Introduction

Horses are unique animals who are very sensitive to dietary changes. Unfortunately, few people take the time to understand why. The horse is a nonruminant herbivore and a grazing animal. In order to utilize nutrients, horses rely on enzymes to digest their feed in the small intestine. Conversely, in the large intestine, horses rely on microorganisms (such as bacteria) to break down the feed and forage not digested in the small intestine. A disturbance in the digestive system can lead to problems such as ulcers, colic, laminitis, and behavioral issues.

In this guide, we take a closer look at the horse’s digestive tract and identify where disturbances may occur. We have combined this scientific insight into an innovative product that not only supports your horse’s nutritional requirements, but is also designed to improve the health of your horse’s entire digestive system.
EQ8™ (pronounced *equate*) means “to make equal or to balance.” A balanced nutrition program helps to create consistency, which is the best program for all horses. Consistent forage, feed ingredients, exercise schedules, and environment help reduce stress and potential imbalances in your horse’s digestive system. Our nutritionists and scientists have worked with horse owners, veterinarians, and university experts to identify common issues that affect your horse. Based on our research, we are proud to present EQ8™ Gut Health.
How does my horse function?

1 Brain & Behavior:
How does nutrition influence my horse’s behavior?
Why does my horse act that way and how can I help to improve his temperament?

2 Stomach:
What makes my horse's stomach so sensitive?
3 Small Intestine:
Why is my horse’s small intestine so important?
How does digestion occur?
How can I protect my horse’s small intestine?

4 Large Intestine:
What happens if too much starch and sugar reaches the large intestine?
What roles do microorganisms play in digestion?

5 Working Together:
How can I help optimize my horse’s entire digestive system?
1 Brain & Behavior

A horse’s attitude and temperament are an important part of the relationship with your horse. What your horse eats affects not only the digestive tract, but also brain function. When your horse eats, powerful chemicals (e.g., hormones) are released into the bloodstream, which then communicate with other organ systems. Each hormone is responsible for a specific job. Cortisol for instance, increases glucose metabolism, allowing increased energy for the horse to escape a stressor during a “fight or flight” situation\(^1\).

As it relates to digestion, insulin is another hormone produced by the pancreas that regulates blood glucose (sugar). Insulin transporters are located in the pituitary gland of the brain. When blood glucose levels increase, insulin is released to reduce glucose back to a stable range. Diets high in starch or sugar tend to keep insulin levels elevated (see Figure 1), which has been implicated in the development of stress-related stall vices. High starch diets have been linked to aggressive behavior and cribbing. Wood chewing may be an attempt to alleviate digestive upset, increasing salivation to neutralize stomach acid caused by diets high in starch. By balancing the diet to make up for these issues, you can reduce stress and create a calming effect in the horse\(^2\).

Tips to promote thoughtful behavior

- Lower starch and sugar levels help reduce over-excitability.
- Maximize fiber intake to increase mealtime and reduce boredom or unwanted behaviors.
- Place your horse’s forage in a rack or net to slow intake rate. Your horse will have to work harder to get feed out of a container, thus increasing mealtime.

Managing meal size and consumption rate can also aid in controlling behavioral issues. Adding a minimum of 20% fiber with your feed can lengthen mealtime and bring the domestic horse back to a more natural grazing state\(^3\). By altering the diet composition, and increasing fat and fiber content, stall vices may also decrease. Horses may seem less flighty and more willing to perform than horses on a higher starch or sugar diet\(^2\).
Low Starch and Sugar with Added Fat and Fiber

For superior performance, EQ8™ Gut Health is scientifically formulated to help support proper stall behavior and to help reduce excitability in the horse, whether in the show ring or out to pasture.

![Insulin Response Over Time](image)

**Figure 1 - Diets high in starch and sugar keep insulin levels elevated for several hours of the day**


2 Stomach: Unique & Sensitive

The horse’s stomach is a one-way road. The quality and quantity of the feed that goes into your horse is even more critical because of the anatomical presence of the cardiac sphincter. This valve traps food in the stomach so it can be further processed, making it impossible for the horse to eructate (burp). Moreover, horses are also unable to regurgitate their food (like ruminant animals such as cows).

