

# FOOD

*Understanding the equine digestive system can make your horse healthier and give you fewer worries about gastric upset*

# Factory

BY LES SELNOW

**T**he equine digestive system is a complicated factory that is designed to process small amounts of food frequently and convert them into nutrients that can be absorbed and produce energy. The same, concerning the end result, could be said of the cow, pig, dog, cat, or even man. But, the horse's digestive system is unique, and perhaps more prone to problems than most others.

This is not because of poor design, but is the result of humans changing what nature intended for the horse.

In the wild, horses have little to do but eat, stay out of the way of predators, and procreate. This means they range across the countryside, selecting immature forages that are easy to digest. They graze as they roam, consuming small amounts of food throughout the day and even at night. Under this scenario, there are few digestive problems.

However, man has altered Nature's scheme. First, he often adds workloads that require more than just grass to provide the necessary nutrition. Second, in many cases, all choices have been taken from the horse. He no longer roams at will, picking out choice spots for grazing. Instead, he is confined to pastures or paddocks where there might be little to choose from in the way of food. He eats what is there or is provided by his caretakers.

Because his owners or caretakers often have busy schedules, the horse no longer is able to eat small amounts frequently. Instead, he usually is fed a large quantity of food, and that sometimes occurs only once each day.



DR. ROBIN PETERSON ILLUSTRATIONS

## **Editor's Note**

*This is the tenth article in a 12-part series on equine anatomy and physiology. Future topics include the circulatory and respiratory systems and the reproductive system.*



What all this adds up to is an assault on the horse's digestive system that it typically can't handle, and problems such as colic and founder can be the result.

There is information available about nutrient needs for various levels of activity

and conditions. For example, the working horse has different requirements than one turned out to pasture, and the lactating mare has different needs than the gelding being used for trail riding.

There also is a strong and growing emphasis on frequent feeding of small amounts of feed instead of large single portions.

In this article on the digestive system, we'll take a look at just how this "factory" is designed and how it functions. Knowledge of the factory is step number one in deciding how nutrient needs can be

met for individual animals.

### The Mouth

A discussion of the digestive system must begin with the mouth, because it is here that digestion gets under way.

There are three salivary glands in the horse's mouth, which can produce up to 10 gallons of saliva per day. A prime purpose of saliva is to mix with the feed being consumed so it can be formed into what amounts to moist, loosely formed balls that are easily swallowed.

There are two ingredients in saliva that help to launch the digestive process. One ingredient is bicarbonate, which buffers and protects against amino acids in the stomach. Saliva also contains small amounts of the enzyme amylase. This ingredient assists with carbohydrate digestion.

When on pasture, the eating process begins when the horse grasps grass by using a combination of the lips, tongue, and teeth. It was estimated by one researcher that the average horse will take about 60,000 "jaw sweeps" (chewings) per day when grazing. This amount, of course, will be dramatically decreased when the horse is confined and fed hay and grain.

Incidentally, the way in which a horse is fed can have a profound bearing on the condition of the teeth that are used for grinding. Because there is not as full a jaw sweep when consuming hay and grain as when grazing, the confined horse often develops sharp edges that can hinder proper chewing.

### Esophagus

The esophagus is a simple muscular tube that is between 50 and 60 inches in length, and it conveys food from the mouth to the stomach. When the horse is consuming grass and even hay, few problems involving the esophagus occur. However, when fed crunch items, such as carrots or apples, there can be problems with pieces becoming lodged if the horse does not masticate (grind or crush) the food properly.

The same can happen when consuming grain if the horse "bolts" food (consumes its food in a hurry) without chewing it properly. Because the horse has very little reflux capability, choking on food can have serious consequences.

### Stomach

The stomach of the horse is very small in relation to the overall size of the animal, and it makes up only about 10% of the capacity of the entire digestive system. The

