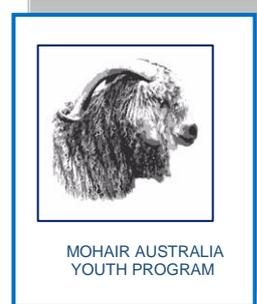


Fact sheet 6 The digestive system of the goat



Goats are members of the class of animals called ruminants because they chew their cud (ruminates). They have a stomach with four compartments that are especially designed to digest food which is high in fibre (roughage), such as hay, grass and silage.

The four chambers in the goat's stomach are the:

- rumen
- honey-combed reticulum
- omasum
- abomasum or true stomach.

As the animal matures, the relationship between the size of the four chambers changes as the abomasum gets proportionally smaller.

Rumen

The function of the rumen is fermentation, which is the digesting or breaking down of food without oxygen. This process produces heat that helps to keep the goat warm.

There are bacteria and protozoa in the rumen that produce enzymes to break down fibre in the goat's feed. These organisms also help build proteins from the feed and generate all of the B vitamins that the goat needs. Many of the nutrients that help provide the goat with energy are also absorbed in the rumen.

When an adult goat eats roughage, it will chew it, coat it with saliva and then swallow it. The roughage travels from the esophagus through the reticulum to the rumen where food particles form on the surface of the rumen. The microorganisms in the rumen break down (ferment) the food particles that are spread across both the rumen and reticulum.

At regular intervals, the reticulum squeezes any of the food particles floating in it to form a bolus or cud. This is pushed back up the esophagus into the goat's mouth for it to re-chew and then swallow again. Eventually, the cud is swallowed permanently to join the food particles in the rumen-reticulum, where those that are small and heavy enough, settle out.

This process is called rumination. If you watched the goat's neck carefully, you would see it swallow and then regurgitate its cud. The goat will often burp to expel the gas produced by the fermentation process in the rumen. If for some reason, the goat is unable to burp up the gas, it will build up and bloat or swell up the rumen. Your goat may become very sick with what is known as bloat.

Reticulum

Once the food particles in the cud are broken down enough and become small, dense, and heavy, they drop to the floor of the rumen and then pass into the reticulum, which is also sometimes referred to as the hardware stomach. The main function of the reticulum is to act as a pump sending the heavier, fermented particles over to the omasum.

This is also where any foreign objects that may have been swallowed with the feed will settle into the honeycomb structure of the reticulum's walls.

Omasum

Once the fermented particles enter the omasum, water is removed and nutrients called volatile fatty acids are absorbed. These nutrients help supply the goat with energy.

Abomasum

From the omasum, the particles are then forced into the abomasum or true stomach, where the particles are broken down further by the hydrochloric acid (HCl) that is present in the abomasum.

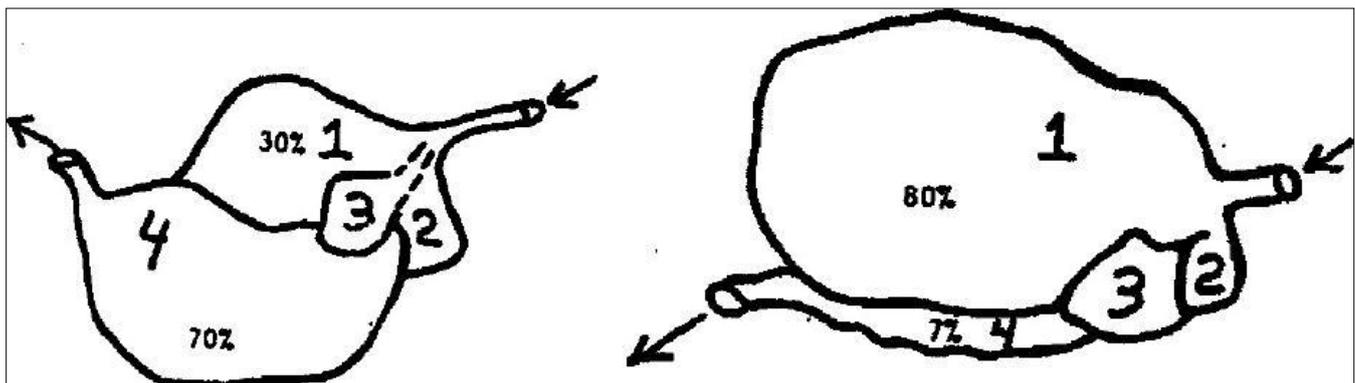
What remains is passed into the small intestine, where the remaining nutrients are absorbed and made available to the goat.

When a goat kid is born, its rumen, reticulum and omasum are very small and do not have a useful function, because the goat kid depends on milk for its feed source. When the kid swallows milk, it goes directly to the abomasum through the esophageal groove. Every time the kid swallows, a skin flap folds over to block the entrance to the rumen so the milk goes straight into the abomasum and is digested by stomach acid.

As the kid gets older, it will begin to eat roughage. This triggers the rumen to become active and it increases in size as its population of microorganisms increases. The reticulum and omasum also respond to the changes in diet by getting bigger.

By the time adulthood is reached, roughage is the goat's main source of food and its rumen is much larger than its abomasum.

Figure 1. The difference in proportion between a kid goat (on the left) and an adult goat



1. Rumen, 2. Reticulum, 3. Omasum, 4. Abomasum

Suggested activities

Get some human cereals, such as baby food yogurt or custard, rice cereal and shredded wheat. Put a 1/4 cup of each in separate unstarched cotton spice bags or squares of cotton cloth and tie them up. Ask senior students to weigh out 100 grams of each feed sample, rather than a 1/4 cup.

Boil the cereals in a solution of 1 tablespoon of neutral detergent soap (such as baby shampoo) per cup of water in a saucepan with a lid on for one hour. This will break down all the nutrients except the fibre. Remove from the saucepan, rinse the bags in cold water, then gently squeeze them dry and open them. Which foods contained more fibre? Which would be easiest for a kid or a wether to digest?

Do the same experiment using 100g each of milk replacer, a complete pelleted calf or lamb ration, and various grains, hay and straw. After boiling, dry them in the oven at 200°C and reweigh them to compare the fibre content. Which ones have more fibre?

Watch a goat chew its cud for 15 minutes. Try to work out how many times the goat brings up its cud in that time.

Invite a local veterinarian with experience treating goats to talk to your goat group about issues such as bloat and other metabolic diseases that can occur when there is a problem with your goat's digestion.

A rumen fistula is an artificial opening that allows scientists to look inside the rumen of an animal. Contact an agricultural college and ask if they have a fistulated cow, sheep or goat, so that the students can take turns examining the animal's rumen.

Obtain a clean and rinsed out digestive tract of a sheep or goat from a slaughterhouse, and lay it out for students to examine and identify the various parts. Measure the length of the parts, including the small intestine.

Acknowledgement:

Dr Titanna Stanton NY 4-H Youth program