are cystine and methionine, which maintain the health of the differentiating cells. The sulfur atoms in these amino acids create strong bonds that make the cell walls rigid and resistant *(Vervuet, 2021)*.

The first thing owners should do to ensure their horses' diets contribute to healthy hoof growth is to inspect their forage *(Lesté-Lasserre, At a Glance: Equine Hoof Supplements, 2018)*. Horses can get the vast majority of their hoof-building nutrients in their forage, either in grass pasture or stored hay and haylage. The right quantity of forage to aim for (in horses that need to maintain their current weight) is 1.5% of body weight in dry matter (which varies considerably from one forage to the next but can be determined by laboratory analysis) every day. So in a 600 kg horse eating hay with a water content of 10%, that means 10 kg of hay.

In addition to providing these important nutrients, forage also promotes good health by promoting good intestinal health which, in turn, promotes good general health. Horses in poor physical condition usually have feet that lack strength and luster. And you can usually find the history of horses' diets — including different kinds of pastures and stored forages — by reading the rings in their feet. Rings usually grow down parallel to the coronary band and can reflect food changes over the past year — the time it takes to grow a full hoof.

The best hay and haylage for healthy feet are those that have been analyzed for their nutritional content, properly stored in a dry space, and steamed in a Haygain Hay Steamer.

Proper storage helps prevent the development of dust, mold, bacteria, and other pathogenic microbes as well as the leaching of nutrients through uncontrolled humidity. Regardless of storage methods, though, stored forage always includes some of these microscopic pathogens. While soaking can keep those pathogens from becoming airborne and thus less visible to humans, that doesn't make the hay healthier. In fact, soaking can increase the concentrations of pathogenic bacteria exponentially within 10 minutes *(Moore-Colyer, 2012)*.

HAYGAIN HAY STEAMERS, HOWEVER, KILL PATHOGENIC MICROBES WHILE MAINTAINING THE HEALTHY-GUT-PROMOTING MICROBES KNOWN AS THE HAYBIOME *(Daniels, The haybiome: Characterising the viable bacterial community profile of four different hays for horses following different pre-feeding regimens, 2020)*.

That's not only important for the horse's general intestinal health, though. It's also critical for good hoof building because it supports the production of one of the key elements for hoof growth: biotin.

Also known as Vitamin B7, biotin is a vitamin that's essential for healthy hoof growth due to its involvement with multiple enzymes related to metabolism, as well as in cell reproduction and tissue growth — including hoof horn growth. Horses can get biotin in the food they eat, but the vast majority of what they absorb into their bodies is actually manufactured in the hindgut by their own gut microbiota.

In fact, adding biotin into horses' feed may not even be very helpful for hoof growth because they might be more dependent on the biotin that's produced internally. Studies show mixed results of biotin supplementation on hoof quality *(Burns, 2021)*. As such, the best way to ensure that horses are getting the biotin they need for healthy feet could be ensuring that their gut microbiota remains healthy.

Haygain hay steamers play an important role in ensuring the integrity of horses' gut microbiota by killing off the bad bacteria while safeguarding the good bacteria that horses need for healthy gut function *(Daniels, The haybiome: Characterising the viable bacterial community profile of four different hays for horses following different pre-feeding regimens, 2020)*.

If the barefoot sport horses are prone to laminitis, owners should oversee the nonstructural carbohydrate content in their diet to ensure good hoof health and prevent any time off work and/or therapeutic shoeing. In general, owners should be aware of their horses' insulin responses to these carbohydrates and provide low-carbohydrate foods — like hay that has been soaked to leach out sugars and then steamed — to those at risk *(Moore-Colyer M.J., 2014)*.

As a complement to Haygain-steamed hay, horses should receive a daily ration of either concentrated feeds or a balancer that includes horse-specific vitamins, minerals, and proteins. These are scientifically proven to contribute to general health and fitness *(Vervuet, 2021)*. As such, they're vital for growing healthy feet.

Vitamins & Minerals Crucial to Healthy Hooves:

Zn	Cu	Mn	Se	Ca
zinc	copper	manganese	selenium	calcium

In particular, zinc contributes to good hair and hoof growth. Horses should have at least 40 mg of zinc for every kg of dry matter in their daily diet. Horses with zinc deficiencies tend to have poor hoof quality and may need supplementation if their blood analyses confirm the deficiency. Owners should take care to not overfeed zinc, however, as it can interfere with the proper absorption of copper *(Burns, 2021)*.

Copper works as an antioxidant and plays a role in the metabolism of collagen and the synthesis of melanin. In particular, it activates the enzyme that binds the sulfur atoms that provide strength to the growing cells *(Vervuet, 2021)*. A lack of copper is associated with developmental orthopedic disease (DOD) and possibly other skeletal disorders, and it might also be involved in hoof health *(Burns, 2021)*.

