

# Feeding To Prevent and Control Disease

BY NANCY S. LOVING, DVM

**H**orse owners often search for a magic feedstuff that will enable horses to go farther, run faster, be healthier, and move sounder. Often, a variety of oral supplements are added to the diet, with unknown results. Some feed additives can cause more harm than good, or at the very least, put a large hole in your wallet. In many cases, performance improvements are best accomplished with conditioning, training, and stable management rather than through some oral potion given in the feed. Yet, that being said, dietary management can work like magic for specific equine diseases.

Muscular, joint, intestinal, and metabolic problems can be created by a horse's intake of inappropriate or imbalanced nutrition. These same problems can be solved with proper dietary management. With careful consideration of how best to feed, there might be a simple solution at hand that relies only on inexpensive modifications to your horse's nutritional routine.

## Equine Metabolic Syndrome

One disease that has come into the spotlight in recent years is equine metabolic syndrome (EMS). In most cases, a horse with EMS is obese due to breed predisposition, body type, and management considerations such as overfeeding and restricted exercise. Because fat stores in abdominal locations do not just store fat, but also exert hormonal effects, these horses are often insulin resistant and prone to laminitis.

The most logical and effective means to prevent and/or manage obese horses is with exercise; dietary controls are second. Philip Johnson, BVSc, MS, Dipl. ACVIM, MRCVS, and colleagues Nat Messer, DVM, Dipl. ABVP, and V. K. Ganjam, BVSc, PhD, at the University of Missouri, have been instrumental in defining the physiology of equine metabolic syndrome.

"Overfeeding is a common malnutritional practice in Western society," says Johnson. "Horses evolved to eat native grass and stay healthy. Nowadays, we feed horses like food animals—using improved

grassland species and grain. Horses are confined and often precluded from exercise by constraints imposed by the needs of human management systems. In evolutionary terms, wild horses were supposed to acquire some 'obesity' in readiness for winter that would be lost by the end of winter. Nowadays, our horses are fed too much energy using highly glycemic (high sugar and starch content) rations, and obesity not only develops, it persists."

Additionally, in the context of today's culture, an obese appearance has become the accepted "norm" in horses, although it is actually an unhealthy state.

*Muscular, joint, intestinal, and metabolic problems can be created by a horse's intake of inappropriate or imbalanced nutrition.*

"To improve metabolic health, a philosophical shift is necessary such that a fit and trim horse is a body condition that is acceptable and desirable," says Johnson.

His treatment for obesity is based on common sense and dietary management. First, an owner must recognize that a horse is overweight. Johnson suggests, "The ideal body weight and body condition score of the horse should be ascertained with actual measurements (see Body Condition

Score on page 41). All unnecessary grain and supplements, including complete or senior feeds containing high starch or sugar, should be removed from the ration, in consultation with the veterinarian. The forage intake should be decreased accordingly at a rate of 10% per week, yet forage intake should not be less than 1.25% of body weight per day.

"If the roughage proportion of the ration is reduced too much, the horse tends to become 'stir crazy' and will try to eat the wood in the stall walls and develop stable vices, in addition to being more prone to colic and gastric ulcers," he adds.

Additionally, Johnson says, "Affected horses should not be 'starved' to reduce weight/obesity because starvation will lead to further insulin resistance. It is reasonable to eliminate grain and anything else that might contribute to sugar and starch in the ration, such as molasses or sweet feed. Some grass hays and pastures are high in sugar and starch (non-structural carbohydrates or NSC)

and should be avoided. For reasons that are incompletely understood, alfalfa should be avoided—it appears to be a risk factor for laminitis in and of itself."

In general, Johnson suggests feeding low NSC grass hay, such as timothy, but he urges owners to run a lab analysis to certify the hay is safe. He says beet pulp is a good supplement, provided it does not contain molasses. When feeding more than a pound of beet pulp (dry weight) per

*Various diseases can be caused and/or cured by using specific feeding regimens*

Almost all horse owners have fed their horses some type of supplement to promote health or performance, but not all supplements are beneficial.

