

Types of Animal Digestive Systems

MONOGASTRIC, avian, ruminant, and pseudo-ruminant are the four basic types of digestive systems in animals. To select the proper type of feed for animals, knowledge of these four different types of digestive systems is critical.



Objective:



Identify and describe the various types of digestive systems in animals.

Key Terms:



abomasum
absorption
concentrates
crop
cud

digestion
digestive system
gizzard
omasum
proventriculus

pseudo-ruminant
reticulum
roughages
rumen

Various Types of Digestive Systems

Digestion is the process of breaking down feed into simple substances that can be absorbed by the body. **Absorption** is the taking of the digested parts of the feed into the bloodstream.

The **digestive system** consists of the parts of the body involved in chewing and digesting feed. This system also moves the digested feed through the animal's body and absorbs the products of digestion. Different species of animals are better able to digest certain types of feeds than others. This difference occurs because of the various types of digestive systems found in animals. There are four basic types of digestive systems: monogastric, avian, ruminant, and pseudo-ruminant.

MONOGASTRIC DIGESTIVE SYSTEM

A monogastric digestive system has one simple stomach. The stomach secretes acid, resulting in a low pH of 1.5 to 2.5. The low pH destroys most bacteria and begins to break down the feed materials. Animals with this type of digestive system are better adapted to eat rations high in concentrates. **Concentrates** are highly digestible feedstuffs that are high in energy and low in fiber. Concentrates are typically 80 to 90 percent digestible. Common concentrates are cereal grains and oil meals. Cereal grains include corn, wheat, barley, and oats. Oil meals include soybean meal, linseed meal, and cottonseed meal. Examples of monogastric animals are hogs, cats, dogs, and humans.

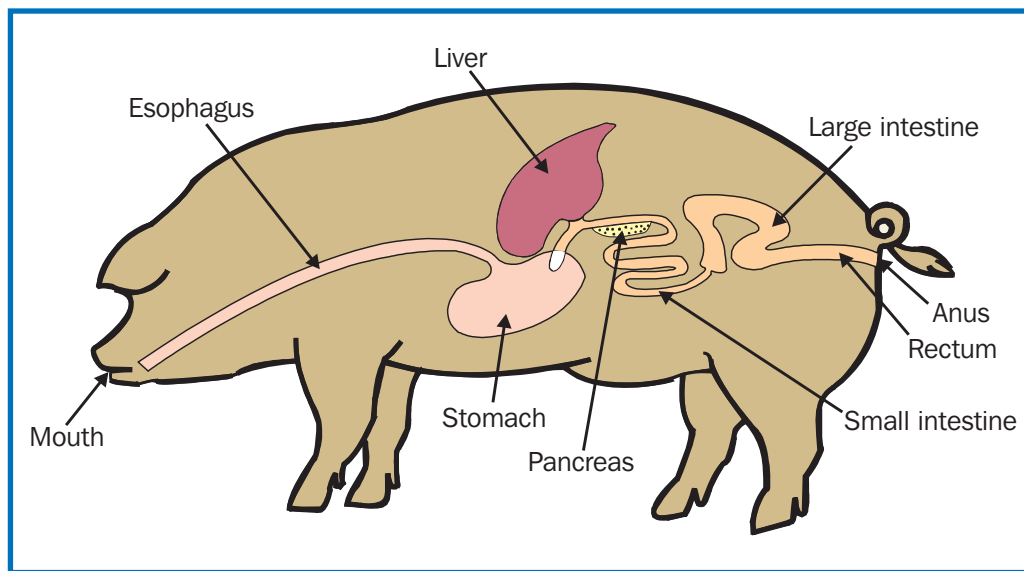


FIGURE 1. A basic diagram of the digestive system of a hog.

AVIAN DIGESTIVE SYSTEM

The avian digestive system is found in poultry. This system differs greatly from any other type. Since poultry do not have teeth, there is no chewing. Poultry break their feed into pieces small enough to swallow by pecking with their beaks or scratching with their feet. Feed enters the mouth, travels to the esophagus, and empties directly into the crop. The **crop** is where the food is stored and soaked. Food then moves from the crop to the proventriculus. The **proventriculus** is the stomach in a bird, where gastric enzymes and hydrochloric acid are secreted. From the proventriculus, the food makes its way to the gizzard. The **gizzard** is a very muscular organ, which normally contains grit or stones that function like teeth to grind the food. The food then moves from the gizzard to the small intestine and then to the large intestine. The nondigestible food components then travel into the cloaca. Urine is also emptied into the cloaca. The material is then passed out of the body through the vent. Digestion in the avian system is very rapid.