In relation to size, you might think the horse’s stomach is of large proportion. In reality, it only has the capacity to hold about 2-4 gallons. This makes the passage rate within the stomach very rapid (as fast as 20 minutes) compared to other digestive sections.

The horse’s stomach constantly produces acid, which is counteracted by the production of a buffer within the saliva. Horses produce saliva in response to chewing, so the constant grazing of a horse allows saliva to neutralize acid at a steady rate. If your horse is confined indoors and fed once a day, this could cause an imbalance from decreased saliva production, often associated with the development of gastric ulcers. This is one reason why small, frequent meals are the best management for horses.

Gastric ulcers (equine gastric ulcer syndrome) have been reported in 90% of racehorses, 75% of three-day event horses, and 58% of working horses. Symptoms of gastric ulcers include general irritability, poor appetite, discomfort, unthrifty appearance, and dull coat.

Tips for a healthy stomach

- Feed small, frequent meals to mimic a horse’s natural digestive pattern. Keep meals under 5 lbs at one time.
- Increasing fiber levels in the diet allow for longer chewing time, which can help with ulcer prevention from increased saliva production.
Large meal size and decreased chewing time are not the only risks for ulcers. The amount of starch consumed in one meal is another contributing factor proven to affect gastric ulceration in the horse. Optimum gastric support can be provided by offering frequent small meals, reducing starch content of feed, and by increasing the fat content, since fat has been shown to delay gastric emptying⁹.

Low Feeding Rate, Low Starch and Sugar, and Added Fat and Fiber

Increased fat levels with lower starch and sugar, EQ8™ Gut Health helps to minimize stomach upset.
3 Small Intestine: Enzyme Breakdown & Absorption

The small intestine is about 4 inches in diameter and approximately 70 feet long with the capacity to hold 10-12 gallons of digesta. This portion of the digestive tract is the primary site for breakdown and absorption of starch, protein, fat, vitamins, and minerals.

A host of digestive enzymes are released to unlock the bonds that hold nutrients together and allow absorption to occur. For example, amylase is an enzyme that breaks down starch to small sugars. After enzymes break down feed components, other digestive chemicals break down larger feed ingredients into smaller nutrients. These nutrients (like sugar in grains or vitamins in fresh grass) are transported across the intestinal wall and enter the blood. The blood and nutrients are taken to the liver for repackaging and distributed to the rest of the body for use.

In some cases, not all ingested material will be digested in the small intestine. The type and form of the feed ingredients determine the rate of digestion in the small intestine. For example, fiber is made up of chemical bonds that animals do not have the enzymes to digest. Therefore, fiber and other materials will pass through the small intestine and reach the large intestine.

The other event in which feed material will not be digested in the small intestine is when the system gets overloaded. Even though the horse can make the “keys” needed to unlock chemical bonds in feed, the amount of enzymes needed could be too much for the horse to make. There is simply not enough time to unlock all nutrients in the intestine, either because there is too much grain to be digested in the time available, or that the grain is unprocessed so the enzymes cannot access the nutrients (see Figure 2).

Tips for a healthy small intestine

- Use feeds with highly digestible ingredients to maximize small intestine function.
- Limit intake of unprocessed grains to reduce starch overload and maximize digestibility.
- After times of stress or antibiotic treatment, replenish beneficial bacteria with live probiotics.
Ingredient processing plays a large role in digestion. For example, a kernel of corn has a complicated structure (see Figure 3), including a waxy coat that protects the kernel from moisture. Although the horse can produce the enzymes to break down starch, the enzymes cannot reach the corn’s starch because it cannot break through the waxy coat. For this reason, whole shelled corn should never be fed to horses because it cannot be digested in the small intestine. If large quantities of undigested starch are fermented in the large intestine, digestive upset will occur. To minimize the risk of starch overload, processing grains, such as cooking, can greatly increase its digestibility (see Figure 2).

Does this mean corn is bad for horses? The answer is no. Corn starch is a very good calorie source for horses. Two reasons corn has been associated with negative health concerns are the amount of grain being fed per feeding and the physical form in which it was fed. Oats have historically been fed to horses because the starch content is typically half the amount of corn, allowing you to feed more in one feeding without the same negative results. This has given the perception that oats are a safer feed than corn.