Sponsored by Platinum Performance

Sponsored by Platinum Performance

ERIN RYDER

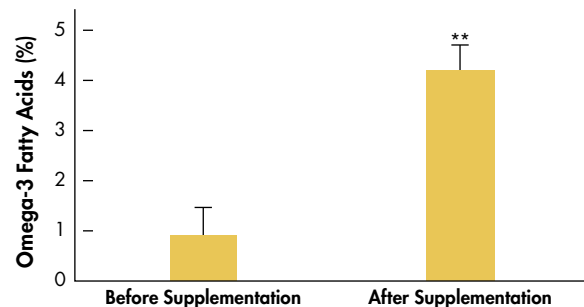
# Diet, Health and Defense Against Inflammation

Tara Hembrooke, Sina Wallace, University of California, Davis

At the cellular level, metabolites of omega-3 fatty acids are anti-inflammatory; whereas, metabolites of omega-6 fatty acids are pro-inflammatory. Horses in the wild consume up to five times as many omega-3 fatty acids as omega-6 fatty acids. In contrast, many of today's equine grains and complete feeds contain far fewer omega-3 and more omega-6 fatty acids (Table 1). This dietary imbalance may predispose the horse to excessive inflammation, which has been implicated in diseases such as joint disease, laminitis, colic, and colitis. One source of supplemental omega-3 fatty acids is fish oil; however, there is concern about heavy metal contamination in fish. Therefore, plants, such as flax and algae, are more desirable sources of omega-3 fatty acids for horses. A supplement utilizing these sources of omega-3 fatty acids is Platinum Performance™.

In a recent study conducted at the University of California at Davis, percentages of omega-3 and omega-6 fatty acids in red blood cell membranes from five horses were compared before and after six weeks of supplementation with Platinum Performance™. Ingestion of Platinum Performance™ increased the amount of omega-3 essential fatty acids in the cell membranes by 78% (Figure 1), causing a 40% decrease in the ratio of omega-6 to omega-3 fatty acids.

Figure 1. Omega-3 content in cell membranes before and after supplementation with Platinum Performance™



\*\*Significantly (p < 0.05) greater than Before Supplementation value

## The Omega-3 Fatty Acid Link

Incorporation of omega-3 fatty acids into cell membranes may help modulate inflammation and reduce the risk of inflammation-related diseases.

For example, O'Neill demonstrated that supplementing horses with flaxseed for six weeks altered omega-3 profiles in hair and reduced allergic skin test responses, as well as inflammation.

Linking the inflammatory response to lipid metabolism requires an understanding of the process by which lipids regulate cellular activity. This is generally accomplished by assessing the genes that control the generation of pro-inflammatory cytokine mediators and enzymes that produce inflammatory products.

## Nutrigenomics

Platinum Performance™ Inc. is actively involved in nutrigenomics - the study of how diet affects gene expression, an area that also is being investigated in humans with chronic diseases. One important area of nutrigenomics is the effect of different feeds on the level of inflammation in the body and their role in the development or progression of various diseases.

Two important inflammatory markers are tumor necrosis factor-alpha (TNF-α) and interferon-gamma (IFN-γ). Both TNF-α and IFN-γ are required for horses to adequately respond to substances that cause illness or disease, such as bacteria. However, continued or over-expression of TNF-α and IFN-γ can cause the inflammatory responses that characterize various acute and chronic diseases. For example, increases in TNF-α have been documented in horses with acute traumatic joint disease and osteochondritis dissecans, colic, and laminitis. In addition, both TNF-α and IFN-γ are increased in horses with lower airway disease.