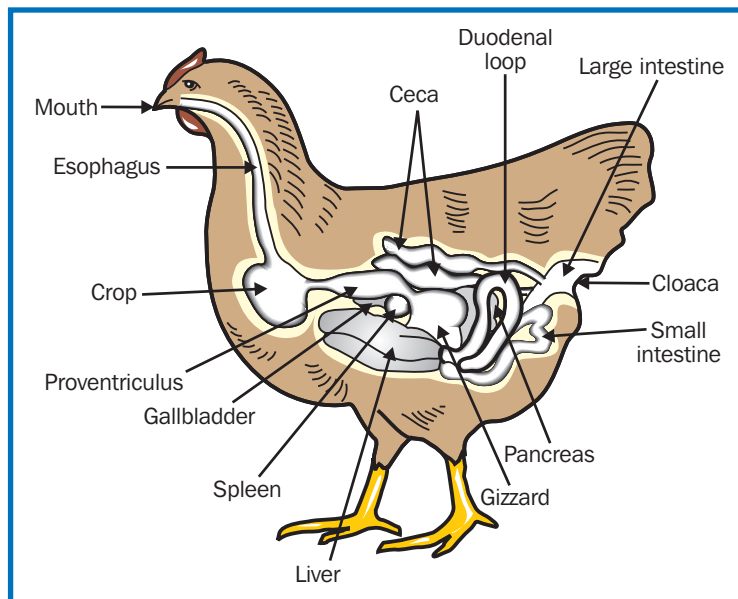


FIGURE 2. A basic diagram of the digestive system of a chicken.

RUMINANT DIGESTIVE SYSTEM

The ruminant digestive system has a large stomach divided into four compartments—the rumen, the reticulum, the omasum, and the abomasum. The ruminant digestive system is found in cattle, sheep, goats, and deer. Ruminant animals eat feed rations that are high in roughages and low in concentrates. **Roughages** are feedstuffs that are high in fiber, low in energy, and typically only 50 to 65 percent digestible. Roughages include hay, straw, grazed forages, and silage. Ruminants are different from monogastric animals in that they swallow their food in large quantities with little chewing. Later they will ruminate, or belch up the feed, chew, and swallow it again. The regurgitated feed is called a cud. A **cud** is a ball-like mass of feed brought up from the stomach to be rechewed. On average, cattle chew their cuds about six to eight times per day.

Rumen

The first and largest section of the stomach is the **rumen**. In the rumen, solid feed is mixed and partially broken down. The rumen contains millions of bacteria and other microbes that promote fermentation, which breaks down roughages. The rumen also contains microorganisms that synthesize amino acids and B-complex vitamins. Amino acids are the building blocks of proteins and are essential for the growth and maintenance of cells.

Reticulum

The **reticulum** is the second segment of the stomach. The reticulum is a small pouch on the side of the rumen that traps foreign materials, such as wire, nails, and so forth. Since ruminants do not chew their food before swallowing, they will occasionally swallow foreign objects.

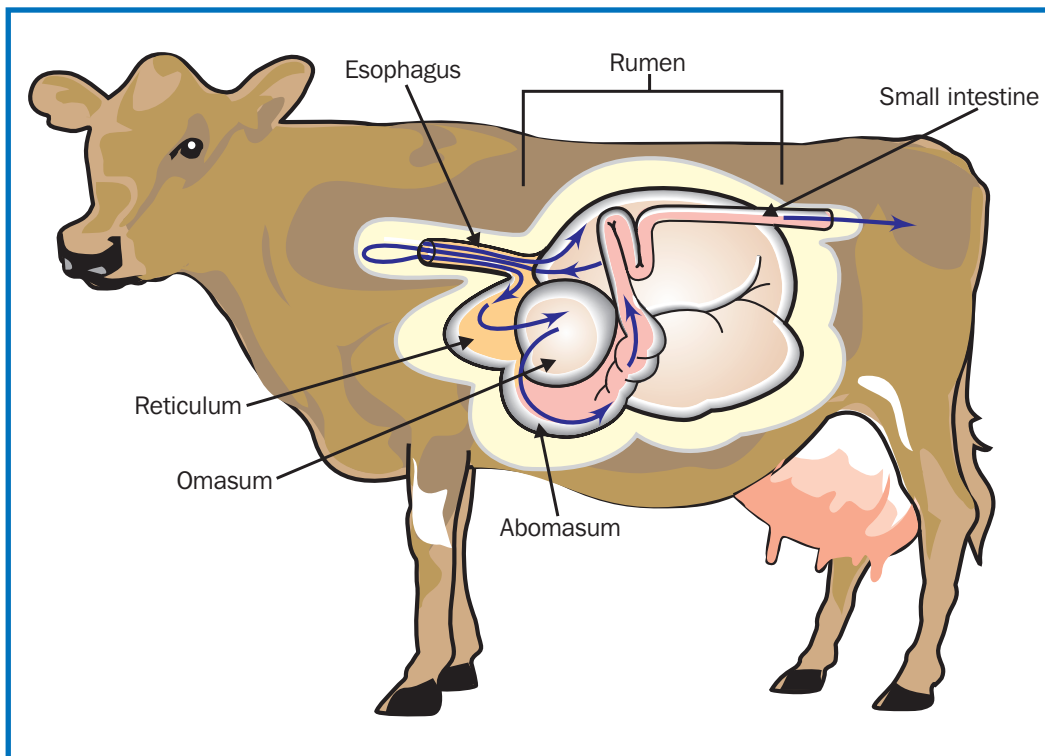


FIGURE 3. A basic diagram of the digestive system of a cow.

