

Gastric Ulcers

Causes and Management

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Over the past decade, the diagnosis of acid irritation and associated erosion ulcers on the stomach wall has become common finding in horses in race training. There have been many studies carried out to help provide a better understanding of how gastric ulcers occur and the ways in which the incidence can be reduced in exercising horses.

This review provides some of the current findings relating to the cause and management to avoid gastric ulcers in exercising horses. More studies are continuing.

Dr. Merritt, an equine gastroenterologist from Florida, reviewed the possible causes and then accepted management of gastric ulcers in horses at the American Equine Practitioner's Symposium in late 2003. He grouped the various types of lining erosion or ulcerations under a collective term of "Equine Gastric Ulcer Syndrome", or EGUS, to include ulcers in the oesophagus (gullet), stomach and small intestine. Around 48% of horses in training have small intestinal ulceration as well as gastric ulceration and 'acid burn' to the relatively unprotected upper lining of the stomach.

It has been shown that the non-secretory upper areas of the stomach lining, especially around the entrance from the oesophagus or gullet, do not have a glandular area to produce protective, viscous mucus, and this area relies on the alkaline saliva swallowed as the feed is chewed to buffer the acid produced in a continuous flow by the acid-secreting glandular and well protected, lower gastric lining.

EGUS is graded into 5 grades (0-4) relative to the number, position, type and depth of the ulceration, with Grade 4 being the worst form.

Young foals subjected to the stress of transport, injury or separation from their mothers, without a regular opportunity to drink for up to 4 hours, have up to 100% incidence of developing ulcers in the glandular lining of the stomach. However, ulceration of the non-glandular lining occurs most commonly in horses in intensive training, irrespective of breed or training program. Dr. Hammond, a veterinarian with the Hong Kong Jockey Club in the mid 1990's, reviewed the incidence and types of gastric ulcers in horses on which post mortems were performed after they were retired from training. He reported up to 40-50% of horses had non-glandular ulcers, with around 30% of horses having ulceration of both the glandular and non-glandular areas.

Did You Know that.....

- Up to 90% of horses in training, irrespective of breed or stage of training, have visual evidence of erosion and ulcerated surfaces on the non-glandular stomach lining when an endoscope is passed into the stomach when the horse has had food withdrawn for 12 hours to empty the stomach to enable the lining to be carefully examined for evidence of irritation with inflammation and reddening, erosion or full thickness ulceration. A study by Dr. Scott McClure and colleagues at Iowa State University (2005) found that 15 Thoroughbred horses, previously scoped and found to be free of ulcers, after 7 days in training on a standard sweet feed and alfalfa (lucerne) hay diet, that 11 out of the 15 horses had developed gastric irritation, with 10 showing thickness and reddening of the upper gastric lining. After 21 days in training, all horses showed evidence of gastric ulcers.
- Another study in Kentucky reported 57% of Thoroughbred race mares with gastric ulcers diagnosed at the time of retirement from racing, retained the same severity and position of gastric ulcers after 15 months as broodmares with foals at foot on a pasture based diet.
- The more severe forms are full thickness erosions that can haemorrhage during intense exercise, due to the high blood pressures generated during all-out galloping.
- It has been estimated that a horse with the most severe Grade 4 ulcerations may haemorrhage up to 1.5 litres of blood during a 2000 metre race into the stomach, resulting in the passing of darker, smelly droppings within the following 36-48 hours due to the blood being digested as it passes through the intestinal tract. Recurring gastric haemorrhage can be a possible cause of blood loss anaemia in racing and upper level event horses.
- Studies reveal that some gastric ulcers can decrease in severity, and often disappear, when a horse is turned out for a spell.
- It is possible that non-glandular gastric ulcers in horses are similar to gastro-oesophageal reflux or 'heartburn' in humans, caused by a combination of gastric acid and other digestive secretions produced by high grain feeding.
- A recent review (2007) of the incidence of gastric ulcers in Thoroughbred horses in training by Dr. Guy Lester and co-workers at Murdoch University in Western Australia collected on 402 horses spread over 37 trainers in urban and rural locations, found that 54% of the Thoroughbreds in training had gastric ulcers, with 32% being classed as moderate to severe. It was found that...
 - » City trained horses were 4 times more likely to have moderate to severe ulcers as compared to country trained horses.
 - » 50% of thin horses had ulcers, compared to only 14% of over-weight horses in training.
 - » Horses which were racing below expectations were more likely to have ulcers.
 - » Horses that were crib-biters and wind-suckers were more likely to have ulcers.
 - » Horses in work for extended periods, and those that were trained on a race track or were swum daily, were more likely to have ulcers.
 - » Playing a radio with a noise background in the stable appeared to increase the prevalence of ulcers in horses in training.