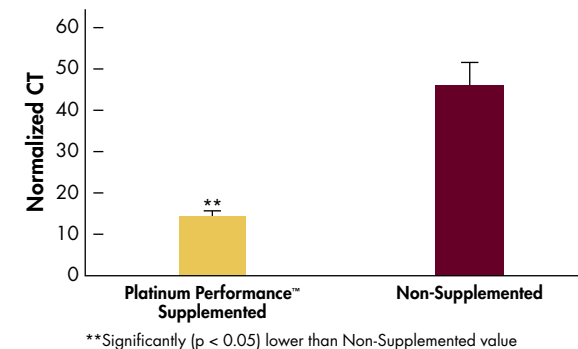
ADVERTISEMENT

## Drug Therapy versus Nutritional Therapy

While most anti-inflammatory drugs block a single point in the enzyme cascade that regulates lipid mediators of inflammation, this process works as a short-term blockage of these mechanisms. In contrast, dietary manipulation of the substrates used by these enzymes alters the rate of mediator production by limiting the reactants entering the pathway. As a result, dietary modulation is a more flexible and longer lasting method for modulating inflammation.

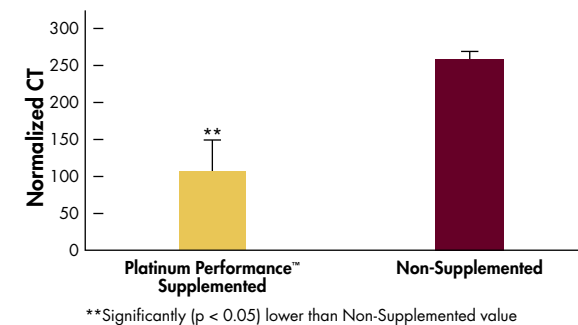
To investigate the potential effects of supplementation with Platinum Performance™ on inflammation, researchers at the University of California at Davis recently conducted an observational study comparing levels of TNF-α and IFN-γ in 63 horses on different diets. Expression of TNF-α and IFN-γ genes in horses consuming oat hay and alfalfa supplemented with Platinum Performance™ were ~60% lower than horses consuming other feeds (Figures 2 and 3).

Figure 2. TNF-Alpha Gene Expression Among Horses Supplemented with Platinum Performance™ vs. Non-Supplemented Horses



\*\*Significantly (p < 0.05) lower than Non-Supplemented value

Figure 3. IFN-Gamma Gene Expression Among Horses Supplemented with Platinum Performance™ vs. Non-Supplemented Horses



\*\*Significantly (p < 0.05) lower than Non-Supplemented value

## Inflammation and Disease

A further regression analysis suggested that individual dietary components significantly impacted expression of TNF-α (Table 2).

Table 1. Fatty Acid Ratios in Platinum Performance™ Compared to Common Feedstuffs

Feedstuff	Omega-3 :Omega-6 ratio
Grass	1 : 0.2
Platinum Performance™	1 : 0.4
Complete Feeds containing Omega-3 Fatty Acids*	1 : 3.7
Corn	1 : 54.5
Oats	1 : 19.4
Barley	1 : 9.6
Soybean Oil	1 : 7.5
Soybean Meal**	1 : 6.9

\*Average of three complete feeds containing omega-3 fatty acids tested by an independent laboratory.  
\*\*Fat extracted.  
Adapted from Hallebeek.<sup>1</sup>

Table 2. Dietary Components Affecting TNF-α Gene Expression

Diet Component	Affect on TNF-α Expression	Level of Significance
Corn Oil	Increased	P = .0004
Rice Bran	Increased	P = .042
Pasture Feeding	Decreased	P = .076

## Bottom Line

Supplementation with Platinum Performance™ increases incorporation of omega-3 fatty acids in red blood cells, and lowers the expression of the pro-inflammatory cytokines TNF-α and IFN-γ. Lower levels of inflammation in the horse could potentially protect them from inflammation-related and other chronic diseases. In order to curtail excessive inflammation, it is important to maintain horses on an anti-inflammatory diet.

## PUTTING IT INTO PRACTICE

- Reduce feeds with an imbalance of omega-3 to omega-6 fatty acids, such as grains, corn oil and some commercial feeds.
- Avoid feeds with high levels of rancidity.
- Increase intake of forage and pasture grazing.
- Supplement with omega-3 essential fatty acids and antioxidants.

For more information, visit [www.platinumperformance.com](http://www.platinumperformance.com) or call (800) 553-2400

O'Neill, W., S. McKee, and A. Clarke, Flaxseed (*Linum usitatissimum*) supplementation associated with reduced skin test lesional area in horses with *Culicoides* hypersensitivity. *Can J Vet Res*, 2002. 66: p. 272-77.



