

# Understanding Muscle Atrophy

Causes, treatment, and prevention of a common muscular problem in horses

**M**uscle is the tissue that turns a skeleton into a mobile body. Attached to bones via tendons, muscles contract and relax to maneuver that skeleton. Then there's the smooth muscle that allows all sorts of functions that keep our horses alive and active, from digestion to tissue oxygenation. Muscular activity keeps legs moving, head turning, heart beating, and the lungs breathing. A common skeletal muscle issue is atrophy—the shrinkage or loss of muscle cells called myocytes. Stemming from a wide range of causes and linked to potentially serious diseases, muscle atrophy warrants a deeper look.

## A Real Impact on Your Horse's Health and Performance

With the crucial role musculature plays in every aspect of life, it's easy to imagine the consequences of faulty, diseased muscles. "If muscle mass is insufficient, which can occur with muscle atrophy, a horse's welfare can be significantly impaired," says Alisa Herbst, PhD, postdoctoral associate at Rutgers, The State University of New Jersey, in New Brunswick, who recently developed and evaluated a muscle atrophy scoring system for horses. "For example, that horse might not be able to get up after lying down, or he might be unable to avoid an attacking horse," she says. "Aside from compromised quality

of life, horses with low muscle mass are limited in their ability to perform athletically. Lack of proper muscling increases the risk of injury, especially if high-intensity work or performance is requested.

"The full extent of the impairment on performance depends on the extent of strength lost from muscle loss compared to the amount of strength required for a given type and intensity of work or performance," she adds.

## The Culprits

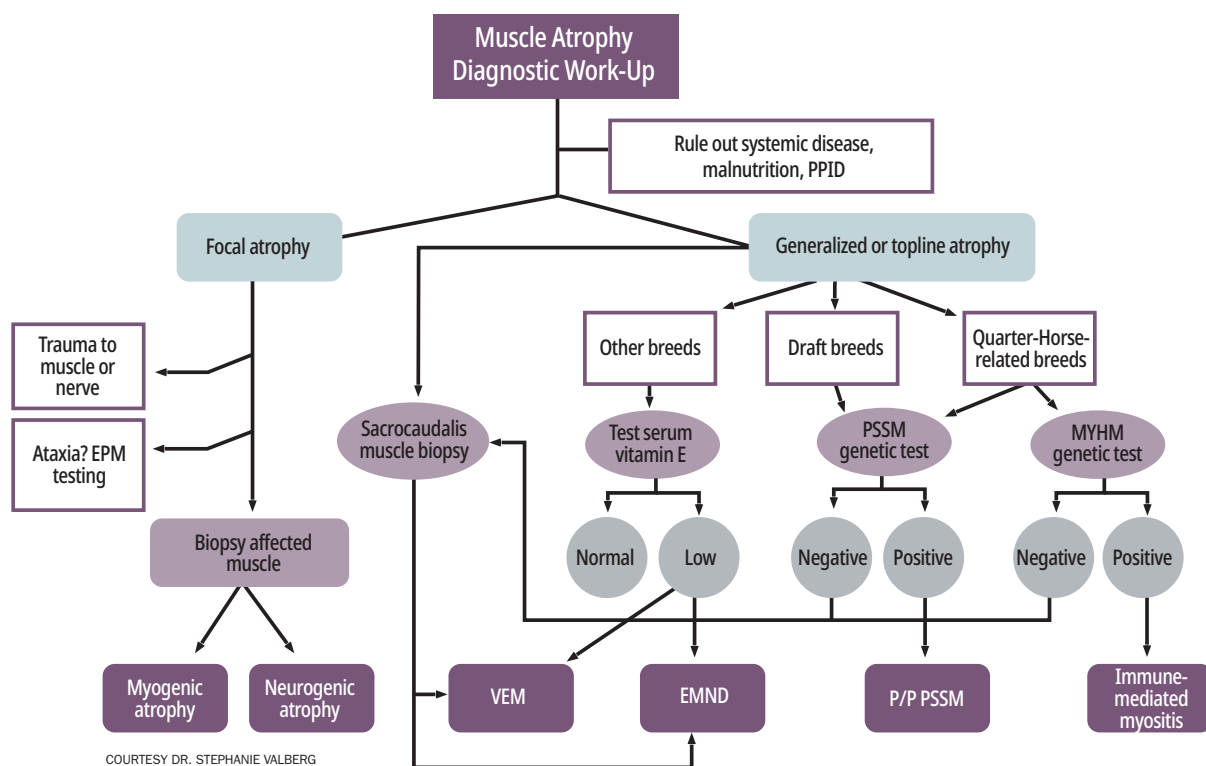
We can divide the root causes of muscle atrophy into five main categories:

