Kentucky Equine Research®
World Leaders In Equine Nutrition

Technical Bulletin

Targeted Supplementation for Horses Predisposed to Gastric Ulcers

ReSolvin EQ™ *features a blend of long-chain polyunsaturated fatty acids, a potent anti-inflammatory for horses predisposed to gastric ulcers.*

The athleticism of horses escalates with each passing decade, as horses gallop faster, jump higher, and slide farther. What factors have led to these changes in strength, speed, and agility?

To start, breeders have fine-tuned their concept of athleticism based on the demands of specific disciplines and have produced horses with certain advantageous traits. Further, advances in nutrition have influenced how horses in sport are optimally fed based on the performance goals asked of them. In a similar vein, improvements in the diagnosis and management of musculoskeletal problems by the veterinary community have occurred at an incredible pace, improving the soundness and longevity of many horses. These specialties occasionally intersect, as is the case with the recent identification of myofibrillar myopathy and nutritional strategies that help ameliorate clinical signs.

Beyond musculoskeletal problems, another veterinary concern lurks among working horses, proving problematic for many racehorses, sport horses, and leisure horses: gastric ulcers. When severe enough, gastric ulcers can completely sideline a horse, making prevention or resolution of them paramount.

Modern feeding and management scenarios often place horses at risk for gastric ulcers. As nonruminant herbivores, horses evolved to ingest a high-fiber, low-starch diet through near constant foraging, sometimes up to 18 hours daily. In addition to stomach fill, saliva produced during mastication helps buffer gastric acid. Common management practices that place horses at risk of gastric ulcers include meal feeding, diets high in concentrates and low in forage, intense training schedules, and social stressors.

Terminology: EGUS, ESGD, and EGGD

By the late 1980s, interest in gastric ulcers had amplified among horsemen, and the primary focus involved erosive and ulcerative diseases of the squamous, or upper, region of the stomach with little regard given to lesions in the glandular, or lower, region. By 1999, a group of academic and private clinicians published a consensus report that classified all ulcerative lesions within the esophagus, stomach, or upper duodenum—sites with potential exposure to gastric acid—as "equine gastric ulcer syndrome" (EGUS).

That term soon proved too nonspecific, often being used without differentiation between squamous and glandular lesions. Years later, in 2015, a consensus statement from the European College of Equine Internal Medicine suggested two subclassifications of EGUS based on anatomical region affected: equine squamous gastric disease (ESGD) and equine glandular gastric disease (EGGD) (Sykes et al., 2015).

Prevalence of EGUS

The prevalence of gastric ulceration depends largely on breed, use, and disposition. Racehorses seem to be most affected. In untrained Thoroughbreds, prevalence of ESGD is 37% but escalates to 80–100% within two to three months of race training. Standardbreds show a similar trend in ESGD prevalence, 44% in untrained horses and 87% among horses in training.

ESGD is not as prevalent in show and sport horses, ranging from 17–58%. Horses kept primarily at home and used in familiar environments have the lowest prevalence of ESGD at 11%. Conversely, the prevalence of EGGD is less well documented but seemingly less widespread in racehorses and more common in leisure and sport horses.

Abbreviations for Gastric Disease

EGUS	Equine gastric ulcer syndrome
ESGD	Equine squamous gastric disease
EGGD	Equine glandular gastric disease

Abbreviations for Fatty Acids

Omega-3 fatty acids

ALA	alpha-linolenic acid
DHA	docosahexaenoic acid
EPA	eicosapentaenoic acid
DPA	docosapentaenoic acid

Omega-6 fatty acids

LA	linoleic acid
GLA	gamma-linolenic acid
DGLA	di-homo-gamma-linolenic acid
AA	arachidonic acid

Clinical Signs of EGUS

Numerous clinical signs of EGUS have been identified, though expression of these signs varies from one horse to the next.

- Inappetence: feed intake is generally reduced, and some horses will lose appetite for only certain elements of their ration, such as grain or hay.
- Loss of weight or body condition: weight loss is generally associated with reduced appetite, but may be attributed to chronic, low-level pain.
- Dull or staring hair coat: perhaps due to weight loss and low-grade pain.
- Behavioral changes: often show signs of sourness toward horses and humans, including increased frequency of pinned ears and wringing tail; some horses become more reactive, while others become duller.
- Abdominal discomfort: some horses will lie down more frequently or will stand in a stretched position; ridden horses often express discomfort when adjusting the girth.
- Decline in performance: though this might be an effect of reduced energy consumption and weight loss, distraction due to pain could be the cause.
- Colic frequency: recurrent colic with mild to moderate pain has been identified in horses with gastric ulcers.