ADVERTISEMENT

day, for each pound of beet pulp fed, 1.5 pounds of hay should be removed from the diet.

According to Kathryn Watts of Rocky Mountain Research and Consulting ([www.safergrass.org](http://www.safergrass.org)), soaking hay in hot water an hour before feeding can also help reduce NSC content.

Your horse might have access to abundant pasture, yet grazing is problematic due to the high sugar content of pasture grass, especially in periods of high growth or when the plants are stressed with frost, drought, or overgrazing. While turnout is one way to achieve light exercise, a fat horse should wear a grazing muzzle to control forage intake.

The obese horse that has developed laminitis can be a challenge.

Johnson explains, "Laminitis is a problem from the perspective of increasing exercise—there is not an easy way around this problem.

Theoretically (albeit not particularly practical), use of a swimming pool could get around this impediment. Certainly, increasing exercise is a logical approach, as is anything to reduce 'stress' since stress is associated with elevated levels of glucocorticoids (any group of corticosteroids involved in metabolism) that promote insulin resistance."

Johnson emphasizes that equine metabolic syndrome and obesity are all about feeding beyond normal requirements, particularly when owners provide nutritionally improved grass species, grain, and "enhanced" grain feeds.

**Developmental Orthopedic Disease**

A common disease complex that occurs in foals and youngsters is known as developmental orthopedic disease or DOD. This complex is inclusive of a variety of musculoskeletal disorders including epiphysitis (inflammation in the growth plates), osteochondrosis dessicans (OCD), flexural tendon contractures, angular limb deformities, and cervical vertebral stenosis (wobbler syndrome). While the problems often originate from multi-factorial causes such as heredity and exercise, diet and nutrition play a key role in their inception and can go a long way in prevention.

Sarah Ralston, VMD, PhD, Dipl. ACVN, who specializes in equine nutrition at



This is an example of a fat horse that has equine metabolic syndrome and has consequently developed laminitis

"Rutgers University, is passionate about educating horse owners to avoid DOD. It is known that overfeeding of carbohydrate energy sources (grains, starches, sugars)—especially in the face of mineral imbalances—is a primary cause of DOD.

"Excess energy, carbohydrate, and mineral imbalances cause abnormal and improper mineralization of bone, which translates into legs that are prone to develop defects," Ralston says. "Protein used to be considered a culprit in this nutritional imbalance scheme, but it is not the protein, which is a good thing, considering that many pastures provide over 20% protein dry matter."

Ralston emphasizes that a diet must be balanced to achieve musculoskeletal health.

"Malnutrition includes both underfeeding and overfeeding nutrients," she says. "Underfeeding will stunt a growing horse and increase risk of disease, yet if minerals are lacking, will still cause DOD. Overfeeding, especially calories and supplements, potentially causes permanent damage to the limbs and has possible metabolic repercussions. There is speculation that the increased incidence of insulin resistance may be, in part, due to overfeeding carbohydrate-rich grains."

One of the big upsets to equine metabolism is the tendency of humans to feed as a matter of convenience rather than focusing

on evolutionary adaptation of the equine digestive tract.

Ralston explains, "Even when forage is scarce, horses do not 'fast;' they'll eat anything they can get their teeth on. One main change in domestic conditions is the abundance of grain and carbohydrates year-round, although even 'dead,' dry grass in winter can have a fair amount of sugar in it. Another change is restriction of exercise along with diurnal feeding and fasting cycles (feed available only twice a day)."

For a young horse, such feeding practices can exacerbate DOD. Many DOD problems for a foal begin in the uterus, with insufficient or imbalanced nutrients provided to the pregnant mare.

"In the last trimester of pregnancy, the mare should be on a 'growth-type' feed formula," advises Ralston. "The foal should be given access to growth-formula feed from Day 1 on, so it is available when he begins to eat solid food. Remember that if the mare is on straight oats (not balanced), and the foal steals from her, he then eats an unbalanced ration. To avoid this, a mare should be fed the same formula you want for the foal, even though it will probably exceed her actual mineral requirements."