Omasum

The omasum is the third compartment of the stomach. The **omasum** produces a grinding action on the feed and removes some of the water from the feed. Hydrochloric acid and digestive enzymes are mixed with feed in the omasum.

Abomasum

The **abomasum** is the fourth compartment of the stomach. The abomasum is also referred to as the true stomach because it is similar to the stomach in monogastric animals.

Rumen Microorganisms

Ruminants rely on microorganisms for the digestion of roughages. The rumen microorganisms are very diverse and consist of bacteria, protozoa, and fungi.

Bacteria are the most numerous rumen microorganisms, at approximately 1 billion bacteria per milliliter of rumen fluid. Bacteria are responsible for most feed digestion in the rumen. They break down cellulose to form volatile fatty acids (VFAs). The VFAs provide the ruminant with 60 to 80 percent of its energy needs. Protozoa are typically responsible for about 25 percent of the fiber digestion in the rumen, even though a ruminant can survive without any protozoa in the rumen. Fungi contribute up to 8 percent of the total rumen microorganisms. Fungi are responsible for the digestion of cellulose and lignin in more resistant forages, such as barley straw.

Feed conversion and rate of gain in a ruminant are strongly affected by the type and number of microorganisms in the rumen. The rumen must contain the appropriate proportions of certain types of microorganisms to maximize productivity. For example, it is believed that protozoa can have a negative impact on protein utilization. The number of protozoa in the rumen is inversely proportionate to the number of bacteria. Therefore, if a ruminant is fed in a manner that is most conducive to bacteria in the rumen, protein utilization will be maximized by eliminating or reducing the number of protozoa in the rumen. To illustrate, feeding yeast culture to cattle could help to ensure a healthy population of rumen bacteria.

PSEUDO-RUMINANT DIGESTIVE SYSTEM

A **pseudo-ruminant** is an animal that eats large amounts of roughage but does not have a stomach with several compartments. The digestive system does some of the same functions as those of ruminants. For example, in the horse, the cecum ferments forages. An animal with a pseudo-ruminant digestive system can utilize large amounts of roughages because of the greatly enlarged cecum and large intestine, which provide areas for microbial digestion of fiber. Pseudo-ruminants often eat forages as well as grains and other concentrated feeds. Besides horses, examples of pseudo-ruminants are rabbits, guinea pigs, and hamsters.

Summary:



Digestion is the process of breaking down feed into simple substances that can be absorbed into the bloodstream. The four basic types of digestive systems in animals are monogastric, avian, ruminant, and pseudo-ruminant. Monogastric animals, such as swine, eat rations high in concentrates. The avian digestive system, found in poultry, is completely different from the other three types of digestive systems. A poultry animal does not have teeth but has a crop, a proventriculus, a gizzard, and a cloaca. The ruminant digestive system is found in cattle, sheep, and goats. Ruminants eat feed rations that are high in roughages. The ruminant digestive system has a large stomach divided into four compartments—the rumen, the reticulum, the omasum, and the abomasum. A pseudo-ruminant is an animal that eats large amounts of roughages but does not have a four-compartment stomach. A pseudo-ruminant animal can utilize roughages because of an enlarged cecum and large intestine.

Checking Your Knowledge:



1. Name the four basic types of digestive systems.
2. What type of feedstuff is high in energy and low in fiber?
3. What type of feedstuff is low in energy and high in fiber?
4. Name three examples of monogastric animals.

5. How do poultry break their food into smaller pieces?
6. List the four compartments of the ruminant stomach.
7. Name three examples of ruminant animals.
8. What are amino acids?
9. What is the most prevalent microorganism found in the rumen?
10. Name three examples of pseudo-ruminant animals.

Expanding Your Knowledge:



Visit a local feed mill and interview an animal nutritionist. Determine how feed rations vary for animals of different species, ages, and genders.

Web Links:



The Digestive Tract of the Pig

<http://edis.ifas.ufl.edu/AN012>

Bird Digestion

<http://people.eku.edu/ritchisong/birddigestion.html>

Rumen Physiology and Rumination

<http://www.vivo.colostate.edu/hbooks/pathphys/digestion/herbivores/rumination.html>