Researching EGUS

Dr. Al Merritt and his Gainesville team, investigated the association between exercise (training) and the incidence of gastric ulcers. To determine the likelihood of gastric acid reflux into the higher parts of the stomach, they introduced a 1.6 litre balloon into the forward region of a horse's empty stomach without feed, to measure changes in internal gastric pressure associated with treadmill exercise. Pressure was equalised with a volume of 1200mL of air when the horse was standing at rest and moving at walking speed. Once the horse was exercised from a walk to a trot, and faster, the increasing pressure in the stomach deflated the balloon until it was virtually empty. Once the horse was slowed to a walk, the internal gastric pressure reduced and the balloon was re-inflated as air flowed due the higher outside air pressure. The procedure was repeated after a horse was fed, with similar changes in air pressures, although it is now known that gastric acid 'splash' onto the upper non-protected gastric lining is reduced if a horse is fed just prior to exercise.

A follow-up study to determine why the intestinal gastric pressure was elevated during exercise above walking speed, found that the abdominal cavity pressure increased dramatically during exercise, presumably due to tensing of the abdominal muscles when breathing or contracting during exercise.

It was concluded that forced exercise during training, perhaps due to the restriction of the girth as well, increased abdominal cavity pressure, pushing the highly acidic gastric juice normally present in the lower portion of the gastric contents, up into the higher, non-protected lining of the 'reflux' area, resulting in acid 'burn' and symptoms of heart burn after exercise, causing symptoms of reduced appetite and 'picking' at feed, and eventually gastric erosion and ulceration as the acid 'burns' the non-glandular lining in horses fed on concentrated grain based diets with minimal roughage.

Changes in Gastric Acidity

The acidity of the gastric juice bathing the non-glandular area of stomach was also increased during exercise. Studies indicated that while a horse was standing or walking, the acidity of the stomach remained in the pH 5-6 range (closer to alkaline), but at faster exercise speeds above a trot, the acidity increased with the pH dropping to as low as 1.0 in severe cases. It remained low until the horse was brought back to a halt. The studies indicated that even in a horse denied of food with an empty stomach, that gastric pH cycled at least once per hour between pH 6 to pH 1.0. This indicated that horses secrete some gastric acid even when the stomach is empty. This is possibly caused by reflux of the alkaline duodenal fluid, with the backflow reduced when food is present in the stomach. The stomach also contracts and relaxes in a regular cyclic frequency, whether it is full or empty.

Summary of Causes

- Dr. Merritt's studies, combined with earlier research findings, conclude that:
- Exercise increases gastric pressure and causes highly acidic stomach fluid to reflux into the higher non-glandular and poorly protected lining of the stomach.
- Stabled horses generally had higher gastric pressures as compared to horses trained from the paddock.
- Horses that are exercised on an empty stomach are likely to

have an increased risk of highly acid reflux than horses given a small roughage meal of hay or chaff prior to exercise.