**Sarcopenia** is the Greek-originating



AMY K. DRAGOO

Atrophy—the shrinkage or loss of muscle cells—can affect both a horse's performance and his quality of life.



scientific name for “age-related flesh loss.” It refers to a loss of muscle mass, quality, and strength, all of which are common in senior horses. In addition to giving geriatrics a sunken or skinny appearance, with the vertebrae and hip bones protruding, this generalized muscle loss can cause weakness. Some theories suggest sarcopenia is linked to inflamm-aging, a progressive bodywide inflammation affecting older horses and humans (Liang et al., 2022). In people it is also well-established that malnutrition correlates with sarcopenia (Ligthart et al., 2020).

**Underuse of muscles** leads to atrophy. Senior and retired horses are especially at risk of muscle atrophy because of naturally occurring sarcopenia, their tendency to develop pituitary pars intermedia dysfunction (more on that later), and the sedentary aspect of their lifestyle. Prolonged inactivity causes both atrophy and functional deconditioning of skeletal muscle, meaning muscle function is lost when unemployed. Muscle misuse can cause atrophy, as well.

“If a saddle is incorrectly fitted to a horse,

that saddle will create painful pressure points on muscles,” explains Stephanie Valberg, DVM, PhD, Dipl. ACVIM, ACVSMR, emeritus Mary Anne McPhail Dressage Chair in Equine Sports Medicine and professor and director of the Neuromuscular Diagnostic Laboratory at Michigan State University’s McPhail Equine Performance Center, in East Lansing. “The pain and soreness will prompt the horse to avoid using affected muscles, manifesting as trouble lifting the back and engaging the hindquarters. The horse won’t develop proper musculature because using the muscles hurts.”

**Neurologic diseases**, including problems with the nerves innervating the muscle (neurogenic cause), can also lead to atrophy in horses. This could be focal (limited to a specific area) loss of muscle mass from traumatic nerve damage or originate from central neurologic systemic diseases such as equine protozoal myeloencephalitis (EPM) and equine motor neuron disease (EMND).

**Myopathy** is an umbrella term that encompasses all muscular diseases. Common

myopathies in horses are classified as three types:

1. Those that cause muscle degeneration with exercise, such as exertional rhabdomyolysis, or tying-up.
2. Those that cause damage not associated with exercise (nonexertional rhabdomyolysis).
3. Those that cause muscle atrophy. “Common muscle diseases that cause atrophy include vitamin E responsive myopathy (VEM), as well as myosin heavy chain myopathy (MYHM) and polysaccharide storage myopathy (PSSM), both inherited diseases of Quarter-Horse-related breeds,” says Valberg.

**Systemic disease** that causes generalized weight and muscle loss—but is not primarily muscular or neurologic in nature—can also lead to this issue. Most commonly, this refers to pituitary pars intermedia dysfunction (PPID, formerly known as equine Cushing’s disease). “We’ve established that muscle atrophy is an important clinical sign of PPID and seems to affect

roughly 50% of cases,” says Herbst. “The visible loss of muscle mass in PPID-affected horses is considered to result from the loss of certain muscle fibers.”