The key to minimizing starch overload is limiting the amount of total starch per feeding while providing the most digestible form of starch. In Figure 4, we compare the in vitro digestion of ground corn, oats, kibbled (cooked) corn, and the starch nugget developed for the EQ8™ Gut Health feed. As you can see, kibbled (cooked) corn has a much greater total digestibility, and the starch is much more available.
for digestion in the small intestine (see Figure 4). Moreover, the starch source developed for EQ8™ Gut Health has a total starch content similar to that of oats, but with a much greater, easily digested fraction. With EQ8™ Gut Health, we have developed a calorie source similar to oats, but much more readily available.

The small intestine is not only a major site for digestion; it also has a large number of bacterial species. The majority of bacteria that line the walls of the small intestine are beneficial and protect the intestine from harmful bacteria (pathogens). Typically, one million bacteria per milliliter of fluid are common in the small intestine and the types of bacteria are often very different from those that reside in the large intestine.

When these beneficial bacteria are reduced through stress or antibiotic treatment, pathogens such as E. coli can thrive (see Figure 5). A large percentage of beneficial bacteria isolated from the small intestine of animals are from the Lactobacillus and Bifidobacterium bacterial genera, which are similar to the cultures utilized in yogurt.

Problems often associated with the small intestine range from overgrowth of harmful bacteria to immune response from feed allergens. The most common signs of small intestinal upset are reduced feed intake, depression, and general discomfort.
The most common prevention strategy to limit bacterial overgrowth is to supply the small intestine with live beneficial bacteria (probiotics) that will continuously line the intestinal wall, creating a barrier of protection. Other protective measures include adding ingredients that promote beneficial bacterial growth. These growth compounds are called prebiotics. Several prebiotics have been studied with the most abundant research focused on yeast cell wall fractions, Mannan oligosaccharides, and Fructo-oligosaccharides (see Figure 6).

Cooked Grains and Added Live Probiotic Species

By gelatinizing the starch sources, we are able to minimize the risk of excess starch reaching the large intestine. EQ8™ Gut Health is fortified with live probiotic species, which provide an extra barrier of protection for the intestinal wall. Using our BioFuze™ technology, we are able to ensure viability of the beneficial bacteria.
Large Intestine: Balancing the Microbes

The large intestine is comprised of the cecum, colon (both large and small colon), and rectum. The cecum is extremely important as it represents about 15% of the total digestive tract. It is approximately 3 to 4 feet long and holds 7 to 8 gallons of digesta. The colon represents about 54% of the total digestive tract, which makes the total large intestine approximately 70% of the entire gastrointestinal tract.

The primary function of the large intestine is to host a microbial population that degrades feed material that is not (or cannot be) digested in the small intestine. Bacteria, protozoa, and fungi live in the large intestine and acquire the nutrients they need by degrading undigested feed material in a process called fermentation.

The products of fermentation are short-chain organic acids. These are absorbed into the horse’s bloodstream, taken to the liver, and sent out to the rest of the horse’s body for energy. Fiber degrading bacteria are by far the most abundant microbial population that lives in the large intestine at approximately 10,000,000 bacteria per milliliter of digesta.

The organic acids produced are dependent upon the type and amount of microbes, as well as the feed material available to be fermented at that time. When fiber is fermented, the primary end products are acetate and butyrate. These acids are readily utilized by the horse and not harmful to the microbial population. In contrast, starch is rapidly fermented in the large intestine to produce lactic acid. This stronger acid changes the environment in the large intestine and its microbial population, which can have detrimental effects on horse health (e.g., hindgut acidosis).

Tips for a healthy large intestine

- Provide adequate levels of fiber in the total diet to optimize digestive motility.
- Give horses that are stabled for long periods of time regular exercise, even if it is only hand-walking. This will help decrease stress and allow for movement of gas build-up in the digestive tract.
Laminitis and colic are two conditions commonly caused by rapid changes in microbial population of the large intestine (see Figure 7). When rapidly fermentable material (such as lush pasture or starch) reaches the large intestine, lactic acid is produced instead of less acidic organic acids such as acetate. A U.S. survey found that approximately 1.2 million horse owners reported a problem with laminitis in their horses over the course of a year.