- Stomach acidity increases in a cyclic fashion irrespective of food ingestion.
- Resting horses spend the majority of their day standing or walking around, with grazing providing regular stomach fill and copious quantities of alkaline, mucus buffering saliva mixed with alkaline pasture grass to provide a protective shield to the non-glandular lining and avoid highly acidic gastric acid reflux 'burn' of the sensitive lining.
- It is possible that horses in training that lie down flat on their side on their bedding to rest, instead of standing, have increased gastric pressure due to the surrounding weight of the abdominal contents pressing on the stomach, and the increased risk of reflux and ulceration due to the spread of gastric acid onto the unprotected upper lining as the horse is lying down.
- Ulcerations of the acid, secretory lining, or the glandular lining, of the horse can also be caused by high dose, or long-term administration of non-steroidal anti-inflammatory drugs (NSAID's) such as 'bute', with 'bute' causing a higher incidence than flunixin and ketoprofen. This risk is not associated with direct contact of the NSAID with the gastric mucosa, as it can be a side-effect from oral powder, paste and intravenous forms of NSAID administration due to the anti-prostaglandin action of the NSAID on the protective and immune defense mechanism of the stomach wall.
- There is no benefit obtained by feeding a protective compound which coats the gastric lining in conjunction with NSAID administration in exercising horses for this reason.
- Some herbal preparations, such as Devil's Claw and White Willow Bark, used as natural anti-inflammatory remedies, may also increase the risk of gastric ulcers in horses given these products to ease discomfort and mild arthritic pain.

Other Factors

Some authorities also believe that certain feeds can increase the risk of gastric ulceration. It is well established that grain feeds produce higher amounts of gastric acid than roughages. Grains have a higher density, or have heavier particle sizes, than chaff (chopped hay) or long-stemmed hay which tend to settle or migrate down through the stomach contents and cause the release of more gastric acid without any natural buffering action.

Studies have found that feeding lucerne (alfalfa) hay (or chaff) resulted in fewer gastric ulcers, possibly due to the buffering effects of the alkaline calcium and magnesium salts, the saponins and mucilage proteins in lucerne as compared to grass hay.

The alkalinity, combined with the lower density and buoyancy that enables it to float to form a 'mesh' of alkaline roughage on top of the gastric acid, aided by buffering from the high bicarbonate, thick mucus secreted in saliva as the hay is chewed more thoroughly than grain, is considered to help protect the upper gastric lining.

A more recent study (2007) by Dr. Brett Scott and colleagues at Texas A&M University found that feeding alfalfa (lucerne) hay along with a grain concentrate significantly reduced the severity of gastric ulceration in young horses in training, as compared to roughage as grass hay. It was concluded that feeding alfalfa (lucerne) hay as a roughage to horses in light work could be a useful adjunct to anti-ulcer therapy for EGUS.

Feeding Lucerne Hay or Chaff before Exercise or Traveling

Observations indicate that feeding a small amount of lucerne hay, such as a quarter of a biscuit, or 500grams of lucerne chaff, about 30 minutes prior to exercising the horse, can help to reduce the risk of gastric ulcers by up to 50% in stabled horses. It is proposed that lucerne provides additional slow release buffering through its naturally high level of calcium and magnesium salts, combined with the saliva secreted as it is chewed more thoroughly as long-stemmed hay as compared to short chop or finely cut cereal or grass chaff, especially if it is fed low down to encourage chewing. It is also postulated that the fibrous mesh-like layer formed as the lucerne mash floats on the surface of the gastric acid secretion helps to prevent acid 'splash' as the stomach is 'squished' during exercise. Other observations indicate that horses that are fed roughage prior to exercise, or have small amounts of hay to nibble on an almost free choice or ad-lib basis, have a low incidence of gastric ulcers.

However control of stomach fill and hindgut weight, as well as weight gain in stabled horses can be a problem in 'good-doers' that eat more than they need. Horses that are bedded on straw have been observed to have a lower risk of gastric ulcers, perhaps because many horses 'snack' on their bedding overnight, with the average horse consuming 4.5kg of straw bedding each night.

