

UNDERSTANDING THE STABLED SPORTS HORSE'S *GUT & GUT HEALTH*

By Enid Norton

Equines are herbivores and have a complex digestive system to break down and digest nutrients from plant material. The horse's digestive system is large, complex and sensitive to change. Horses are mono-gastric, meaning their stomach has a single compartment.

Horses forage for approximately 16-18 hours per day in their natural habitat, better known as trickle feeding. Domesticated sports horses are offered a variety of feed, often containing starch and GMO grains which are not easily digestible. They also have a less natural lifestyle which doesn't allow for 24/7 grazing and roaming. When horses are fed in a manner that deviates from this natural grazing behavior, it can disrupt their digestive health, potentially leading to conditions such as impaction colic, gastric ulcers, or imbalances in the hindgut microbiome.

The equine gastrointestinal digestive tract digests portions of feed enzymatically, first in the foregut and then ferments in the hindgut.

Always be sure of what you add to your horse's diet and if it is not an essential nutrient or intestinal protectant, consider leaving it out.

Good management practices and balanced diet have everything to do with how a horse behaves and it's durable health.

THE DIGESTIVE TRACT

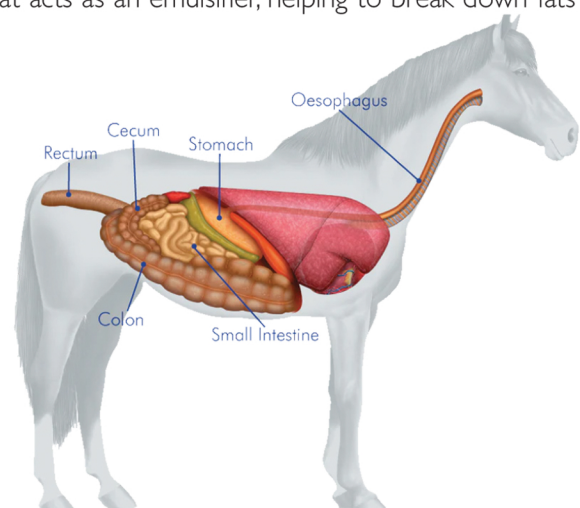
1. The Mouth - the whiskers start the digestive process by means of feeling the food source. The upper lip moves the forage to the incisors to cut while the tongue moves the food to the molars for grinding, better known as mastication. Grinding the forage activates the salivary glands to secrete saliva to lubricate the chewed food forming a bolus. The saliva contains bicarbonate which buffers the food from the stomach acids.

2. The Oesophagus & Cardiac Sphincter - the oesophagus is a muscular tube that moves the bolus downward toward the stomach by means of peristalsis contractions. The bolus is then passed through the cardiac sphincter, a one way valve, into the stomach. The sphincter's strength prevents the horse from vomiting, basically enforcing a one-way tract which in turn allows for a higher risk

tendency to colic episodes or distension of the stomach.

3. The stomach - the horse's stomach is a sac like structure and is relatively small in comparison to the horse's overall bodily structure and has a limited ability to expand within the abdominal cavity. The stomach capacity is roughly between 8-12 litres, translational to frequent small meals, suitable to the general small expansion abilities of the stomach. Proteins & fats start to get digested in the stomach yet hardly any or very little nutrient absorption occurs at this stage. The stomach is split into two sections which are both lined differently; the upper part, known as the squamous mucosa and the lower part known as the glandular mucosa. The glandular mucosa secretes stomach acid and enzymes to help start the digestion process. The glandular mucosa is lined with a thick layer of mucus to protect the stomach wall. Hydrochloric acid is continuously secreted by glands that start the breaking down of food. The acid continues to be produced even when the horse isn't eating. Gastric ulcers become an increased risk when natural feeding habits aren't replicated. The stomach empties through the pyloric sphincter into the small intestine.

