

Beating the Metabolic Pull

Part 2 - Gut Motility

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In the second article of this series, factors affecting gut motility and how they help maintain metabolic integrity will be discussed. Remember that last month's article introduced a list of priorities in avoiding a metabolic crisis during an endurance ride---first, pay attention to hydration; second, to gut motility, a very closely related issue; and as a distant third, attend to maintaining energy balance. Maintaining the first two factors exerts such a positive effect on the metabolic whole that overall performance and recovery will be improved even before energy balance is addressed. Later strategies to increase energy throughout the ride then become icing on the cake, while still maintaining strong metabolic scores during vet checks.

The term "gut motility" refers to the normal sounds of digestion audible via stethoscope through the abdominal wall, and provides a good indication of the stress level being experienced by the horse. Under normal circumstances, the gastrointestinal tract of the horse generally maintains a slow, constant churning (or *peristalsis*) as food is digested and moves through the system. Horses and other herbivores evolved to a diet of forages maintain this churning action not only after a meal, but continuously over hours and days as the high fiber portions are fermented and slowly broken down and absorbed into the bloodstream. Control of the digestive process is maintained by circulating hormones, and is subject to a priority system when the body is under stress, as during strenuous exercise. As the exertion level increases beyond that which is easily maintained, the body assumes that the animal is under attack and is fleeing for its life---physiologically, it does not make the distinction between a life-threatening emergency and simply a prolonged, over-enthusiastic gallop. Complex hormonal signals adjust the distribution of blood flow to maximally support the cardiovascular and muscular systems to continue its "escape"; maintain support to the vital organs such as heart and brain; and temporarily diverts blood flow away from those systems uninvolved in the "fight or flight" response, such as the digestive tract. As a result, blood flow to the hind gut gradually decreases as stress and the intensity of exercise increases, and motility concurrently slows or stops. If motility is decreased for long enough, colic eventually results as gas and fluids begin to accumulate, causing distention and pain. Although there are many causes of colic, slow gut sounds at a vet check are almost always related to decreased blood flow to the intestinal tract, which in turn is almost always related to the body being pushed beyond its current capacity and into a state of physiological emergency.

Remember from the previous article that dehydration has a profound effect on efficiency of the cardiovascular system. As plasma volume decreases, blood thickens and becomes less fluid, requiring the heart to work harder to transport oxygen and other resources throughout the body. Likewise, as plasma electrolyte supplies become depleted, the efficiency of cellular function, including muscle, also decreases. The net result is that a dehydrated horse's body more readily goes into a physiological state of emergency, diverting blood flow away from the digestive tract, than does one that is fully hydrated. A vicious cycle is created in that dehydration and electrolyte imbalance directly causes a decrease in intestinal motility, while the loss in motility impairs the horse's ability to absorb the fluid and electrolytes needed to correct the situation. A critical point

to understand that even though a ride's terrain, temperature and speed may not differ greatly from training rides at home, minor variations in conditions can cause a cascade of physiological effects that have a significant impact on the metabolic well-being of the horse. Never make the mistake of thinking that because your horse easily exercises at a certain speed at home without turning a hair, that he will automatically do just as well at that speed during competition. He might, but then he might not! Sometimes even such minor details as level of excitement (of both horse and rider) can affect the body's response to fatigue and stress. Especially in relatively inexperienced endurance horses, continually assess your horse and adjust to meet the change.

As with many other issues in endurance riding, there are many shades of gray in determining the degree of metabolic trouble. Few riders take the time to check gut sounds out on the trail, but carrying a stethoscope just in case is always a good idea. Changes in attitude, lack of interest in eating or drinking and signs of dehydration warrant a quick check in all four quadrants on both sides. While fully accurate interpretation of gut sounds is not easily learned without veterinary training, simply being familiar with your horse's normal frequency and characteristics will help you identify brewing trouble out on the trail if a veterinarian is not readily available.

What to do if faced with potential colic either at or between vet checks? Recognize that poor gut sounds are an indication that the horse is exercising beyond his current capacity, creating a progressive state of physiological stress. If you are out on the trail and moving towards a vet check, the obvious first answer is to *slow down*. Decreasing the demand on the cardiovascular and muscular systems will allow the body to recover and reduce the emergency status it is responding to. As the body moves back towards recovery, blood diversion away from the digestive tract will eventually begin to reverse itself and intestinal activity will improve as blood flow returns. Helping the horse to recover does not necessarily mean stopping entirely to rest. In fact, gut activity will be improved if you keep moving steadily. Research has indicated that blood flow to the digestive system, and therefore maximum efficiency of the digestive process, occurs when the horse is exercising at approximately 20% of his maximum aerobic capacity. For most fit horses carrying a rider, this is usually somewhere between a brisk walk and an easy jog. As an added bonus, continuing low-level exercise flushes waste products such as lactic acid from the muscles more efficiently than occurs at rest, so the entire body benefits and recovers more quickly, while still maintaining forward progress towards a check and veterinary help.