She also points out the importance of mineral balance, and cautions that regional differences are significant mainly in the microminerals, such as selenium,

copper, zinc, and magnesium. Therefore, rations must be balanced relative to your geographic area and feed availability.

Ralston emphasizes, "Growth formulas are becoming increasingly sophisticated, with increased protein and minerals that complement the average hays, and many are designed specifically for legume versus grass hays, so this must be taken into account. A horse under 18 months old should receive a concentrate only if it is formulated specifically for growth. I prefer the newer formulas that are pelleted or extruded, with little or no molasses added. Fat is a helpful supplement to provide calories, but rations with more than 10% total fat may interfere with calcium absorption in a growing horse."

DOD is usually an insidious disease, not showing up clinically until after the damage has occurred. Ralston says while no breed is immune, it seems to be more prevalent in horses selected for large body size and early performance, although that might have something to do with their management, since they tend to be "pushed" harder.

However, Ralston adds, not all DOD is irreparable.

"Epiphysitis and flexural and angular limb deformities are evident immediately with dietary imbalances, usually appearing at three to six months when the foals start drinking less milk and eating more of whatever feed is available," she says. "These DOD issues generally resolve quickly once the imbalances are corrected, along with corrective hoof trimming for the latter two syndromes.

"New data shows that constant, unrestricted turnout exercise results in better bone density and reduced DOD," she says.

**Equine Polysaccharide Storage Myopathy**

As research unfolds, previously elusive muscle syndromes are better explained. One such ailment, equine polysaccharide storage myopathy (PSSM), causes a variety of performance issues.

Beth Valentine, DVM, PhD, associate professor at Oregon State University, has devoted her research efforts to this disease.

"I consider 'tying-up' to be the tip of the iceberg as relates to clinical signs of PSSM," she says. "Other, more subtle problems—such as exercise intolerance, mysterious abnormal hind limb gait, back soreness, poor muscling or symmetrical muscle atrophy, stiff gait, shivers, and atti-

tude problems—are probably as common, if not more common, than tying-up."

Although primarily identified in draft and draft-related breeds, Quarter Horses, and Warmbloods. PSSM is also recognized in a variety of other breeds.

The muscles of horses afflicted with this disease is related to an abnormal accumulation of glycogen and glycogen-related polysaccharide (sugars) in skeletal muscle. There seems to be some abnormality with carbohydrate metabolism that might be heritable; to date researchers haven't defined the defect.

The recommended diet for managing PSSM is to reduce sugars and starches (grains, molasses) from the diet, put the emphasis on providing quality forage, and supplement with fat, as much as two cups per day (equivalent to a pound of oil) for a 1,000-pound horse.

"We don't really know exactly what is happening when we change to a high-fat and low-starch and low-sugar diet," says Valentine. "This type of diet was originally designed to bypass what we assumed was an enzyme defect leading to defective carbohydrate metabolism. As yet, we have found that there is no enzyme defect involving carbohydrate metabolism, and yet this high-fat and low-starch and low-sugar diet works wonders on most affected horses. I suspect that we are providing fat calories that are needed for effective muscle energy metabolism in these horses."

Fat comes in many forms, such as vegetable oil, powdered animal fat, and rice bran. Vegetable oil is 100% fat, whereas rice bran products only contain 20% fat and are combined with other nutrients. Although somewhat messy to handle, vegetable oil is the preferred choice to offer as a fat supplement for a PSSM horse.

In addition to the fat, Valentine suggests feeding at least 1 international unit (IU) vitamin E per pound of horse per day.

Valentine counsels that it takes approximately four months for full-fat adaptation in PSSM horses, and in the best case a favorable response can occur within one to two months of dietary change. "Positive signs of managing PSSM horses include increased energy, better attitude, and

improvement in gaits," she says. "Improved muscling is often seen within two to four months of diet change."

Because these horses are fed high amounts of fat, you might wonder how this strategy can be applied to an already-fat horse.

