

Monitoring Metabolics - Implications for ALL HORSE SPORTS!

The Equine Gastro-Intestinal Tract (GIT) - By Dr Jo Hamilton-Branigan BSc(Hons), BVSc(Hons)

Traditionally, the equine digestive tract has had to work hard to derive energy from its graminivorous ("grass based") diet. It is this diet which led to the development of a comparatively complex GIT. The horse had paid particular evolutionary attention to modification of the hindgut. The hindgut consists of a vat of living organisms (bacteria and protozoa) whose job is to breakdown the cellulose. This enables the break down of highly resistant food materials into simple volatile fatty acids. These simple C-chain (carbon) molecules are then absorbed and used as the horse's primary energy source.

When we feed the horse easily digestible food-stuffs, such as cereal grains, legumes and oils we can inadvertently change relationships within the "living vat". If we feed these food-stuffs to excess and in the wrong proportions the horse will be much more predisposed to systemic problems and digestive up-sets.

As well, the activity of the equine GIT at rest is significantly different from that of the activity of the GIT during competition.

At the onset of strenuous exercise, the central nervous system signals the cardiovascular system to reprioritize.

At rest, nearly a third of the blood supply is servicing the GIT (30%), during competition this is reduced by about a factor of ten, to three percent. With continued exercise there will be some degree of dehydration and loss of electrolytes. This can potentially reduce the GIT circulation to extremely low levels. It makes it easy to see why the equine GIT is one of the first body systems to be affected under competitive conditions.

It is good practice to familiarize yourself with the magnitude of these changes in your own horse. Remembering that every horse will be a slight variation on the same theme. It may help you to anticipate and trouble-shoot problems before they occur.

Simple things to keep in mind are:

- The equine GIT will not operate optimally when highly acidified (i.e. too much grain)
- The equine GIT operates optimally under conditions of high fiber
- The equine GIT (+ kidneys) will be the first organ to suffer if the horse undergoes prolonged exercise and dehydration.

Optimal performance goes hand-in-hand with the promotion of a healthy, normally functioning gastrointestinal tract.

PROMOTING A HEALTHY GASTRO-INTESTINAL TRACT

1. Limit stress; promote a relaxed attitude

Gastro-intestinal tract function alters greatly during times of stress. Think of yourself during times of high anxiety eg. exams, arguments, etc. Anxiety causes altered GIT motility; it usually results in over stimulation or "hyper motility". This is due to the "fright & flight" component of the nervous system preparing the animal for exercise or other confrontation.

To a point this is not detrimental and serves a purpose. A little adrenaline helps to sharpen competitive performance. However, if it translates to horses that are "over" agitated at events i.e. reluctant to eat or drink properly, then it will influence gut-fill and hydration levels. If these horses defecate more often, and void very loose, sloppy manure they will predispose themselves to metabolic problems. It is important that you try to have an understanding of what is "too much for too long". If you are worried you really should discuss potential problems with the veterinary team at the event.

For example, if your horse paces the fence all night, and refuses to eat or drink properly, then he cannot be expected to perform at optimal levels. Horses will also come to anticipate events so it is up to you to try and make the lead-up training and novice rides as relaxing as possible. Try to minimize pressure and excitement. Avoid temptations to take a horse too fast too soon or to bring on young horses quickly.

Stress prior to events - Another consideration is the lead-up period to an event. Horses which have suffered some sort of accident, stressful incident, or even taxing competition, in the two weeks preceding will have suffered a degree of physiological stress even though they appear perfectly normal. Observation suggests that all too often these horses are more prone to suffer GIT or other metabolic disorders if further physiological stress is encountered.

2. Temperament

The temperament of your horse is EXTREMELY important in determining how much effect pre-competition anxiety has on performance.

Everyone can think of potentially "brilliant" horses that become so hyped-up prior to competition that they become management nightmares. Many of these horses actually precipitate GIT motility problems even BEFORE competition starts. It is quite common for an overly anxious horse to start the event with a significant degree of dehydration.