**Highly Digestible Starch Minimizes Digestive Imbalances**

The starch sources used in EQ8™ Gut Health have been gelatinized to increase digestibility and minimize the risk of starch reaching the large intestine. Highly digestible fiber helps promote digestibility of your forage and supports microbial health.

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1. High intake of soluble carbohydrate-rich food (grass and/or cereals)
2. Starch, sugar, and fructans can overflow from the small intestine and enter the hindgut
3. Rapid fermentation increases lactic acid production, which decreases pH and causes hindgut acidosis
4. Absorption of laminitis trigger factors (e.g., amines, exo/endotoxins, matrix metalloproteinase activators) into the bloodstream
5. Laminitis trigger factors delivered in the circulation to the foot

Figure 7 - How carbohydrate overload causes laminitis
5 Working Together

The goals of the gastrointestinal tract are to process and absorb nutrients, and to protect your horse against harmful bacteria or chemicals from entering the blood. All of your horse’s organs and systems are supported and are affected by what enters the horse’s digestive tract. For instance, limiting excessive sugar and starch levels in feed can decrease blood glucose and reduce the risk of unwanted behavior. By limiting the amount of fermented starch in the large intestine, it is possible to decrease risks of laminitis and founder. With the recent research and knowledge developed over the past 20 years, it is now time to use the information about ingredients, nutrients, feed processing, beneficial compounds, and organisms to support the most delicate and important system in your horse’s body. EQ8™ Gut Health has taken “horse feed” to the next level.

General guidelines for a healthy horse

- Provide your horse with clean water at all times and track consumption.
- Supply a minimum of 1% of your horse’s bodyweight in good quality forage.
- Make feed changes gradually, including forage.
- Horses are creatures of habit. Keep your horse on a routine, whether it is exercise or feeding times, to minimize stress.
- Feed by weight, not volume. Utilize pounds rather than “scoops” or “handfuls”.
- Feed according to body condition and workload to ensure your horse receives its nutritional requirements.
- Maintain a schedule for vaccinations, worming, and dental care.
"I love the idea that there are live probiotics in this feed. I work my horses very hard and they do compete regularly, so I like the extra assurance that this feed will keep my horse's digestive system healthy when they're stressed. Feeding EQ8™ Gut Health helps me ensure that my horses are healthy enough to give me their best performances without me having to buy any extra supplements."

"I have a 35-year-old horse who was my first love. Before I switched his feed to EQ8™ Gut Health, he was very inactive and just never looked happy. After about 6 weeks on EQ8™ Gut Health, he would actually trot around the pasture. I haven't seen him this active in a long time."

Lara Anderson at Full Gallop Farm in Aiken, SC.

"We had one horse who had chronic ulcers and always had a soft, runny stool. We kept him on a popular digestive supplement to try to manage it. After 10 weeks on EQ8™ Gut Health, his stool firmed right up and we were able to take him off the supplement."

Mike McCormick, McCormick Training Center in Shelbyville, TN

"The palatability of EQ8™ Gut Health was excellent. Even my most finicky horses ate the feed extremely well and never turned away from it."

Jaron Gold, Gold's Farm in Ira, MI

"The biggest change I saw in my horses after they were on EQ8™ Gut Health was in their topline and haircoat. I noticed that my horses really filled out across the back and rump and had a much better overall body shape. I also noticed that my older horses seemed happier and were much more active after switching to EQ8™ Gut Health."

Dawn Smith, Lone Cedar Stable in Hannibal, MO
7 Solutions and Product Information

1 Brain & Behavior:
EQ8™ Gut Health is low in starch and sugar - NSC averages 23%.

EQ8™ Gut Health promotes smarter, calmer behavior

2 Stomach:
EQ8™ Gut Health is high in oil and low in starch and sugar with a reduced feeding rate.

EQ8™ Gut Health helps to reduce risk factors associated with ulcer formation

3 Small Intestine:
EQ8™ Gut Health is fortified with prebiotics.

EQ8™ Gut Health promotes the growth and health of good bacteria to protect the small intestine

EQ8™ Gut Health contains live probiotics to ensure the bacteria reach the small intestine.

