



# BASIC HORSE NUTRITION

## The Digestive System

**Wallace Eide**  
Extension Livestock Specialist

**W. E. Dinusson**  
Professor of Animal Science

**Larry Insley**  
Animal Science Graduate Student

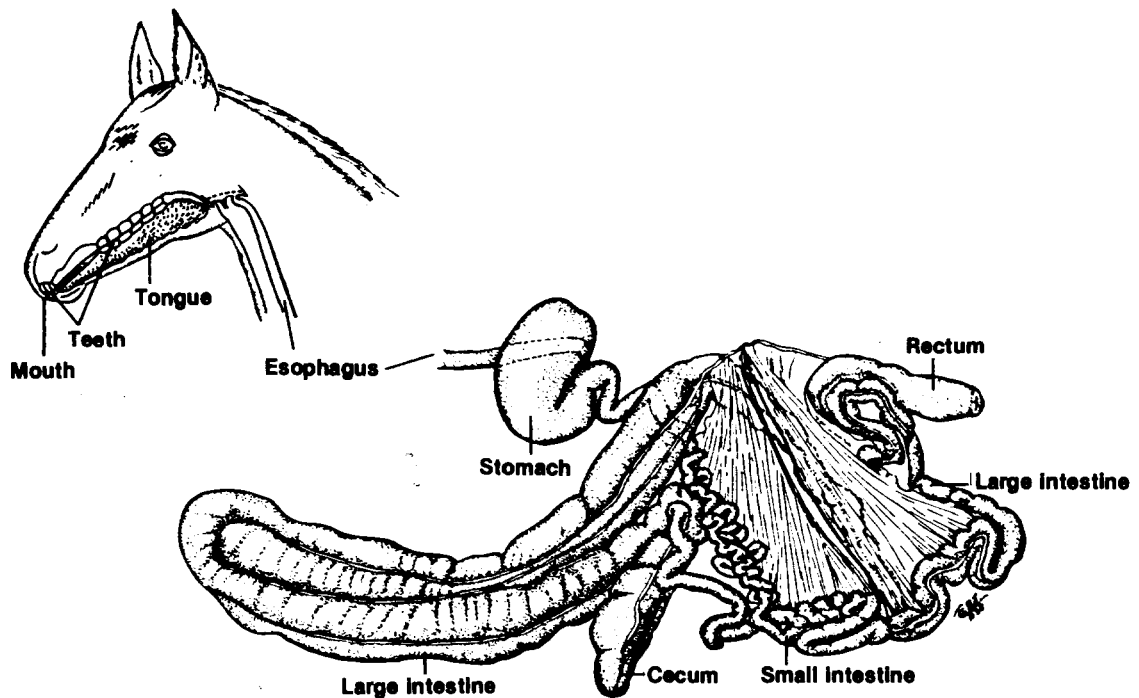
The horse is classified as a simple-stomach animal. Other species which have a simple-stomach classification are man, swine and dogs. The horse is also a herbivore (forage consumer) like cattle and sheep and the digestive tract design is similar to that of a rabbit.

A working knowledge of the unusual digestive system of the horse is essential for the producer who wants to properly feed and care for the horse.

The majority of the day-to-day feeding practices are based on the horse's unusual digestive system.

The digestive system is composed of the alimentary canal and accessory organs. The alimentary canal is a hollow muscular tube consisting of the mouth, pharynx, esophagus, stomach, small intestine, cecum, large intestine, rectum and anus (Figure 1). The accessory organs are teeth, tongue, salivary glands, liver and pancreas.

Figure 1.



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Understanding horse nutrition begins at the mouth. The mouth is important for grasping and chewing feed. The horse uses its upper lip as the main structure to grasp feed; forages are pulled into the mouth by the upper lip and severed by the incisor teeth. The upper lip is strong, mobile and extremely sensitive. Foreign materials, unpalatable feeds, etc., can be sorted from the diet with considerable efficiency.

The act of chewing reduces the feed into fine particles. The finely divided particles provide a greater surface area for the action of the digestive juices. Saliva is also mixed with the feed at this time. Saliva aids in both chewing and swallowing. This is particularly important with dry feeds. Estimates have been made that a horse will secrete about 10 gallons of saliva a day from the three sets of paired salivary glands in its mouth. Saliva also contains a protein, amylase, which acts as a catalyst or enzyme that when mixed with feedstuffs initiates the conversion of starch into maltose (grain sugar).

The horse's mouth is well equipped for chewing roughages and grain. The male horse has 40 teeth, while the mare has only 36 teeth. The mare usually does not have the canine teeth. Horses have both upper and lower teeth in contrast to cattle and sheep which have only lower incisors. The chewing movement of the horse is up and down as well as from side to side. The side to side chewing motion results in the molar teeth wearing sharp edges on the outside of the upper teeth and on the inside of the lower teeth. These sharp edges can damage the cheek and tongue tissue and cause the horse to eat slower or not at all. Signs of teeth problems are a horse which holds its head to one side while chewing, chewing in an open mouth fashion, excessive salivation and whole grain appearing in the manure. Teeth problems are more frequent in older horses or horses grazing short grass, sandy pastures. Floating or rasping the teeth is the usual method for removing the sharp edges. A horse's teeth should be checked annually or anytime these symptoms occur.

The pharynx is a funnel-shaped sac which is common to both the digestive and respiratory tracts. Feed will normally move through the pharynx quickly and not enter the windpipe. The action of the soft palate blocks feed and water from returning to the mouth once it enters the pharynx. It is for this reason a horse normally does not breathe through its mouth and ingested food comes out the nostrils rather than the mouth during choke or pharyngeal paralysis.