At the other end of the scale there are the less capable quieter, but reliable horses, who do extremely well in performance sport just because of efficient energy usage, better hydration and resultant trouble free GIT function.

3. Environment and the GIT - Unfortunately we tend to keep our horses in an environment that suits our lifestyle. Stabling of horses in race training in inner city suburbs illustrates one extreme end of the scale. Most of these horses are on a high grain diet, exercised once daily and stabled and/or yarded for the rest. It is not uncommon for these horses to have digestive upsets while in work.

At the other end of the scale there are the PC ponies, brood-mares and stock-horses which roam large paddocks with minimal supplementary feed. These horses are often checked infrequently and exist quite happily on pasture with hardly a sick day in their lives. In the first instance there is massive human intervention and interference with the content, frequency and quality of diet and exercise frequently at odds with equine digestive physiology. In the second instance – the horse is in an "equine friendly" environment. Once you take the horse away from the environment and routine he was designed for he is at a much greater RISK of suffering physiological malfunction.

4. General Health

Teeth - Equine teeth should be checked at least once every 12 months. Sharp edges and hooks can frequently lead to inefficient chewing which will result in digestive inefficiency and will increase the risk of impaction colic. If your horse drops feed (quid's) when he eats, has "pockets" in his cheeks or even throws his head constantly you should have a qualified person examine the teeth. Regular dental care is a must for the equine performance athlete.

Parasite control- Optimal performance will also depend on the GIT being parasite free. The advent of the ivermectin-based anthelmintics has meant that keeping your horse parasite free is easier and safer than ever before. Not only do these parasites live in the "brew" of the GIT but they also migrate and encyst in the walls and arteries of the GIT, as well as the lungs and other parts of the equine body. Bot-fly larvae typically promote ulceration of the gastric mucosa and tape-worm in large numbers will block the ileo-caecal orifice and so affect function of the large bowel. Your horse will not perform well with a parasite burden of any kind.

5. Diet

Dietary Considerations At Rest

FREQUENCY Frequent feeding - The horse is designed to be a continuous, or frequent, feeder – GIT motility is better kept at a constant level. It is far better to feed 3-4 feeds a day (break up your hay and grain rations as separate feeds if you can).

QUANTITIES Small feeds - If the horse eats more than its stomach capacity allows for the food will be "pushed" through into the small intestine prematurely. Hence, digestion will be less efficient and this may inadvertently affect GIT health.

TYPE Be careful with grain - Large quantities of grain (CHO) can adversely affect GIT pH (more acidic) and often has systemic influences.

FOOD ORDER Feed hay prior to grain feed - Consider that most horses will preferentially eat their grain feed before their hay if they are fed BOTH at the same time. Because the hay will push the "hard" feed through the stomach more quickly - your grain will not be digested fully and may result in higher levels of acidity in the hind-gut.

FIBRE Lots of fiber. - Efficient and healthy digestive processes depend on hindgut fermentation - which takes place in the caecum/large colon. This depends on the provision of suitable quantity of "fiber" foods. Make sure you provide enough good quality fiber.

QUALITY Dust and mould free. - Always use good quality feed and ingredients. Try to avoid stinky, poor quality feeds - these may increase the risk of impaction colic. Dust and mould can compromise respiratory health.

Understanding GUT SOUNDS

Different regions of the abdomen house different portions of the gastro-intestinal tract. Generally left abdominal noise reflects the activity of the small intestine and the right reflects large bowel - i.e. colonic and caecal movement.

The presence or absence of gut sounds is the simplest way to evaluate the degree of stress and fatigue relating to digestive activity and function. Low pitched, progressive rumbling in all four quadrants is a sign that gut motility is active and unsuppressed.

Relating noise anatomically - the abdominal "QUADRANTS"

Dietary Considerations during the ride

QUANTITIES Gastric emptying - Keep in mind large quantities of carbohydrates (large grain feed) or fats will contribute to delayed gastric emptying.

TYPE Hydration – promoting too much protein in the diet means that precious water will be needed to excrete the high nitrogen content. Avoid soya-bean meal and excessive quantities of lucerne. Plenty of good quality fiber will promote water retention and uptake.