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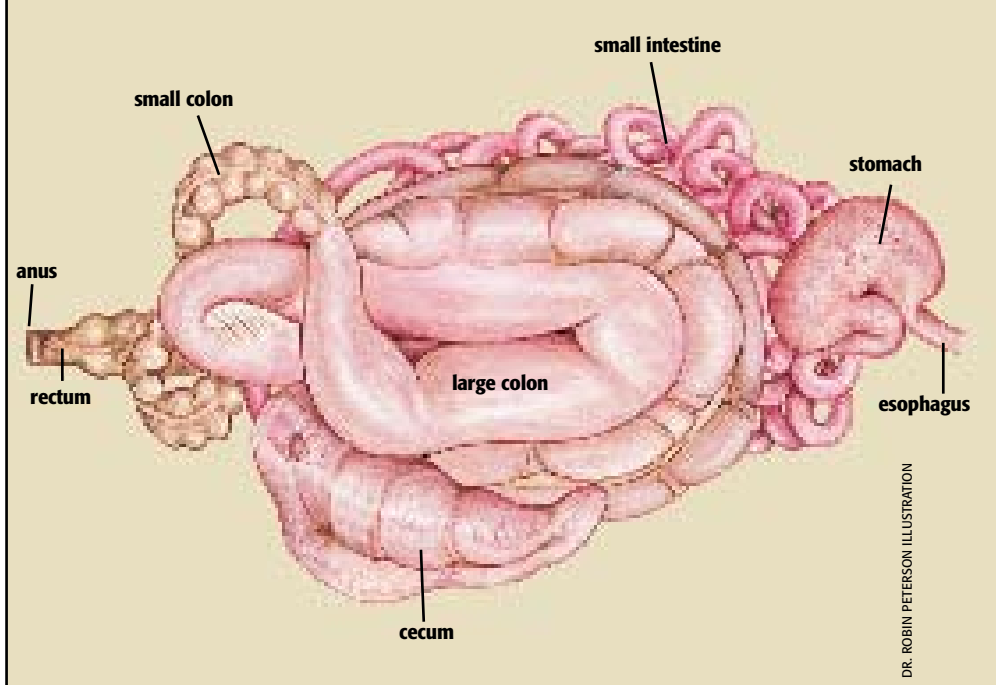
**Notebook Ultrasound**

stomach can vary in size from eight to 16 quarts. However, it appears to function best when only about three-quarters full—another strong argument for frequent meals containing small quantities of feed.

Food passes through the stomach quite quickly. In fact, by the time a horse has finished with a meal, under some circumstances, the first part of the meal consumed might already be leaving the stomach. That time often is as little as 15 minutes. While in the stomach, the food is mixed with pepsin (an enzyme utilized in the digestion of protein) and hydrochloric acid (which helps to break down solid particles).

The stomach has three main regions—saccus caecus, fundic, and pyloric. The saccus caecus region is located near the spot where the esophagus enters the stomach. It is here where hydrochloric acid first mixes with food and slows the fermentation process that began with the release of soluble sugars from the food in the horse's mouth.

It is important that there is very little fermentation in the stomach as it will cause the formation of gas, and the horse has little capability to belch or otherwise dissipate accumulating gas.



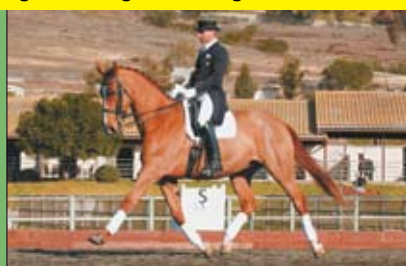
The second area is the fundic region. There the level of fermentation decreases even more. The third and final area is the pyloric region, where the stomach joins the small intestine. At this point the fermentation has almost ceased, but protein digestion increases.

Still another argument in favor of frequent feeding of small amounts of food

is that the stomach does not do well when empty. There are strong acids at work in the stomach, but when there is an even flow of food, the stomach acid is put to positive use in the digestion of fats and amino acids. However, when the stomach is empty, the acid attacks the unprotected squamous cells in the saccus caecus region of the stomach (the non-glandular

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area of the stomach).

These attacks frequently result in the horse developing ulcers that can affect the animal's performance, appetite, and/or behavior.

### Small Intestine

The partially digested food from the stomach passes into the small intestine that represents approximately 28% of the horse's digestive system. Basically, the small intestine is the tube that connects the stomach with the large intestine. On average, it is about 70 feet long and three to four inches in diameter when distended. It has a capacity of about 12 gallons.

Although there are few similarities between the digestive systems of cows and horses, the small intestine of each has about the same capacity. However, the cow's small intestine is nearly twice as long, but only

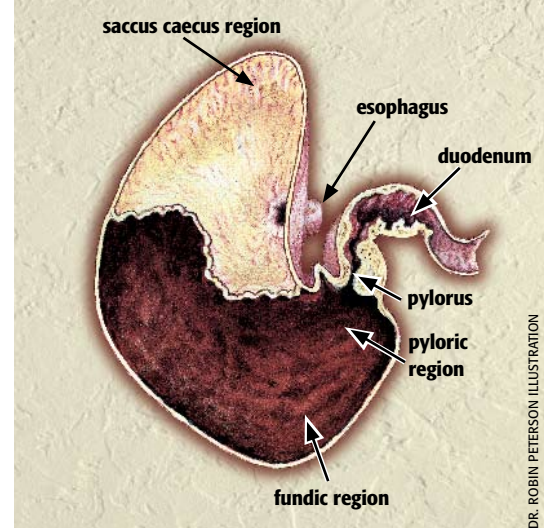
about half as wide in diameter.