Diagnosis and Management of EGUS

The only reliable method for diagnosing gastric ulceration is endoscopy, which must be performed by a veterinarian. Nutritional management strategies can reduce the risk of gastric ulceration. Key considerations include:

- Horses should be fed a forage-based diet. Continuous access to pasture forage may be preferable for at-risk horses, but free-choice hay or haylage can be fed to stabled horses that are not overweight. For overweight horses and ponies at risk of EGUS, hay with low energy content should be fed in small meals throughout the day with a goal of feeding no more than 1.5–1.7 lb per 100 lb of body weight daily. Augment all-forage diets with a ration balancer to ensure protein, vitamin, and mineral requirements are met.
- Feed concentrates only when necessary to satisfy energy requirements. Consider feeds that are low in starch with higher levels of fat (oil, stabilized rice bran) and fermentable fiber (beet pulp, soy hulls). Add chaff or alfalfa pellets to concentrate meals to dilute starch intake. Feed small concentrate meals, three or four times daily.
- If concentrates cannot be tolerated by especially sensitive horses, vegetable oil (canola oil) can provide energy to the diet. Mix oil with alfalfa pellets or chaff. Horses on high-fat diets should be supplemented with a natural-source vitamin E, such as Nano-E®.

A diet of high-quality forage (pasture, hay, or hay alternatives) and limited starch should reduce acidity of the stomach, support healing of stomach lining, and decrease the likelihood of ulcer recurrence.

In addition to dietary changes, other pharmaceutical agents or supplements are available for the treatment or prevention of EGUS. Omeprazole is the only FDA-approved treatment for gastric ulcers in horses. Omeprazole blocks secretion of hydrochloric acid for 24 hours when given to horses at the recommended dosages. Researchers found that omeprazole reduced calcium digestibility in mature horses by nearly 18% but did not affect the digestibility of other nutrients (Pagan et al., 2019). Horses routinely receiving omeprazole should have their calcium intake reviewed and, if marginal, may benefit from calcium supplementation.

Further, antacids such as aluminum phosphate buffer gastric pH, and sucralfate buffers hydrochloric acid by increasing bicarbonate secretion and stimulating prostaglandin secretion.

For information on Kentucky Equine Research digestive health products containing these ingredients, visit *ker.com/digestive-health*.

ReSolvin EQ: A Source of Long-Chain Polyunsaturated Fatty Acids

Dietary supplementation of polyunsaturated fatty acids (PUFAs), particularly eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA), and gamma-linolenic acid (GLA), has been a key focus of research efforts due to their positive effects in the body. Virtually every body cell features membranes composed of PUFAs, and these membranes are extremely responsive to dietary supplementation.

The omega-3 and omega-6 pathways (Figure 1) produce a cascade of biomolecules, including cytokines and prostaglandins, that influence diverse physiological processes. Alpha-linolenic acid (ALA) and linoleic acid (LA) are considered essential PUFAs because they cannot be produced by horses in sufficient amounts to satisfy requirements and must be obtained through direct dietary consumption.

Starting with ALA or LA, fatty acids elongate sequentially through the omega-3 or omega-6 pathway, respectively. The omega-3 and omega-6 pathways compete for the same enzymes throughout the elongation process. Generally, omega-3 fatty acids reduce inflammation and omega-6 fatty acids promote inflammation. Researchers have shown that long-chain omega-3 fatty acids—EPA and DHA—improve several inflammatory conditions.