4. The small intestine - the small intestine is made up of 3 sections, the duodenum, jejunum and ileum. The lining of the small intestine consists of finger-like projections called villi that increase the surface area available for absorption of nutrients. The duodenum is the start of the small intestine and is approximately one metre long. Here the food is broken down into basic nutrients by the enzymes secreted by the liver and pancreas. Horses do not have a gall bladder to store bile so the liver continuously keeps producing it. Bile is a digestive fluid, not an enzyme, that acts as an emulsifier, helping to break down fats for





digestion and absorption, rather than directly catalyzing chemical reactions like enzymes do. Digestion of proteins, fats and hydrolyzable carbohydrates, such as those found in grain, takes place mainly in the foregut. Next the food passes through to the jejunum. The jejunum is more folded and finishes off most of the digestive process by using enzymes. Here starches, proteins and fats are absorbed into the bloodstream through the gut lining. These nutrients are either used straight away or stored in the liver. The final part of the small intestine is the ileum which is approximately one metre in length. The ileum controls the passage of food to the large intestine, continuing the absorption of nutrients process. The only non digested matter remaining at this stage are fibres and water. Trickle feeding is always recommended to allow for rapid digestion. The relation between food volume and passage time through the small intestine can limit the digestion process and later cause problems in the large intestine.

5. Large intestine - the large intestine makes up the hind gut. It is made up of four parts, the caecum, large colon, small colon and rectum. It is here that structural carbohydrates, such as those found in stemmy grasses, are digested and waste products are eliminated from the body. The majority of the horse's dietary energy comes from fermentation of structural carbohydrates/fibre in the cecum and the colon. The approximate length is about eight meters long. The caecum is an essential part of the digestive system and can hold a volume of approximately 35 litres. The caecum contains millions of essential specially adapted bacteria called gut flora. The gut flora break down fibre. Gut flora are incredibly sensitive which is why any dietary changes should be made gradually and over a few days. Sudden dietary change may cause diarrhoea, colitis, colic and even laminitis. The gut flora break down fibre by fermenting it. This creates heat and acts as the horse's inbuilt central heating system. Should undigested starch from the small intestine enter the caecum, the flora rapidly breaks it down creating lactic acid. This lactic acid can cause the environment to become too acidic killing off the vital bacteria and may cause acidosis of the gut lining. From the caecum, the food material passes into the large colon which is approximately 3.5 metres long and can hold about 90 litres. The large colon folds tightly with tight turns in a small restricted area. This makes it vulnerable to food becoming stuck and resulting in impaction colic. Large amounts of water get absorbed in the large colon

while it continues to absorb water and electrolytes. At this point any food matter remaining passed into the rectum where the faecal balls form. The rectum is around 30cm long and passes to the anus which expels faeces.

NUTRITIONAL REQUIREMENTS OF THE HORSE

1. Fiber - found in hay, grass, pasture and other plant materials. Fibre aids in maintaining healthy gut motility and blood sugar levels. Horses should consume approximately 2 % to 2.5% of their body weight in dry matter (forage) per day, depending on their condition and workload.

2. Protein - Essential for muscle growth and maintenance. Proteins aid in building and repair of muscles, tendons, and ligaments as well as providing a source of amino acids

3. Energy - Derived from carbohydrates, fats, and fiber.

4. Vitamins and Minerals - Crucial for various bodily functions.

5. Calcium and Phosphorus - these are essential for bone growth and maintenance.

6. Concentrates - grains and supplements are used to supplement the diet and meet specific needs, such as energy for working horses or protein for growing foals. Horses require different energy levels depending on age, breed, and activity level. To calculate what a horse needs, we can use the Nutritional Requirement Calculator.

NUTRITIONAL REQUIREMENT CALCULATOR

To determine your horse's nutritional needs, you can use online calculators such as FEED XL HORSE NUTRITION CALCULATOR

Using Nutrition Calculators the input information you would typically require would be:

- Horses body weight
- Horses activity level/ work load - Is the horse in light work, moderate work, heavy work or normal maintenance
- Physiological status - Is the horse in foal, lactating, growing or a stallion.
- Type of concentrates and volume the horse is being fed
- Type of forage and volume the horse consumes

The nutritional requirement calculation will determine and recommend the daily forage intake, concentrate requirements and the nutrient requirements to adequately support the horse's daily needs for energy, protein, vitamins, and minerals.

It's important to treat each horse as an individual and calculate its nutritional requirements based on their breed, health, workload & age.

Should you have specific concerns about your horse's nutrition, consulting with a veterinarian or equine nutritionist is imperative.