Little research has been carried out on the roles of zinc and copper supplementation on hoof health, but owners could try supplementing horses with laboratory-confirmed deficiencies *(Burns, 2021)*.

Manganese activates enzymes that contribute to energy in growing cells, including in the hoof horn. There are no studies on manganese supplementation, but horses on an ample, good quality forage diet usually get sufficient manganese for hoof health *(Vervuet, 2021)*.

Owners also need to keep an eye on selenium content. Selenium is a vitamin that promotes membrane integrity, growth, reproductive functions, and immune response. But too much selenium can be toxic, and it can break down the sulfur atom bonds that keep growing cells strong *(Vervuet, 2021).* Selenium concentrations of only 5 mg per kg of dry matter in the diet can cause hoof wall cracks and even, in worse cases, sloughing of the hoof capsules *(Burns, 2021).* As such, it's important to strive for a healthy balance of this vitamin.

There's been very little investigation into any benefits of amino acid supplementation, and in fact many commercial hoof supplements do not include some of the more critical amino acids in hoof growth anyway *(Vervuet, 2021)*.

Calcium helps build hooves by activating important enzymes involved in hoof growth. Supplementing horses with alfalfa hay might provide the calcium and the amino acids that support good hoof growth *(Vervuet, 2021)*. Steamed in a Haygain steamer, alfalfa can be provided to horses free of dust, mold, and other microscopic pathogens.

And of course, all horses should have constant access to abundant, clean water. Horses can drink about 40 liters of water per day — and more in hot weather and/or with exercise. Such hydration contributes to good general health as well as foot health in particular, as it provides for cellular function and growth as well as adequate hoof tissue hydration. Water also supports the delivery of nutrients to the foot and to epidermal cells that are responsible for hoof growth by helping maintain proper blood flow through the foot. In addition, good hydration is necessary for supporting all the physical properties related to foot strength, elasticity, and function *(Hood, 2016)*.

Even so, diet isn't everything when it comes to growing strong hooves. Age, breed, genetics, metabolic rate, exercise levels, outdoor temperatures, humidity, illness, and farriery also contribute to horn quality, hoof growth, and hoof strength *(Vervuet, 2021)*. As such, owners should recognize when their horses' hooves lack the quality needed to stay barefoot despite the best of diets.

GOOD FOOTING FOR GOOD BARE FEET

As a general rule, horses do best without shoes when they're worked on ground that is neither too wet, nor too hard, nor too slippery.

Hard surfaces could wear down horn faster than it grows back. Wet surfaces could allow moisture to seep into to hoof and create cracks, abscesses, and/or white line disease *(DeFee Mendik, 2022)*. And slippery surfaces, like a dew-dotted grass jumping terrain, could cause any horse to fall — barefoot or not. They can also make horses take shorter strides or make awkward movements (*Thomas, The Trouble with Mud, 2019)*. Working on such surfaces usually requires additional protection like studs screwed into shoes *(Lesté-Lasserre, The Barefoot Equine Athlete: Big Shoes To Fill?, 2022)*.

Frozen surfaces can be too hard for bare feet, and ice can be too slippery. Additional protection, such as special hoof boots, would be useful in these circumstances *(Donaldson, 2019)*.

As such, well-maintained sand and fiber arenas, such as those used in high-level competitions in particular, could offer ideal barefoot ground for sport horses. Their different biomechanical properties — hardness, friction, cushioning, and rebound — can (and should) even be fine-tuned to the specific needs of each discipline *(Clayton, 2014)*.

However, that doesn't mean barefoot horses can't work on harder ground. It just means that they need to work up to it with exposure to different kinds of grounds that can gradually toughen up their hooves. In fact, it's preferable for horses to work on different kinds of grounds in order to condition them, little by little, to various footing. Even at competitions, footing can vary from one arena to another, and on the show grounds between events as well. When they've had appropriate conditioning, many horses can go barefoot on even extreme kinds of footing, including rocky terrains *(Clayton, 2014)*.

If necessary, horses can also have added protection, such as hoof boots, when working on harder ground. This can be useful when transitioning horses to barefoot or increasing their exposure to harder or more difficult terrains. Hoof boots can absorb pressures over hard grounds and rocky or uneven grounds, relieving the foot from those pressures *(Lynn, 2019)*.

OPTIMAL BAREFOOT BEDDING

On average, horses spend more than 90% of their time standing up, even when they're resting. That means that managers need to carefully consider the ground their horses are resting on, whether in the stall or outdoors.

Concrete and asphalt offer no give, so their properties can be hard on joints, bones, muscles, skin (when the horses lie down and get up), and of course their feet — regardless of whether they're barefoot or not. Barefoot horses in particular may find such hard surfaces painful to stand on during their resting hours *(DeFee Mendik, 2022)*.