Valentine clarifies, "For managing obese horses that are candidates for developing laminitis, or have already done so, we provide a diet supplement that is close to forage, but with fat added at an amount the horse will accept. Feeding a forage-based product such as timothy/alfalfa pellets or cubes, other hay products, or beet pulp will provide the least unwanted calories, and fat can be added to that. An owner should reduce the pounds of hay fed by the pounds of forage-based feed (pellets or cubes or beet pulp) fed with added oil. Just don't reduce total forage intake to less than 1% of the horse's total body weight per day—10 pounds of fiber fed per 1,000-pound horse.

Other management strategies must be implemented for an overweight PSSM horse.



**A.** Developmental orthopedic disease is a complex, inclusive variety of musculoskeletal disorders including epiphysitis (inflammation in the growth plates). This horse is suffering from fetlock epiphysitis.

**B.** This is an example of flexural tendon contracture 10 days post onset.

"For horses on pasture, a grazing muzzle may be necessary to reduce intake of grass," she says. "I'd rather see a horse out on pasture with a grazing muzzle, moving around, than in a stall. If the horse feels better on the high-fat diet, he may exercise himself more and actually build muscle rather than fat. And, of course, if the horse is older it is important to check for pituitary dysfunction, as these horses could benefit from medical therapy to manage Cushing's disease."



COURTESY DR. BETH VALENTINE

Equine polysaccharide storage myopathy causes a variety of performance issues such as tying-up, exercise intolerance, mysterious abnormal hind limb gait, back soreness, poor muscling or symmetrical muscle atrophy, stiff gait, shivers, and attitude problems.

### White Muscle Disease

Another nutritionally related muscle disease is due to a selenium deficiency. White muscle disease occurs in foals; a related muscle problem can occur in adults.

Valentine says, "The most common sign in foals is difficulty eating due to degeneration of masticatory (chewing) muscles, causing bilateral swelling or atrophy with difficulty in chewing and swallowing. In areas with soils that contain virtually no selenium, selenium deficiency myopathy has been documented in horses of all ages. Too often, this gets interpreted as something else, such as equine protozoal myelitis (EPM).

"Adults with selenium deficiency myopathy may present in recumbency due to severe, diffuse, acute muscle degeneration. Blood tests denote very high muscle enzyme levels associated with selenium deficiency myopathy."

Selenium deficiency is fairly easy to rectify. Valentine suggests feeding 1-2 mg of selenium per 1,000-pound horse each day. However, before supplementing with selenium, a feed analysis and/or blood test should confirm its need.

She says, "Selenium testing I've done on horses receiving only selenium salt blocks indicates that most do not get nearly enough. Horses fed vitamin E/selenium products with 1 mg selenium per day for a 1,000-pound horse have good blood levels of selenium. For pregnant mares, it might be necessary to double the selenium supplementation to ensure adequate passage of selenium across the placenta to the fetus. Milk is very low in selenium, so a foal needs internal stores to draw on."

However, too much selenium supplementation, especially at early stages of pregnancy, can cause birth defects. Other signs of toxicity include loss of mane and tail hair, and eventually the hooves can slough in conjunction with an advanced case of laminitis.

### Hyperkalemic Periodic Paralysis

Hyperkalemic periodic paralysis (HYPP) is a muscle disease related to a genetic defect that alters function of the sodium channel within the membrane of muscle cells. This defect causes the channel to "leak," with accumulation of excess sodium ions within the muscle cells and excess potassium ions in the bloodstream (hyperkalemia). The alteration of the ionic balance in the muscles decreases the threshold required for muscle contraction and allows convulsive muscular contractions.

As an attack begins, an affected horse experiences sustained muscular contractions visible as uncontrollable muscle twitching especially noted over the thorax, shoulders, hips, and flanks. The nostrils flare, the third eyelid prolapses across the eye, and facial muscles wrinkle to create an anxious expression. Partial muscle paralysis or weakness results in swaying, staggering, and buckling at the knees; episodes can progress to collapse and death.