PRACTICAL STRATEGIES TO KEEP YOUR HORSE'S GUT HEALTHY

- Provide high-quality forage
- Minimize fasting periods. Horses are trickle feeders, their intestines flourish best when there is access to ad-lib hay or pasture
- Feed small & frequent meals
- Limit the intake of grains to prevent hindgut disruption
- Ensure adequate water supply
- Feed salt to encourage hydration
- Use supplements to fill gaps in the diet.
- Feed a minimum of 2% of a horse's body weight per day in forage
- Ensure that the horse's diet stays consistent.
- Decrease or eliminate concentrate feeds consisting of high starch percentages in the horse's diet.
- Starches found in oats, corn, or barley have an adverse impact on intestinal microbes.
- Digestive aids may be useful during stressful situations like travel, competition, use of NSAIDs or antibiotics, changes in routine, ownership, and environment.
- Intestinal aids include probiotics, prebiotics, and postbiotics.
- Prebiotics are a non-digestible feed ingredient that serves as food for beneficial intestinal organisms such as quality forage, beet pulp and psyllium.
- Probiotics are live organisms with beneficial properties for intestinal health and digestion. Examples include Lactobacillus and Enterococcus which are lactic-acid-producing bacteria. Yeast also provides probiotic functions, particularly for fiber digestion.
- Postbiotics are compounds that are released from the intestines after gut microbes feed on fiber.
- Provide ample turnout to limit the duration of confinement, free choice exercise, mental stimulation and herd socialisation
- Provide routine dental care to support chewing
- Conduct routine fecal egg count tests to check for parasites
- Feed digestive supplements to maintain gut health

HIGH RISK FACTORS DUE TO GUT DISORDERS IN HORSES

- **ULCERS** - Intermittent feeding leaves the stomach empty and exposed to the continuous production of stomach acid leading to gastric ulcers. Feeding small, frequent meals of forage, provides a buffering effect so the average pH of the stomach remains above 4.0, this reduces the risk of ulcers from excess stomach acidity.
- **ACIDOSIS** - The pH level in the hindgut must be maintained above 6 to ensure a viable microbiome for effective fiber fermentation. In horses with healthy digestive systems, the pH is between 6.4 and 6.7. Horses with a pH lower than 6 are considered to be too acidic which can lead to proliferation of undesired microorganism and inadequate populations of desired ones.
- **OSMOTIC DIARRHEA** - Imbalances in the gut microbiome increase the risk of osmotic diarrhea

• **ENDOTOXEMIA** - a serious condition characterized by the presence of bacterial endotoxins in the bloodstream. Endotoxins are released when bacteria die, and then dissociated endotoxins are able to cross the gastro-intestinal barrier to end up in the bloodstream. The presence of lipopolysaccharides in the bloodstream is defined as endotoxemia

* **EQUINE METABOLIC DISEASE** - characterised by insulin dysregulation, obesity or localized fat deposits acting as a predisposition to laminitis. These horses have difficulty regulating blood insulin levels, leading to insulin resistance.

• **LAMINITIS** - commonly results from endocrine diseases such as equine metabolic syndrome or pituitary pars intermedia dysfunction or excessive sugar intake from grain or lush pasture. Other causes can include weight bearing on supporting limbs due to injury. Laminitis is irreversible, however with prompt treatment and appropriate rehabilitation, the majority of horses recover from laminitis and can return to light work within two to three months. Once a horse has experienced laminitis as a result of elevated insulin in metabolic syndrome or PPID, the chance of recurrence increases.

• **COLIC** - key gut disorders that can lead to colic in horses:

Impactions:

* **Sand Colic:** Accumulation of sand in the large intestine, especially in horses grazing on sandy pastures. A quick home check, soak faeces in a bucket of water and check for sand residue

* **Feed Impactions:** Undigested or poorly digested feed material, particularly grains, can become lodged in the intestines.

* **Gastric Impaction:** A buildup of undigested food in the stomach.

* **Enteroliths:** these are stones that form in the large intestine, particularly in the right dorsal colon which can cause either a partial or full blockage of the intestine

* **Gas Colic:** Excessive gas buildup in the stomach and intestines, often due to changes in diet, moldy feed, or excessive grain intake. Spasmodic colic, is a common



type of colic characterized by painful contractions of the intestines.