It is in the small intestine of the horse that serious digestive processes take place. The intestine itself secretes enzymes to facilitate the process, but the prime supplier is the pancreas, which provides enzymes that break down proteins, fats, starches, and sugars.

Pancreatic enzymes help digest the food while carbohydrates digest sugars and starches, and proteases break proteins down into amino acids. At the same time, lipases and bile from the liver are added to emulsify fats (make globules and suspend them as particles) in water.

The horse does not have a gall bladder (which stores bile), so bile from the liver flows directly into the small intestine.

Once the digestive process in the small intestine reaches a state of completion, the food is absorbed through the walls of the small intestine and is carried off by the bloodstream. Between 30-60% of carbohydrate digestion and absorption, and almost all amino acid absorption, occur in the small intestine. In addition, vitamins A, D, E, and K are absorbed in the small intestine, as are some minerals, such as calcium and some phosphorus.



DR. ROBIN PETERSON ILLUSTRATION

It generally takes food 30 to 90 minutes to pass through the small intestine. The faster the food moves through the small intestine, the less time there is for the enzymes to perform their digestive tasks.

Horses are susceptible to a variety of ailments, including colic, if they ingest toxic materials. The reason is basic. With cows, the action within the rumen can detoxify feed before it reaches the small intestine. With the horse, this is not an option and the toxic material lands in the small intestine in an unaltered state and is absorbed into the bloodstream before it can be detoxified.



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## Large Intestine

There are five basic parts to the large intestine. They are the cecum, which is about four feet long and one foot in diameter; the large colon, which is about 12 feet long and 10 inches in diameter; the small colon, which is about 10 feet long and four inches in diameter; the rectum; and the anus.

The cecum can hold eight to 10 gallons of food and water. It is in the cecum that undigested food from the small intestine, such as hay and grass, is broken down.

The cecum is an odd-shaped organ with both the entrance and the exit being at the top. Food enters at the top, is processed, and then leaves the cecum by the same route. If a horse consumes a heavy diet of dry food matter without adequate water, impaction can occur in the lower end of the cecum, which can cause colic.

The cecum and other components of the large intestine contain active populations of bacteria and microbes that break down food through a fermentation process. Food will remain in the cecum for up to seven hours, allowing the bacteria and the microbes to handle their phase of the digestive process. Vitamins and fatty acids

that result from the fermentation process are absorbed in the cecum.

The microbial populations within the cecum become specific for digestion of the type of food that the horse normally ingests. It's very important to change a horse's diet gradually in order to give the microbes an opportunity to adjust, which could take several weeks.

Microbial digestion continues in the large colon. A large share of the nutrients that result from microbial digestion absorbed here are B-group vitamins, along with some minerals and phosphorus.

It is in the large colon that a "twisted gut" usually occurs. The large colon consists of right and left ventral colons and the dorsal colon. The ventral colons have a sacculated construction, which means there are a series of pouches involved. The structure is designed to efficiently digest large quantities of fibrous materials, but the pouches or sacs can become twisted and can fill with gas during the fermentation process. The result, in either case, can be a serious case of colic.

By the time food reaches the small colon, nearly all of the nutrients have been digested. Basically, what remains is matter that is

not digestible by the horse. The prime function of the small colon is to reclaim excess moisture and return it to the body. In the process, fecal balls are formed, which can be passed through the rectum and are expelled out the anus.

The whole process of ingesting food, digesting it, and expelling waste material can take from 36 to 72 hours on average.

## Take-Home Message

The horse's digestive system is a complex grouping of organs that is designed for the free-grazing animal. Because of man's constraints on the movement and feed choices of domestic horses, problems can arise.

Horse owners who understand how the digestive system works can better manage their horse's feeding to get the best nutrition, with the least complications. ◀

## ABOUT THE AUTHOR

*Les Sellnow is a free-lance writer based near Riverton, Wyo. He specializes in articles on equine research, and he operates a ranch where he raises horses and livestock. He has authored several fiction and non-fiction books, including Understanding Equine Lameness, Understanding The Young Horse, and The Journey of the Western Horse, published by Eclipse Press and available at [www.ExclusivelyEquine.com](http://www.ExclusivelyEquine.com) or by calling 800/582-5604.*



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