The esophagus is a muscular tube which extends from the pharynx down the left side of the neck to the stomach. This esophagus has muscular contractions that move the feed to the stomach. These contractions only move in one direction — toward the stomach. There is a valve (sphincter) at the junction of the stomach and esophagus. This sphincter is so arranged and so strong that it, along with the muscles in the esophagus, prohibits vomiting. If

vomiting does occur, it can result in a ruptured stomach or esophagus and foreign body pneumonia.

The unique construction of the esophagus occasionally causes it to become a trouble spot and "choke" can occur. "Choke" is often caused by food that has not been fully chewed or moistened by saliva. Feeding, whole or large pieces of apples, potatoes, etc. can also cause choke.

Horses will indicate choking in a characteristic way: the neck will arch, the eyes will bulge, and the horse will generally look panicked or distressed. Saliva mixed with feed is usually seen drooling from the nostrils.

"Choke" is better prevented than treated. Proper dental care will insure that the horse can adequately chew the feed. If the problem is one of greediness (bolting), a few large rocks in the feed bucket will force the horse to slow down as it eats around the rocks. The rocks should be large enough so the horse won't swallow them and hard enough so they will not break up.

The stomach of the horse is a "J"-shaped sac, having a range in capacity of 8-19 quarts in the mature horse. When feed enters the stomach, the liquids pass out very quickly leaving only the solid particles to be acted on by the digestive juices. The walls of the stomach secrete hydrochloric acid and pepsinogen. These digestive juices are very powerful. They have the ability to break up food particles, split proteins into smaller molecules and dissolve mineral matter.

A horse's stomach is not designed to handle large, infrequent meals. Remember, a horse at pasture eats slowly and regularly throughout the day. Real problems can arise if the stomach becomes overloaded. The most efficient digestion occurs when the stomach is only  $\frac{2}{3}$  full. Do not feed large meals of grain once a day. Try to divide grain meals into a number of feedings throughout the day. Make any changes in the diet of the horse slowly.

Feed has a tendency to arrange itself in layers in the stomach. The partially digested feed does not leave the stomach until approximately two-thirds of the stomach's capacity has been reached. Powerful stomach muscles contract and expand to push the contents of the stomach through the pyloric valve and into the small intestine where most digestion occurs.

The small intestine of a mature horse is approximately 70 feet long with a capacity of about 68 quarts. It is the major site of both digestion and absorption. Bile and pancreatic juice flowing into the small intestine from the liver and pancreas mix with the foodstuffs. These two digestive agents serve to neutralize the stomach acids and add more enzymes to further break down the feed. Starch, sugars, fats and proteins are broken down into simple chemical

units which can be absorbed into the blood stream. Minerals and vitamins are absorbed in a similar manner.

The small intestine of the horse is also an extremely sensitive area. The extreme length and mobility can lead to twisted and telescoped intestines. Any blockage of the small intestine can cause large volumes of fluid to accumulate and back up into the stomach. Dehydration sets in because cells are deprived of needed fluids. Twisted or telescoped intestines can cause an area of the intestine to be deprived of blood and, if not corrected, may result in a portion of the intestine becoming necrotic. The result is severe colic which may lead to death.

The large intestine consists of the cecum, large colon, and small colon. The cecum is a blind sac located at the junction between the small intestine and large colon. The cecum is a functional appendix with a capacity of 28-36 quarts.

The cecum and large colon are colonized by microflora similar to those found in the rumen of cattle. Fermentation of the fibrous carbohydrates of the feedstuffs produces volatile fatty acids, primarily acetic, propionic and butyric acids. These volatile fatty acids can provide over 25 percent of the energy needs of the horse. These bacteria also synthesize B-vitamins and amino acids in a manner similar to that in the rumen of cattle. However, because the synthesis is so far back in the digestive tract, absorption is not efficient as it is in the small intestine. Therefore, it may be necessary to add B-complex vitamins to rations of debilitated horses and to rations of early weaned foals and fast growing yearlings. The same may be true for some of the amino acids. Good quality proteins should be fed to foals and yearlings. The amino acid lysine may be deficient for optimum growth.

The relative importance of digestion in the cecum and large colon increases as the forage content of

the ration increases. It is because of the cecum and colon that horses can consume large amounts of roughage. The large colon has a capacity of about 86 quarts and is 10-12 feet long.

Problems can arise in the cecum and large colon because there is a delicate balance between the delivery of food and the growth of the microorganism population. When food is digested by fermentation, the bacteria, as well as the horse, use some of the resultant energy. If the horse has overeaten, had its diet changed or has eaten large amounts of lush grass, the bacteria in these areas can get out of control. As a result these normally helpful organisms can gorge themselves and run wild causing intoxication, colic, diarrhea and founder.

The small colon is approximately the same length as the large colon but only has a capacity of 16 quarts. One of the major functions of this organ is the formation of the characteristic fecal balls of the horse. The small colon also removes large amounts of water from the ingesta and recycles it back into the body.

Mishaps in the small colon can and do occur. Colic can still happen, but it is not usually as painful or serious as when it occurs in the small intestine. If the horse has impaction or a twist in the small colon, the passage of feces slows or stops. The appetite of the horse is suppressed. Dehydration should be only mild since much of the digestive fluid has already been reabsorbed.

The rectum is about one foot long and terminates at the anus. The normal mature horse will excrete from 30-50 lb. of feces per day. Diet will influence the quantity as well as consistency of the feces. It is more desirable to have a slightly moist feces than dry, hard feces.

The smooth operation of this remarkable system requires careful planning and attention.

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