Sharon Spier, DVM, PhD, Dipl. ACVIM, of the University of California, Davis, has pioneered research into HYPP and the effect of dietary potassium on episodes.

Spier emphasizes, "It is best to select hays that have been tested for potassium content, and try to feed diets that are less than 1.5% potassium. Many horses are

maintained well on timothy or bermuda hay and oats, with free access to a salt block. Research has shown that over time, there can be adaptation to slightly higher potassium-containing diets, so these horses can be fed diets higher in potassium, provided the diet is consistent.

"Pasture and paddock turnout are best since exercise stimulates uptake of potassium by muscles. Pasture access also allows a horse to graze to prevent harmful periods of fasting that cause fluctuations in insulin; this helps stabilize potassium concentrations."

Low-potassium feeds are the goal, and these include pasture grasses that have been verified to have low potassium, beet pulp without molasses (0.3%); fats and oils (0%); and oats, corn, or barley (up to 0.5%). Water-soaked beet pulp can be combined half-and-half with grass hay to meet normal roughage needs while minimizing potassium intake. Soaking the hay in warm water for up to an hour before feeding will reduce its potassium content.

Spier adds, "Electrolyte supplements are particularly high in potassium since most contain potassium chloride salt. Also check labels on commercial feed and vitamin supplements to ensure minimum potassium content."

As stress can precipitate an attack of HYPP, stress control related to transport, stabling, illness, and herd relationships is important in minimizing disease. The most sensible feeding recommendations for managing a horse with HYPP are consistent with good standard nutritional practices.

### Equine Gastric Ulcer Syndrome

In recent years, great advances have been made in the understanding of equine gastric ulcer syndrome (EGUS), particularly in its relationship to diet. Frank Andrews, DVM, MS, Dipl. ACVIM, of the University of Tennessee, is one of the pioneers of EGUS research.

"Soluble carbohydrates (found in grain) are fermented by bacteria living in the stomach to produce volatile fatty acids (VFAs), which have a low pH and are lipid soluble," Andrews says. "The lower the pH in the stomach, particularly when less than pH 4.0, the more likely VFAs can penetrate cells lining the stomach and cause damage. VFAs inhibit normal sodium transport functions in the cells, allowing an influx of physiologic water, with resultant cellular swelling and death. Affected mucosa (stomach lining) sloughs away to form ulcers.

## General Feeding Recommendations

As you read through the nutritional recommendations for many of the ailments that plague horses, you might notice common threads used to manage or prevent many problems. One of the primary considerations mentioned by all these experts is the danger of overfeeding, particularly a diet rich in carbohydrates or grain. To best keep your horse "as healthy as a horse," dietary strategies should follow some basic and simple rules:

- Feed at least 1–2% of the diet as fiber (hay and/or pasture), that is 10–20 pounds per day for a 1,000-pound horse.
- Feed small amounts at frequent intervals or free-choice forage rather than relying on twice-a-day feeding with long intervals of fasting.
- Feed primarily grass hay and supplement with small amounts of alfalfa only when necessary.
- Integrate fat supplements and/or high-fat feeds to substitute for calories previously provided in grain.
- Limit grain to as little as possible, not exceeding four pounds per feeding for a 1,000-pound horse, but better yet, use substitute feeds (fat, alfalfa) instead of grains.
- Minimize extraneous feed additives and minerals so you feed only what is necessary to constitute a balanced ration.
- Have feed analysis done at a lab to obtain specific nutrient content if in doubt.
- Consult with an equine nutritional specialist to tailor a diet specifically for each individual horse.
- Exercise the horse or provide regular turnout as often as possible.

With these dietary practices, you really will possess the magic elixir to cure many equine ills and to achieve the best performance your horse has to offer.

—Nancy S. Loving, DVM

The more acidic the stomach contents, and the less mucous barrier available, the more the mucosal lining is at risk for injury."

Overfeeding of highly soluble carbohydrates leads to ulcers and hindgut problems along with overgrowth of damaging bacterial flora in the bowel.