By adding bulk to a slow digestive tract, additional hormonal signals are released that move the digestive tract higher on the priority list in line for blood flow, thereby increasing intestinal activity. While the GI system's demands will not displace those of the cardiovascular or muscular system during strenuous exercise, once the body recovers from emergency status, blood flow and motility will more rapidly return if feed is in the stomach. The bulkier the food item, the more the stomach walls are stretched, and the more motilin (a hormone which triggers peristalsis) is released. Therefore, whether at a check or out on the trail, encourage continuous eating, preferably of moist, bulky forages such as green grass, wet hay or soaked beet pulp. Avoid concentrates such as grain, which can exacerbate colic and laminitis if the problem persists beyond a temporary situation. Remember from last month that even before a crisis state is reached, allowing for small, frequent meals along the trail benefits hydration status as well. Since gut motility is so closely related to hydration, continuous nibbling along the trail therefore provide advantages in both areas.

It is a common misconception that wheat bran mashes possess laxative qualities to provide bulk and avoid impaction during endurance rides. They do---for the rider! Humans and horses have vastly different digestive systems and while bran (of any type) is poorly digested by the monogastric species such as humans, dogs and pigs, thereby providing bulk as it passes through the GI tract, this is not the case with herbivores, such as horse, cattle or sheep. Horses are able to easily digest the fiber in bran via microbial fermentation in the cecum and large colon, and thus little or no additional bulk is produced to promote motility. Clinical research has demonstrated that horses fed almost 50% of their total ration in the form of wheat bran did not produce greater quantities of fecal material, or produce feces of greater moisture content. So while sloppy bran mashes are an acceptable feed at rides, and a good way to introduce electrolytes, additional moisture and other feeds during a stop, they should be viewed as a grain product, not as a significant source of fiber to promote motility.

In the interest of providing feed with maximum bulk to promote motility, pay attention to particle size of ride-day forages. Remember that motility factors are triggered as the result of stretching stomach walls, and that *maximum stretch yields maximum motility*. A pound of long-stem hay yields the same total nutrition as a pound of pelleted hay, but the *volume* of long-stem hay is significantly greater and therefore it's potential ability to stretch stomach walls, even after chewing. Even if you normally feed pelleted hay at home (and it is recommended that at least 50% of the hay ration be in the form of pasture or long-stem hay to maintain gut integrity), always provide long-stem hay at rides. Due to the relatively slow digestive process of horses, always provide plenty of hay for several days before the ride, including free-choice hay throughout the night before. If you provide wet mashes at stops, consider soaked beet pulp mashes instead of wheat bran. Beet pulp absorbs tremendous amounts of water during soaking and provides significant moisture as well as bulk. Additional grain products such as wheat bran, sweet feed or other concoctions can be added to increase palatability and provide additional energy.

Although added fat as an energy source seems like a good common-sense idea during rides, you're probably better off not providing significant fats on ride day. Fats do indeed provide the primary source of energy during endurance exercise, but if the horse is in reasonable body condition---fit and muscular without staring ribs or hipbones---then he already has sufficient body fats on board to provide sufficient fatty acids throughout the day. Adding additional fats during the ride, therefore, is providing a fuel source already in good supply, at the expense of attending to other critical issues. Because fat is such a concentrated energy source, a meal high in fats tends to decrease total intake, thereby decreasing the total bulk needed to maintain gut motility. For this reason, vegetable oil should not be added to ride-day mashes, and any added rice bran to increase palatability should be provided as a condiment, rather than the majority of the meal. Focus on green grass, long-stem hay and well-soaked beet pulp to provide bulk throughout the day, with additional grain sources to provide energy only if motility is being maintained.

To summarize the main strategies in this article:

1. Recognize that poor motility is an indication of blood flow diversion away from the digestive tract as the result of stress, and reduce the intensity of exercise to allow blood

flow to return. Maximum blood flow to the GI tract occurs at approximately 20% of maximum aerobic capacity.

2. Remember the strong relationship between hydration and motility, and maintain the latter by protecting the former.
3. Move the GI tract higher on the blood flow priority list by adding bulk to the stomach to trigger release of endocrine motility factors and promote peristalsis.
4. Utilize long-stem hays, green grass and soaked beet pulp rather than wheat bran or high-fat feeds to maintain intestinal activity.

Next month's article will address strategies to maintain energy balance during endurance exercise.

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