* **Intestinal Twisting or Displacement:** Volvulus - is the twisting of the intestines around its attachment point, which can restrict blood flow and cause severe damage. Displacement -

is when the intestines can shift out of their normal position, leading to blockage and colic.

* **Volvulus:** Twisting of the small intestine, potentially leading to obstruction

* **Incarceration:** Parts of one intestinal structure get trapped in its own folds or the folds of another structure

* **Intussusception:** A section of intestine telescopes inside itself

• **INFLAMMATORY BOWEL DISEASE** - IBD involves inflammation of the intestinal lining, which can disrupt digestion and nutrient absorption often presenting as recurrent colic, weight loss and reduced performance.

• **BOWEL WALL THROMBOSIS** - formation of blood clots (thrombosis) within the blood vessels of the bowel wall. This is a serious condition with a high mortality rate in horses. Horses with colitis and bowel wall thrombosis may exhibit persistent pain, ileus (loss of bowel function), abdominal distension, and potentially die from toxemia (blood poisoning)

• **SALMONELLOSIS** - Infection with Salmonella bacteria, which can cause diarrhea and inflammation of the intestines.

• **CLOSTRIDIAL ENTEROCOLITIS** - Infection with Clostridium bacteria which can produce toxins that damage the intestinal lining.

• **RHODOCOCCUS EQUI** - A bacterial infection that causes inflammation of the intestines

GUT HEALTH & HOOF QUALITY

The horse's gut health and hoof health are closely linked and affects the quality of the hooves. A healthy gut enables your horse to digest and absorb important nutrients such as biotin, zinc, copper and amino acids properly. If the gut is compromised by an imbalance of gut bacteria or poor-quality forage, the nutrient supply to the hooves will be disrupted. Horses with chronic gut issues often have hoof problems. Poor gut health often leads to a lack of the protein keratin which supports strong, healthy hooves. A poor production of keratin leads to weak, brittle hooves that are prone to cracks and splits.

DID YOU KNOW THAT THE GUT IS REFERRED TO AS THE SECOND BRAIN OF THE HORSE?

The intestinal microbiome in the gut links the horses nutrition and general health. These microbes harvest nutrients and extract energy from the feed. Bacteria, fungi, viruses & parasites form microbial communities in the intestines.

A healthy gut relies on a balance between beneficial and pathogenic microbes. Healthy microbiome promotes the efficient digestion and nutrient absorption, it also resists colonization by pathogens, generates antimicrobial products and creates a barrier against toxins. It also forms a complex immune system responsible for the horse's

overall development of immune responses.

The intestinal tract and the brain's connection is referred to as the gut-brain axis, linking the enteric intestinal nerve complex and the central nervous system together. Gastrointestinal activity and the microbes influence brain neurochemistry, affecting mood & behaviour. The horse's mental comprehension, emotions, coping mechanisms and appetite are all connected through the gut-brain axis.

INTERESTING GUT-BRAIN AXIS CORRELATIONS

* When a horse is in a state of stress or anxiety, the digestive track slows down allowing crucial blood flow to the major organs allowing for flight or fight response or natural survival mechanisms.

* Intensity and type of exercise also affects the microbial gut population.

* Bacteria in the gut are critical to the development and maturation of both the enteric and central nervous systems.

* Neurotransmitters synthesise serotonin (a feel good hormone), dopamine and opioids.

* Stress increases the release of epinephrine and norepinephrine into circulatory system resulting in gut dysbiosis.

* Stress may increase the probability of "leaky gut", a leakage of bacteria past weakened junctions between intestinal cells causing pronounced proinflammatory response, chronic systemic inflammation, behavioural changes and anxiety.

* The parasympathetic nervous system works to balance the sympathetic nervous system by controlling digestion, lowering blood pressure, slowing the pulse, saving energy, and allowing for rest and digestion.

* Norepinephrine promotes the survival of pathogenic bacteria, increases blood pressure, increases heart rate and causes a horse to become hyperactive, anxious, irritable and prone to sleep disturbances.