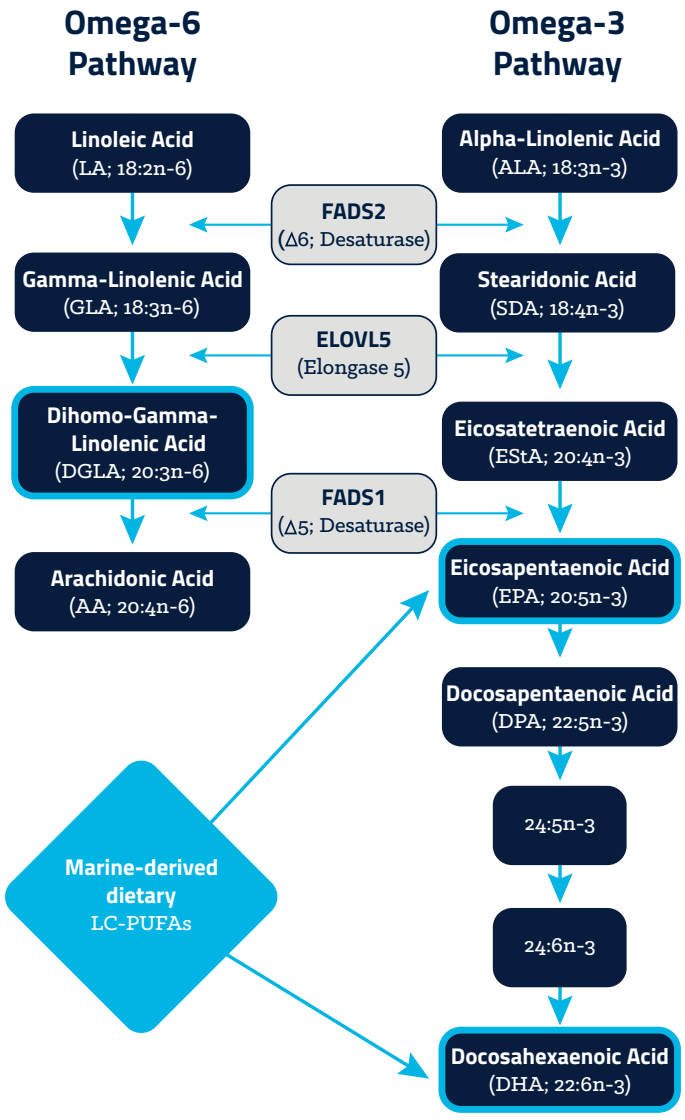

Figure 1. The omega-6 and omega-3 pathways produce biomolecules that influence diverse physiological processes.

Introduction to GLA, an Omega-6 Fatty Acid

Another fatty acid, an omega-6 known as GLA, behaves differently than other omega-6 fatty acids and has received considerable research attention for its anti-inflammatory properties.

Much of the research attributes these anti-inflammatory properties to the conversion of dietary GLA to dihomo-gamma-linolenic acid (DGLA) through the omega-6 pathway. Subsequentially, DGLA converts to several anti-inflammatory biomolecules and inhibits production of pro-inflammatory biomolecules from arachidonic acid (AA).

Popular sources of omega-3 or omega-6 fatty acids primarily contain the parent fatty acids ALA and LA. In horses, LA is the predominant dietary fatty acid and is fed in high amounts when horses are offered vegetable oils such as corn or soybean oil. Conventional grain-based concentrates intended for horses also contain substantially more LA (omega-6) than ALA (omega-3). Forage, particularly pasture grass, although very low in fat, has a higher ratio of omega-3 to omega-6 fatty acids, but horses fed high volumes of grain and supplemental fat may be consuming significant amounts of omega-6 fatty acids. These diets are generally considered more inflammatory and may benefit from anti-inflammatory supplementation. Because these basic feedstuffs primarily contain the parent fatty acids ALA and LA, the horse must elongate these through an inefficient multistep process (Figure 1). Directly supplying longer-chain fatty acids such as EPA, DHA, and GLA allows horses to bypass this process.

Nutritionists recommend that EPA and DHA be fed directly, as opposed to feeding ALA, and marine-derived oil, such as EO-3™, is considered the premier source. Similarly, recent research has also shown that GLA may not be adequately produced within the body from LA, and horses might benefit from supplementation. GLA is primarily derived from the oils of botanical sources: borage, blackcurrant, and evening primrose. Transgenic technology has increased the GLA content in other plant sources, such as safflower oil.

While researchers have looked closely at the benefits of feeding the omega-3 fatty acids EPA and DHA to horses, there is little research on supplementing GLA in horses. Previous research has shown changes in plasma and red blood cell fatty acid composition in as little as one month when horses were fed EPA and DHA, and sufficient supplementation is able to reduce a high omega-6 to omega-3 ratio. In other species, GLA supplementation has produced consistent elevation of DGLA.

Recent studies at Kentucky Equine Research indicate that this conversion is also efficient in horses.