FIBRE Benefits of fiber - Firstly, fiber promotes healthy gut function. Secondly it promotes a "water trap" - the horse has to drink more to digest fiber, therefore will have greater fluid reserves. Thirdly, fiber may help to maintain GIT stability when placed under physiological stress. It helps ensure that GIT circulation/blood supply is maintained.

FATS Energy Dense - Fats are beneficial to competition horses especially during endurance exercise. They can increase the energy density of the feed in times of high demand. Remember that the GIT will take time to adjust to efficient fat usage, optimally allow 2-3 months for this adjustment.

EASILY DIGESTIBLE + MOISTURE + FIBRE Between checks at competition - Consider dampened lucerne hay overnight in under damp sack) AND a bran and oaten chaff mash with a small amount of grain, molasses, chopped carrots and electrolytes AND/OR fresh green grass! Freshly mixed feeds Mix fresh feeds and molasses water at the time of eating/drinking. Feed will start to ferment, especially in the hotter climates.

Quadrant Intestinal Organ/s in this region:

- Dorsal (upper) LHS flank, dorsal small colon noise.
- Ventral (lower) LHS flank, reflects small intestinal and colonic (large intestine) activity.
- Dorsal (upper) RHS flank, mainly ileo-caecal/caecal/colonic, some gastric emptying/duodenal ***Most significant sounds heard in this region.
- Ventral (lower) RHS flank, less obvious small intestine, mostly colonic.

Gut noise is commonly referred to by medical practitioners as "borborgymus" This is pronounced bor" bo-rig'mus The plural form is borborgymi.

Types of Borborgymi

- Mixing contractions (gurgling). Occur every 3-5 minutes. Weak, last <5 seconds, occur in series of approximately 10 together*
- Propulsive contractions (longer gurgling). Occur every 2-3 minutes. Last 10-20 seconds*
- Fluid-related sounds (splashing). Variable & intermittent, esp. after a large drink prior to eating. Small bowel, caecum, large & small colon (All quadrants)
- Pinging or tinkling (gas related). Variable, most reliably at the ileo-caecal region, fermentation sounds. Usually heard in the RHS dorsal quadrant at the ileo-caecal region & lower RHS or LHS flanks and rear mid-line.
- Ileo-caecal related. High pitched flushing & splashing. Occur every 15-120 seconds. (usually 1-3 per minute)
- Caecum, upper RHS flank. Three distinct sounds - mixing, unloading & propulsive sounds.

*Small Intestinal Noise will usually be higher pitched & louder; Large Intestinal Noise is duller, deeper.

Changing GUT SOUNDS

The assessment of gut sounds is based on the audible evaluation of the tone, intensity (loudness) and duration of the sound in relation to the function of the normal gut. Normal GIT sounds are quite loud, frequent, and almost continuous.

Perhaps the most significant of the equine gut sounds is related to large intestinal activity, particularly of the caecum. The peristaltic contractions start in the vicinity of the caecum (RHS flank) and progress to the right large colon (lower RHS) and are easily heard with a stethoscope. The left side is less active at producing easily interpreted meaningful sounds.

Too much pinging and tinkling (tympany - when you flick it with a finger) in the caecal region indicates excessive gas accumulation. This is often the result of decreased motility and fluid loss associated with strenuous exercise. Water is reabsorbed from the GIT, which can cause dehydrated digested food to block passage of escaping gases from food that is fermenting in the hypo motile gut. Lactic acid accumulates as a result of fermentation and slows GIT motility even more. This scenario can result in "impaction" colic.

Gastro-intestinal Circulation

During intense exercise up to 80 per cent of the blood flow is diverted to the musculo-skeletal system. Priority is given to the working muscles (oxygen uptake). The GIT on the other hand loses up to 90% of its normal blood flow and digestive function is reduced to almost nothing. Gastrointestinal sounds during exercise are generally infrequent, much quieter and reflect a much lower level of activity.