That doesn't mean horses should be standing on moist surfaces, though. While these are usually softer, the moisture can seep into the hoof and make it too soft and unable to react appropriately to impact forces. Excessive moisture also makes hooves more prone to disease and more likely to bruise *(Thomas, The Trouble with Mud, 2019)*.

Standing in feces and especially urine can be particularly detrimental to bare feet, as it weakens hooves. That can be worse when mixed with bedding made of pine shavings. The acidity of the pine mixed with the acidity of the urine can be detrimental to the hoof horn *(Thomas, The Trouble with Mud, 2019)*.

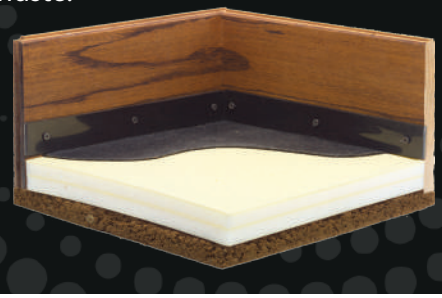
Perhaps not surprisingly, then, the appearance of the first iron horseshoes actually coincides with the first horse stalls, in the Middle Ages. Keeping horses in stalls was not only more convenient for the people working with them, but it also prevented horse theft *(Lesté-Lasserre, Horses Sans Shoes: The Facts on Bare Feet, 2019)*. Unfortunately, it also led to weakened feet, as the horses spent multiple hours standing on hard, wet, urine-soaked ground.

That doesn't mean barefoot horses can't be stalled, however. It just means smart, science-based management. Stall flooring for horses should be both deformable — meaning it takes the shape of the foot that sinks into it — and dry. Sand, dirt, and pea gravel, for example, shape well to the underside of horses' feet, stimulating the different structures while distributing forces in a healthy way *(Bowker R. , 2011)*.

Unfortunately, though, these surfaces do not make ideal bedding. Not only are they difficult to keep clean, they also do not provide a comfortable resting site. Horses need appropriate bedding that cushions their bodies enough to encourage them to lie down so they can enter REM sleep, which is critical for their health and welfare *(Lesté-Lasserre, What Happens To Sleep-Deprived Horses? They Collapse, 2021)*.

A good stall bedding solution for barefoot sport horses, then, is ComfortStall® Sealed Orthopedic Flooring, by Haygain, combined with soft, absorbent, low-dust bedding. **WATERPROOF AND INSULATED, HAYGAIN COMFORTSTALL® OFFERS A CUSHIONED — AND HENCE DEFORMABLE — SURFACE WITH A TRIPLE LAYER THERAPEUTIC PADDING** which lets horses' feet sink into the material, distributing their weight across their soles and stimulating the sole. In particular, padded flooring stimulates the frog — the foot's vascular cushion — significantly increasing blood flow to the foot compared to standing on concrete *(Bowker R. M., 2017)*.

The ComfortStall® should be covered in appropriate bedding for each situation. While pine shavings are acidic, they're also very efficient at absorbing urine and contribute to reduced bacterial proliferation *(Lesté-Lasserre, Which Horse Bedding Harbors the Least Bacteria?, 2017)*. Pine bedding should be mucked out once or twice a day for good foot and respiratory health. Less acidic, straw can provide constant chewing opportunities for horses that aren't prone to impaction colic, but it's much less absorbent and creates more manure waste.



Even with the best stall flooring, though, barefoot horses should still have the opportunity to get regular turnout time to keep their feet healthy.

Movement stimulates hoof growth and resilience, and the texture of the ground can help determine the quality of the hoof that grows.

The ideal paddock footing would be small pebbles or even screening — essentially stone dust. The worst footing would be mud, wet grass, or manure *(Lesté-Lasserre, Horses Sans Shoes: The Facts on Bare Feet, 2019)*.

Barefoot horses standing regularly in mud tend to develop wider and flatter feet. That might be a natural adaptation that helps prevent sinking into mud, but it would be a poor design for sport horses. Hoof dressings applied twice a week can help block out moisture *(Thomas, The Trouble with Mud, 2019)*.

A better solution for paddocks that tend to be muddy or easily soaked with urine is the use of stabilizing footing materials made of geotextiles, high traffic grids, and crushed stones *(Thomas, The Trouble with Mud, 2019)*. Although few people realize it, this is actually a very ancient technique that dates to well over a thousand years before horses even started wearing shoes at all. During the Roman Empire, owners kept their horses on terrains with oval-shaped pebbles sticking out of the ground so that horses never stood in their own urine *(Lesté-Lasserre, Horses Sans Shoes: The Facts on Bare Feet, 2019)*.

Paddocks with activity trails across varied terrains and surfaces are even better for building strong bare feet. Owners can set up various feeding, resting, watering, and socialization stations that encourage more movement across the paddock paths, and they can add safe obstacles, like poles to cross over and hills to climb, to promote healthier hoof growth *(Erhardsen, How to Strengthen your Barefoot Horse's Hooves the Natural Way, 2021)*.

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