Power of Combination: EPA, DHA, and GLA

Human products combine sources of EPA, DHA, and GLA to combat inflammatory conditions such as rheumatoid arthritis. Synergistic benefits arise when supplementing GLA with EPA and DHA. Cosupplementation of GLA, EPA, and DHA prevents accumulation of AA without inhibiting DGLA accretion, likely through competition for a particular desaturase enzyme needed to produce EPA and downstream DHA in the omega-3 pathway. Additionally, different modes of action by EPA and GLA on inflammatory responses have been observed.

A product that supplies all three fatty acids enters the omega pathways at different points, thereby avoiding minimally effective elongation steps and reducing pathway competition. ReSolvin EQ combines these three PUFAs into one product to provide a potent supplement aimed at reducing systemic inflammation through both omega-3 and omega-6 pathways as they act on a variety of bodily processes in different and complex ways.

Backed by Research: ReSolvin EQ

A study performed at Kentucky Equine Research found that GLA can be fed to horses to increase levels of DGLA. With this as a foundation, the researchers designed a crossover study that compared how horses responded to either long-chain PUFA or short-chain PUFA supplementation (Pagan et al., 2022). This study was divided into two 90-day periods. The experimental oils used for the long-chain PUFAs included EPA, DHA, and GLA as a mix of proprietary marine- and plant-derived oils, while the short-chain PUFAs included LA and ALA as a mix of corn and flax oils. Each period featured an exercise component that included galloping on a racetrack three days and walking on a mechanical walker on three alternate days each week.

When fed the short-chain PUFAs, horses had no change in EPA levels, meaning the horses were not able to convert ALA to EPA. On the contrary, when horses were fed the long-chain PUFAs, researchers observed a robust response in EPA levels. The same effect occurred with DHA; when fed the short-chain PUFAs, there was no change, but when fed the long-chain PUFAs, DHA rose significantly. Further, researchers measured GLA and DGLA, and both were increased when horses were fed the long-chain PUFAs.

One important component of this study involved gastroscopy and the identification of gastric ulcers. Researchers performed a gastroscopy on all horses at the beginning of the study, and all squamous ulcers were graded using the familiar 0 to IV scale, where 0 indicates no sign of ulceration and IV signifies severe disease. Eight of the horses had grades between 0 and II, indicating no significant disease, but five horses had grade-III or grade-IV ulcers. Once fed the long-chain PUFAs, however, the ulcers in four of five of these horses resolved completely. As mentioned previously, the researchers designed this as a crossover study, so some of the horses were fed the short-chain PUFAs after the long-chain PUFAs. When switched back, the squamous ulcers returned in the horses that had improvements previously, indicating the long-chain fatty acids showed a protective and healing effect.

This may be partly due to the actions of a particular pair of prostaglandins and their effect on gastric tissues. When produced within the gastric and gastrointestinal tissues, prostaglandins E1 (PGE1) and E2 (PGE2) have been shown to:

- Stimulate bicarbonate secretion to help buffer gastric acid, which can irritate and ulcerate the lining of the stomach;
- Inhibit hydrochloric acid secretion to maintain an approrpiate pH;
- Ensure microvascular blood flow to the stomach; and
- Enhance mucus production to form a protective barrier between the lining of the stomach and the stomach contents.

ReSolvin EQ supplementation increases the concentration of key fatty acid precursors (GLA, DGLA, AA, EPA, DHA) to influence the production of prostaglandins PGE1, PGE2, and other metabolites involved in inflammation, and to prevent and heal gastric ulcers. A prostaglandin E1 analog (misoprostol) is commonly used in the prevention and treatment of EGGD in horses, particularly in those receiving nonsteroidal anti-inflammatory drugs (NSAIDs), a known risk factor for gastric ulcers. While use of ReSolvin EQ in horses with EGGD has not yet been evaluated, supporting natural production of these prostaglandins and mediating the gastric inflammatory response may be beneficial in all horses at risk for EGUS.

In summary, targeted supplementation with ReSolvin EQ, a blend of EPA, DHA, and GLA, provides a potent anti-inflammatory product for horses predisposed to gastric ulcers. Horses given ReSolvin EQ should also be fed Nano-E®, a vitamin E supplement developed by Kentucky Equine Research with superior bioavailability that provides antioxidant protection. ReSolvin EQ can be fed in combination with other KER Digestive Health supplements when additional support is desired.

References

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