Study results further suggest muscle atrophy in PPID cases is linked to proteolysis—the breakdown of muscle proteins by enzymes. Pergolide, the treatment for PPID, has not been shown to improve muscle atrophy (Banse et al., 2021). Aside from PPID, other systemic causes of muscle atrophy include cancer, chronic infections, degenerative disorders such as degenerative suspensory ligament disease (DSL), and malabsorptive disorders, the most common one being leaky gut syndrome.

### Finding the Cause

With so many possible origins of muscle atrophy—some as benign as insufficient exercise and others as grave as cancer—getting to the root cause can quickly turn into a detective mission. Rather than a standalone disease, loss of muscle mass is considered a symptom of many conditions.

“Atrophy can have a range of clinical presentations and underlying causes,” says Valberg. “This complexity can make diagnosing and treating its underlying cause challenging.”

To guide veterinarians through the diagnostic process, Valberg has published a diagnostic tree for equine muscle atrophy (see previous page).

As with nearly all health concerns affecting our horses, the recommended first step in diagnosing muscle atrophy is your veterinarian gathering a detailed history and performing a thorough physical exam. In this preliminary stage, the main goal is to simply determine if the origin of the muscle atrophy is muscular, neurogenic, or systemic. Veterinarians have a range of diagnostic tools available to help (see sidebar).

### Evaluating Atrophy the Scientific Way Using MASS

Until recently, quantifying muscle loss required expensive, hard-to-obtain equipment, such as the three-dimensional photonic scans Valberg and her team use

## Diagnostic Options for Muscle Atrophy

Practitioners have a wide range of tools at their disposal for diagnosing atrophy in horses:

- Ultrasonography offers an in-depth look at the extent and depth of muscle atrophy.
- Radiography of the cervical spine in horses with neck atrophy can help the veterinarian identify areas of osteoarthritis that might impinge upon the cervical motor nerves.
- Electromyography allows the practitioner to monitor electrical activity in muscles and, therefore, identify neurogenic atrophy.
- Blood levels of certain enzymes (CK and AST) can be diagnostic indicators for rhabdomyolysis.
- Vitamin E serology can help rule out myopathy associated with vitamin E deficiency.
- GYS1 genetic testing for type 1 PSSM is available for horses with severe chronic topline atrophy or draft breeds with generalized atrophy.
- An ACTH or a TRH stimulation test can help diagnose PPID.
- Muscle biopsy provides information about the type, cause, and severity of atrophy at a cellular level and, therefore, prognosis for muscle regeneration.

in research settings. That changed in 2022 when Herbst and her team published the Muscle Atrophy Scoring System (MASS). This provides an objective, repeatable, and standardized option for practitioners—and horse owners, with some training—to identify, monitor, and compare muscle atrophy in a particular horse by evaluating muscle in places such as the neck, back, and hind end.

Like the Henneke body condition scoring system, MASS scores are based on descriptions of how body regions feel and look, Herbst explains. Using a four-point scale, the MASS scores indicate muscle mass instead of fat. While developing the system Herbst and her team also found that higher MASS atrophy scores correlated with increasing age and with PPID status. These findings support further evaluation of the potential benefits of MASS to identify and monitor muscle atrophy in horses, she says.

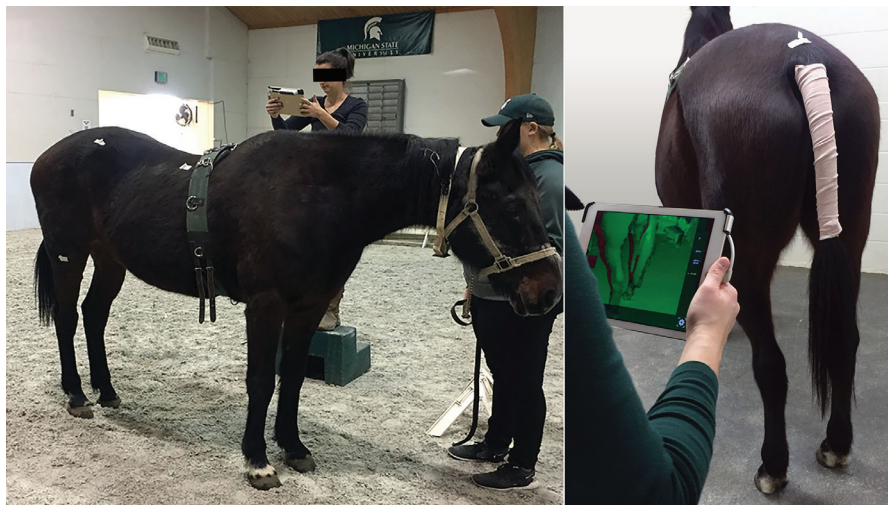
### Building Back: Recovering From Muscle Atrophy