The amount of 'chewing' to release protective saliva may also limit the acidity build-up and mucoid protection of the sensitive non-glandular reflux area. Studies indicate that horses 'chew' (or 'jaw sweep') around 1000 times to consume 1kg of oats and 2000 times to grind 1kg of hay. Horses eating 'sweet', highly processed feeds which they find very palatable, especially when fed in bins at chest height in training, may only chew 350-500 times per kg as they 'gulp' down the feed. Long chopped chaff increases the time spent chewing feed, compared with short, fine "racehorse" chaff that reduces chewing before swallowing and the amount of protective saliva secreted to buffer the higher area of the stomach. It is believed that saliva plays an important part in diluting gastric acid, buffering excess acid and protecting the non-glandular lining with its high mucus content which rises to the surface of the stomach contents and resists acid digestion. Other studies indicate that feeding corn oil, or a balanced Omega-3/Omega-6 oil containing linoleic acid helped reduce the risk of gastric ulceration in humans, rats and ponies.

Handy Hint

Studies have shown that feeding a small amount (1/4 biscuit) of lucerne (alfalfa) hay, or a small 500g meal of lucerne chaff within 30 minutes prior to daily training or work can help to buffer the gastric content (lucerne contains calcium and magnesium salts and mucilage compounds) and provide a food 'mat' to limit stomach "squish" and acid 'splash' during exercise. Feed lucerne hay overnight to help buffer gastric acidity in the higher regions of the stomach before next morning's exercise.

Signs of Gastric Ulcers

The most consistent signs include a **loss of appetite** that develops as a horse progresses in training and fast work, slow feed consumption and "picky eating" habits and "**eat-drink**" habits that give relief from gastric pain by diluting the acid attack on the ulcer and soothing the inflamed sore around the ulcer or irritated "reflux" area.

Other signs include...

- Many horses will readily eat hay and pasture because it provides a buffering action to limit gastric acid attack on ulcerated area(s), but "pick" or leave a grain based feed.
- Often a horse with a painful or an irritated gastric lining will stand with the elbows against the chest and front limbs close together when eating due to gastric pain.
- When pressed on the left (near) side of the chest, by pushing your extended hand under the left elbow, just in front of the girth area, about 15 minutes after exercise or after the start of a feed, a horse with "heartburn" or an irritated gastric ulcer will pull away.
- Some horses "slobber" more and 'chew the bit' during or following exercise, presumably to salivate and buffer the gastric acid that irritates an ulcerated area.
- Often the breath smells "poriky" for 6-12 hours after a hard gallop or race as hemorrhaged red blood cells (a loss of up to 1.5 litres of blood into the stomach due to elevated blood pressure during a race) are digested by gastric acid.
- Some horses eat dirt, others chew the bit or rails and "paw" the ground when tethered, may be depressed and stand in the stalls with their front limbs together after a race as racing "squishes" the acid on to the ulcerated areas.
- Some horses develop crib biting and 'windsucking' habits when on concentrated grain based rations or pellets, which have been shown to be related to gastric irritation. A daily dose of Gastro-Coat can help eliminate the habit in many horses.

Your vet can confirm gastric ulcers by scoping the horse's stomach at 12 hours after its last feed so that the stomach is empty, or assessing the response to ulcer medications over a 7-10 day period. Ulcers are graded from 1-4 relative to their severity by scoping,, with 4 being full thickness, lining erosion and ulceration.

Management of Gastric Ulcers

Controlling acid secretion

This is primarily achieved by administering paste, liquid or powdered compounds of ranitidine and cimetidine, under veterinary prescription. Much higher doses are required to control gastric acid secretion in horses than in humans, and are best given 3 times daily for best effect. Ranitidine is effective in suppressing gastric acid secretion in foals, but it appears to be less effective in adult horses in training and should be given 2-3 times daily for best results.

Recently, studies have indicated that regular dosing with the proton-pump blocking drug, omeprazole (OME), as an oral paste or liquid drench, appeared to significantly reduce the risk and severity of gastric ulcers and allowed ulcers to heal. Studies

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have indicated that horses can be trained within 2-8 hours of dosage with OME without significant elevation of gastric acid, particularly if a small grain feed is offered after dosing.

Handy Hint

Passing of dark, smelly droppings 36-48 hours after a race as a result of blood leakage from a bleeding ulcer, is also a possible sign of severe gastric ulcers in a horse which has a history of picking at its feed for 2-3 days after a race or hard workout.