TABLE 1: Changes in the magnitude of blood flow of the horse associated with rest/strenuous exercise

ORGAN	REST	STRENUOUS EX- ERCISE
Brain	10%	2%
Heart	5%	5%
Skin	5%	5%
Muscle	15%	80%
Kidney	20%	2%
Splanchnic (GIT/Viscera)	30%	3%
Other	15%	3%

From: Duke's Physiology of Domestic Animals, Eds. Swenson M.J. & W.O. Reece,(1993) H. Erickson, Comstock Pub, Cornell Uni, USA

Table 1 demonstrates the gross disparity in circulation to the different organs that exists in a horse at rest and during strenuous exercise. The gastro-intestinal tract and the kidneys will be at risk if this disparity is maintained without a break for extended periods.

Assessing GUT Sounds

Also note that it is much harder for the endurance veterinarian to assess the quality of GIT sounds under VGIH conditions - i.e. when the horse is "hot" and straight off the track as opposed to the 30 minute Standard Check assessment. Therefore, some of the on us is on YOU the rider to monitor your horse in the hold time. You must represent if you perceive any problems - whether you have been requested to or not!

The failure of gut activity to recover after a rest period reflects the degree of stress, dehydration and fatigue associated with the exercise demand and clinical state of the animal.

Decreased Gut Sounds

Characteristically reduced or absent gut sounds encountered in the performance horse after competition is the result of:

- dehydration
- electrolyte depletion
- over-heating
- fatigue
- occasionally the ingestion of a large quantity of cold water
- usually a combination of these things!

Typically, top-ups of electrolytes and fluids during the ride, and dampened hay at rest points may help with dehydration and electrolyte depletion. Rest, fluid and food may help combat fatigue. A reduction in speed will be warranted. Over-heating can be reduced by more efficient or intense strapping methods (or speed reduction). Ice can be used in strapping water to facilitate cooling when conditions warrant.

It is wise to restrict excessively large intakes of water at checks. Horses normally take a break after half a minute or so - enforce this if your horse is hot and guzzles greedily.

When the horse ceases exercise it is wise to provide tepid water i.e. water without chill.

On track, cold water will not cause gut chill or reduce motility if exercise continues immediately. Under these circumstances water rapidly warms to body temperature. Ideally, the horse should be walked for about 50 metres after drinking to allow fluid to settle.

Horses may sometimes refuse to drink chilly water on track. Keep in mind that often they cannot drink enough to satisfy their thirst comfortably in the time available. Try them with slightly warmer water if you can find some. They will often drink out of shallow, muddy puddles in preference to crystal clear flowing mountain streams. Of course horses also refuse because they simply don't like the water taste, smell, location (dams) or they are too excited. Riders should take note of the quantities of fluid ingested and adjust their ride accordingly.

Increased Gut sounds

Increased gut sounds are occasionally auscultated at checks. Likely causes include:

- a large drink of water on an empty stomach
- a stress-related disturbance of motility

The former is not generally a problem, especially if there is no discomfort to the horse. If it is due to stress related conditions, careful monitoring of the horse is necessary. A stress-related endotoxic diarrhea must be treated as a potentially life-threatening condition.

Diarrhea is viewed with great concern in a competitive event. If there is any evidence of loose bowel motions at a veterinary check, careful evaluation of hydration status is necessary. The horse should be eliminated for persistent, unrelenting diarrhea. The horse cannot be expected to maintain fluid or electrolyte status in this condition.

Final Words - The importance placed upon the GUT sounds of the performance horse, particularly endurance athletes, cannot be emphasized enough.

The continuing health of the GIT is vital for the continued well being of your horse. All of the metabolic parameters we have discussed in previous issues are important, particularly those concerned with hydration, but none more so than gut sounds. The one parameter, which will influence a veterinarian's decision more than any other at the veterinary check, is ABSENT or POOR QUALITY GUT sounds.

Riders and trainers alike owe it to their horses to have a "working" knowledge of equine GIT anatomy and function and to have a basic appreciation of equine digestive physiology. Not only will it benefit your horse; IT WILL IMPROVE YOUR PERFORMANCE.