The best treatment plan depends on the underlying cause of your horse’s muscle atrophy. In ridden horses a saddle fit check (see page 12) is a good first-line solution in

cases of topline muscle atrophy. “Beyond that initial measure, in some cases treatment will take the form of an oral treatment with medications such as vitamin E—crucial for muscle health and function—or it may involve a corticosteroid for immune-mediated diseases,” says Valberg. “To help muscle recover its full form, additional therapies such as physical rehabilitation therapy, therapeutic ultrasound, and electrical muscle stimulation may be indicated. Your veterinarian will guide treatment based on the underlying cause of atrophy.”

Often, following the treatment plan for a given condition also helps resolve the associated muscle atrophy. “Take a horse with osteoarthritis, for example,” says Herbst. “That horse moves less because of pain and, therefore, develops disuse-related muscle atrophy. Once the pain is resolved, or at least managed, the horse will be willing to put weight on the affected leg again and might be able to tolerate normal exercise. Similarly, if a horse does not eat sufficiently due to a bad infection (e.g., pneumonia) and, therefore, loses muscle, treating the infection will help with food intake and halt, or even reverse, muscle atrophy.”





VALBERG ET AL., 2020; PLOS ONE

Until recently, quantifying muscle loss required expensive, hard-to-obtain equipment, such as these three-dimensional photonic scans Valberg's team uses in research settings.

**Prevention for Healthy Horses**

Maintaining healthy muscles in your horse starts with the basics: proper nutrition and exercise. Because vitamin E deficiency is a direct cause of muscle malfunction

and atrophy, ensuring appropriate blood levels of the vitamin is crucial. Vitamin E is found naturally in fresh grass. For horses with limited or no access to pasture, ask your veterinarian about blood testing

and supplementation. Secondly, barring any physical limitations, your horse will benefit from a regular physical conditioning program to build and maintain healthy musculature. This includes not only your typical ring work but also hill work, longeing with equipment appropriate for your horse's individual fitness level, and muscle-building programs such as dry and water treadmills.

For owners of healthy horses looking to build strength and stability in the topline musculature, veterinarians often recommend physiotherapeutic stretches. "Dynamic mobilization exercises—aka carrot stretches—were found to increase the size of stabilizing muscle in the horse's back," reports Herbst, citing a 2015 study by De Oliveria et al.

"From a diet standpoint, amino acid supplements may support muscle growth and might also help prevent or slow down muscle atrophy, especially when used in conjunction with an exercise prescription," she says. This being said, supplementation isn't as straightforward as "more is always better," says Valberg.

"If the diet is already well-balanced for muscle health, diet changes are unlikely to affect atrophied muscles," she says. "However, if the diet lacks vitamin E and amino acids (the building blocks of protein), then balancing diet accordingly can positively affect muscle health and tone."

**Take-Home Message**

You can strive to keep your horses' muscles at a healthy mass and tone with two of the most commonsense management practices: a balanced diet and a regular exercise regimen. If you're managing your equine partner through an atrophic episode, there's hope. "Luckily, muscle possesses a remarkable ability to regenerate, and many horses do return to a normal muscle mass and full function, depending on its cause," says Valberg. To maximize your horse's chances of overcoming muscle loss, communicate with your veterinarian at the earliest sign of muscle pain, loss, or dysfunction, and encourage him or her to use the new Muscle Atrophy Scoring System to track progress. 🐾

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