The probiotics in EQ8™ Gut Health line the small intestine and block bad bacterial attachment

EQ8™ Gut Health helps limit hindgut imbalance

4 Large Intestine:
EQ8™ Gut Health is high in digestible fiber to stimulate fiber bacterial growth and limit lactate production.

EQ8™ Gut Health elevates the pH level, creating a more stable microbial ecosystem

5 Working Together:
EQ8™ Gut Health contains elevated vitamin and mineral levels to support digestive tract immunity.

Elevated vitamin and mineral levels ensure digestive tract immunity can keep out and fight harmful compounds
**GUARANTEED ANALYSIS**

Crude Protein  Min. 12.00%
Lysine       Min. 0.60%
Methionine   Min. 0.18%
Threonine    Min. 0.40%
Crude Fat    Min. 8.00%
Crude Fiber  Max. 12.00%
NSC (starch plus sugar)* Max. 23.00%
Calcium      Min. 0.70%
Phosphorus   Min. 0.65%
Potassium    Min. 0.85%
Magnesium    Min. 0.30%
Manganese    Min. 95 ppm
Copper       Min. 40 ppm
Zinc         Min. 140 ppm
Selenium     Min. 0.6 ppm
Vitamin A    Min. 6000 IU/lb
Vitamin D    Min. 600 IU/lb
Vitamin E    Min. 300 IU/lb
Ascorbic Acid (Vitamin C) Min. 65 IU/lb
Total micro-organisms*      Min. 100,000,000 CFU/lb.

* Not recognized by AAFCO as an essential nutrient

**INGREDIENTS**

Wheat Middlings, Soybean Hulls, Kibbled Corn, Heat Processed Soybeans, Dried Beet Pulp, Soybean Oil, Dehydrated Alfalfa Meal, Oat Mill By-Product, Flax Seed, Cane Molasses, Calcium Carbonate, Calcium Phosphate, Salt, Magnesium Oxide, Potassium Sulfate, Magnesium Sulfate, Manganese Oxide, Ferrous Sulfate, Copper Sulfate, Zinc Sulfate, Manganese Proteinate, Iron Proteinate, Copper Proteinate, Zinc Proteinate, Cobalt Sulfate, Ethylenediamine Dihydriodide, Calcium Iodate, Selenium Yeast, Sodium Selenite, Yeast Culture, *Saccharomyces cerevisiae* Yeast Culture, Vegetable Fat Product (Feed Grade), Lecithin, Glycerin, Phosphoric Acid, Propronic Acid, Sodium Benzoate, Acetic Acid, Sulfuric Acid, Vitamin A Supplement, Vitamin D3 Supplement, Vitamin E Supplement, Ascorbyl-2-Polyphosphate, Thiamine Mononitrate, Riboflavin, Niacin, Pyridoxine Hydrochloride, Folic Acid, Biotin, d-Calcium Pantothenate, Vitamin B-12 Supplement, Choline Chloride, *Lactobacillus acidophilus*, *Enterococcus faecium*, *Pediococcus acidilactici*, *Lactobacillus brevis*, *Lactobacillus plantarum*. 
8 Nutritional Situations

1100 lb horse traveling to shows
  • 6 lbs of EQ8™ Gut Health
  • 19 lbs of grass hay

1000 lb Quarter Horse mare in moderate work with an attitude
  • 6 lbs of EQ8™ Gut Health per day
  • 20 lbs of grass hay

1100 lb Thoroughbred gelding in advanced dressage
  • 9 lbs of EQ8™ Gut Health per day
  • 29 lbs of grass hay
1000 lb mare with a history of colic at maintenance
- 3 lbs of EQ8™ Gut Health per day
- 15 lbs of grass hay and pasture

1100 lb gelding prone to laminitis (harder keeper)
- 4 lbs of EQ8™ Gut Health per day
  - 20 lbs of grass hay

1100 lb Thoroughbred gelding, prone to ulcers
- 8 lbs of EQ8™ Gut Health per day
  - 16 lbs of grass hay
Appendix