Handy Hint

Symptoms of a low grade "colic" minutes after a saline drench, with "pawing", standing with the front limbs close together, and in severe cases, "stretching out" to relieve stomach pressure or circling in an attempt to lie down, can be signs of gastric irritation as the salt attacks ulcerated or inflamed upper gastric lining.

Protective Coatings

There are a number of compounds that can provide a protective coating to restore the phospholipid shield to the surface of ulcerated areas. These include slippery elm powder, low-protein whey powder and psyllium husk, administered as a slurry just prior to feeding or in the top layer of dry feed. Inclusion of a hydrophilic compound to attach the protective phospholipids to the gastric lining, helps to increase the benefit of these compounds. The addition of acid buffering compounds can also improve the effectiveness of these compounds. However, the administration of sufficient sodium bicarbonate, a common antacid used in humans to reduce the acid 'burn' associated with a hiatus hernia, would require up to 200grams per dose, which besides giving only short term relief to neutralise gastric acid, would elevate total CO₂ blood levels above the pre-race limit allowed.

The product Gastro-Coat, has been demonstrated to help maintain the optimum chewing action and the amount of salivation by providing natural mucilage and phospholipid

Handy Hint

A blood count of a horse that is a "picky eater" after exercise may also reveal a reduced red cell count as a result of chronic, low-grade blood loss from a grade 3-4 ulcer, as well a decreased plasma protein level below 57g/litre, elevated bilirubin and GGT enzyme readings, and a consistent lower than normal blood potassium concentration. Your vet will interpret these findings in relation to symptoms of poor appetite after exercise, because similar readings may also indicate possible chronic "bleeding" in the lungs.

Handy Hint

Observations also indicate that adding a 50mL supplement of an acidic juice, such as apple cider vinegar which many horses relish, diluted to 100mL with water to reduce mouth irritation in sensitive horses, may help to acidify the feed and encourage salivation, producing more protective saliva to assist in the natural buffering of the stomach lining at the oesophageal inlet and the upper un-protected gastric lining. This can be combined with a supplement of **Gastro-Coat** in the feed to help provide natural mucilage compounds to encourage more thorough chewing and salivation. This combination with lucerne (alfalfa) chaff fed before training and traveling, may help provide increased salivation as a natural gastric buffering mechanism.

compounds, which when mixed into feed, corrects low or inadequate amounts of these compounds in grain and protein feeds, particularly in heat-processed (extruded or micronized) and sweet feeds in which these compounds are destroyed by processing. Gastro-Coat assists the salivation process to provide optimum natural buffering action to the stomach lining, thus helping to reduce the risk of gastric acid 'burn' when horses are exercised and traveled prior to feeding.

When mixed with 500g of dampened lucerne (alfalfa) chaff and given 30 minutes before exercise or training, and prior to traveling and competition, Gastro-Coat may complement the mucilage content in the lucerne (alfalfa) and facilitate a more thorough chewing action and efficient salivation as a natural gastric buffering mechanism.

Use of Probiotics

Recent studies in 2007 (in publication) carried out at the Gatton Campus of the University of Queensland, indicated that feeding yoghurt compound containing lactobacilli spp as a daily supplement in the feed, helped to provide lactobacilli to ferment non-structural carbohydrates in the stomach, and reduce the substrates used by other invasive pathogenic bacteria that would otherwise colonise the upper gastric lining to cause erosion and ulceration. More studies are continuing to determine the best combination and concentration of lactobacilli for this effect.

Use of Omega Fatty Acids

Observations have suggested that dietary supplementation with Omega-3 fatty acids containing natural eicosanoid compounds may have benefit in minimising local inflammatory damage to the upper gastric lining and assist in maintaining natural anti-inflammatory activity of the gastric lining cells to resist erosion associated with gastric ulcers. More studies are continuing.

Synthetic Prostaglandins

These are effective, but generally too expensive to prevent gastric ulcers in horses in training, although they are recommended in horses medicated with high doses of NSAID drugs.