Andrews says studies have shown that, "When a horse must be fed grain, a protective diet relies on restricting the amount of grain fed to less than one pound of sweet feed per 220 pounds body weight. If higher levels of grain are needed, then do not feed this amount any more frequently than every five hours. This keeps the horse's stomach beneath a 'threshold level' of VFAs."

He says adding calcium carbonate in the form of calcium supplements or calcium-containing feed (alfalfa hay) might hasten the recovery of cellular sodium transport systems in gastric mucosa of horses by increasing the pH of gastric contents and stimulating sodium transport in tissues.

"This could reverse acid injury caused by VFAs and hydrochloric acid (HCl) secreted in the process of digestion," he says. "Such mucosal injury is pH and VFA concentration-dependent and may be a reason why diets high in fermentable carbohydrates have been implicated in the development of gastric ulcers in horses."

According to Andrews, even a flake of al-

falfa hay fed every five hours achieves some benefit by buffering acid in the stomach.

There is a bit of concern about the correlation of alfalfa in the diet and the problem of developing enteroliths (mineral stones in the GI tract), particularly in the western United States.

Andrews says, "A mixture of grass hay and alfalfa might decrease the incidence of enteroliths. While alfalfa provides its buffering capacity, grass hay minimizes the amount of calcium and magnesium that contribute to enterolith formation."

It is possible that the feeding of acetic acid (vinegar) as a strategy to thwart enterolith formation in horses could exacerbate the risk for developing EGUS.

### Colonic Ulcers

On the other end of the digestive tract in the hindgut, intestinal ulcers also occur secondary to such things as the administration of non-steroidal anti-inflammatories (NSAIDs), parasites, and Salmonella bacteria. Affected horses typically present with mild or recurrent colic, decreased appetite, lethargy, and/or weight loss. There can be associated diarrhea and fever.

Certain abnormal parameters seen on bloodwork give a high index of suspicion for this problem, including decreased protein levels, increased fibrinogen, and

increased white blood cell count.

Initially, gastric ulcers should be ruled out with an endoscopic exam, and parasite problems or Salmonella should also be considered.

Andrews says feeding strategies differ vastly from those used to prevent or treat gastric ulcers, so it is important to pin down the diagnosis.

He recommends, "Wean the horse off hay over a two-week period, changing over to complete feed pellets that are 20–30% dietary fiber. The horse can be allowed to graze for 15–20 minutes a session for four to six times per day. Small amounts of pasture offered at short intervals is best for providing rest to the intestinal tract affected with colonic ulcers. The pelleted feed diet decreases the bulk in the diet and decreases the actual work of the large intestine."

This low-fiber diet is fed for three to four months until the horse is healed and blood protein levels return to normal.

Andrews also adds psyllium products to improve transit time of the intestinal feed matter. He says psyllium increases the concentration of short-chain fatty acids in the colon, which decrease inflammation, while it also helps coat the digestive tract and hydrates the feed contents to achieve a laxative effect.

In addition, he recommends feeding one cup of vegetable oil twice a day, particularly corn or safflower oil. "These are useful to provide omega-rich fatty acids, which inhibit the production of an enzyme that produces prostaglandins, and thereby indirectly decreases inflammation," he says. (Read more on omegas on page 51.)

### Take-Home Message

There are some general trends in feeding your horse that can help him be healthier, and detailed nutritional management regimens to control specific diseases. If you have questions about your individual horse's nutritional management, discuss them with your veterinarian or an equine nutrition consultant. 🐾

### ABOUT THE AUTHOR

**Nancy S. Loving, DVM**, owns Loving Equine Clinic in Boulder, Colo., and has a special interest in managing sport horses. An endurance rider, Loving is also a veterinary judge for the American Endurance Ride Conference and for FEI (international) endurance events. She authored the books *Go the Distance: The Complete Resource for Endurance Horses, Conformation and Performance* (both available at [www.exclusivelyequine.com](http://www.exclusivelyequine.com) or by calling 800/582-5604), and her new book, *All Horse Systems Go: The Horse Owner's Full-Color Veterinary Care and Conditioning Resource for Modern Performance, Sport and Pleasure Horses*.