Glossary

Absorption - Movement of nutrients through the wall of the gastrointestinal tract and capillary walls into the circulatory system

Acidophilus Bacterial Genera - A general name for a group of probiotics which contain one or more than one bacterial species which aid in digestion

Bicarbonate - A salt ion that plays a crucial role in the physiological pH buffering system (neutralizer)

Bifidus Bacterial Genera - Naturally occurring species of beneficial bacteria found in the intestine of most mammals; utilized as a probiotic

Butyrate - A volatile fatty acid that is thought to support gut health

Cardiac Sphincter - A valve that separates the esophagus and stomach regions and prevents flow of digesta from stomach to esophagus

Cecum - A large compartment of the intestinal tract that contains many bacteria that digest much of the cellulose or fiber in feeds that the animal ingests

Colic - Clinical signs of abdominal pain resulting from potentially life-threatening diseases of the stomach or intestinal tract. Nutritional causes of colic include inadequate fiber intake, low blood magnesium, or excess grain, sodium or Vitamin K

Colon - A portion of the large intestine or terminal portion of the digestive tract which extends from the cecum to the rectum

Coprophagy - A habit prone in foals pertaining to eating feces

Cortisol - A hormone referred to as the “stress hormone”, as it is involved in response to stress and anxiety

Digesta - Contents of the digestive tract including feed, digestive juices, bacteria, etc

Enzyme - An organic catalyst that speeds up or slows a chemical reaction without being used up in the reaction

Esophageal - Of or pertaining to the esophagus

Extrude (Extrusion) - Process of forcing feed through small openings under high pressure. When feed comes out of the opening, the sudden release of pressure causes the feed to expand. This process creates highly digestible kibble

Fermentation - Process of producing energy from the oxidation of organic compounds, such as carbohydrates

Fructo Oligosaccharides - A short chain sugar molecule known for its prebiotic benefits as it serves as a substrate for many bacterial species in the large intestine

Gastrointestinal Tract - The system of organs that takes in food, digests it to extract energy and nutrients, and expels the remaining waste. Comprised of the foregut, midgut, and hindgut

Gelatinization - The process of breaking down the intermolecular bonds of starch molecules in the presence of water and heat, allowing the hydrogen bonding sites to engage more water, and thus improve digestion

Hindgut - The portion of the digestive tract that includes the cecum and the colon, the main site of microbial fermentation of fiber

Insulin - A hormone with extensive effects on metabolism. Insulin causes cells to take glucose (sugar) from the blood and storing it as glycogen in the liver and muscles to stop the use of fat as an energy source
Laminitis (Founder) - An inflammation of the laminae of the horse’s foot creating swelling between the bone and hoof causing pressure, pain, and tissue damage. This results in separation of the hoof wall from the laminae, and could cause the coffin bone to penetrate the sole

Large Intestine - See Hindgut

Mannan Oligosaccharides - A short chain sugar molecule known for its prebiotic benefits as it serves as a substrate for many bacterial species in the large intestine

Passage Rate - The time it takes for feedstuffs to travel through the gastrointestinal tract

Pituitary Gland - A small gland at the base of the brain that produces hormones

Prebiotic - A fermented ingredient that allows specific changes, both in the composition and/or activity in the gastrointestinal microflora that confers benefits upon host well-being and health

Probiotic - An organism containing live bacteria used to restore beneficial bacteria in the horse’s body

Pyloric Sphincter - A strong ring of smooth muscle in the stomach that allows food to pass into the small intestine at a controlled rate

Readily Available Starch - The gelatinized fraction of measured starch

Ruminant - An animal (cattle, sheep, deer, goats, etc.) that is able to regurgitate its food

Small Intestine - A part of the gastrointestinal tract between the stomach and the large intestine where a majority of digestion takes place

Ulcers (Gastric) - Lesions formed in the lining of the stomach or duodenum

References

Quality. Innovation. And 100 years of American tradition.

It’s a lot to fit into one bag. But that’s exactly what you get with every BUCKEYE® Nutrition product. Our history of manufacturing animal feeds dates back to 1910. Our focus on innovation and technology has allowed us to evolve to where we are today. And our commitment to quality will continue into the future.

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