University of Mosul
Lecture No.: 1
College of Veterinary Medicine
Date:22/9/2024
Unit of Scientific Affairs
Website:

Lecture title: **Diseases of the Forestomach of Ruminants**

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Summary:

Anatomy of the ruminant digestive system includes the mouth, tongue, salivary glands (producing saliva for buffering rumen pH, contains enzymes for breakdown of fat (salivary lipase) and starch (salivary amylase)), esophagus, four-compartment stomach (rumen, reticulum, omasum, and abomasum), pancreas, gall bladder, small intestine (duodenum, jejunum, and ileum), and large intestine (cecum, colon, and rectum). The ruminant stomach occupies almost 75 percent of the abdominal cavity, filling nearly all of the left side and extending significantly into the right side. The relative size of the four compartments is as follows: the rumen and reticulum comprise 84 percent of the volume of the total stomach, the omasum 12 percent, and the abomasum 4 percent.

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Anatomy and Function of Ruminant Digestive

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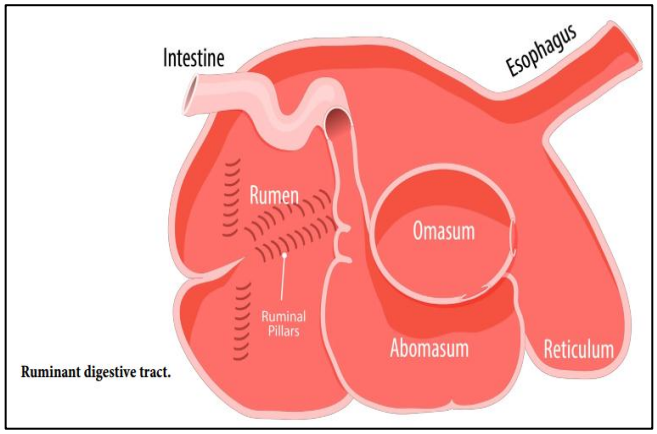
- The ruminant stomach occupies almost 75 percent of the abdominal cavity, filling nearly all of the left side and extending significantly into the right side.
- The relative size of the four compartments is as follows: the rumen and reticulum comprise 84 percent of the volume of the total stomach, the omasum 12 percent, and the abomasum 4 percent.



Ruminant digestive tract.

- The rumen:
  - ✓ It is sometimes called the "paunch."
  - ✓ It is lined with papillae for nutrient absorption and divided by muscular pillars into the dorsal, ventral, caudodorsal, and caudoventral sacs.
  - ✓ The rumen acts as a fermentation vat by hosting microbial fermentation. About 50 to 65 percent of starch and soluble sugar consumed is digested in the rumen.
  - ✓ Rumen microorganisms (primarily bacteria) digest cellulose from plant cell walls, digest complex starch, synthesize protein from nonprotein nitrogen, and synthesize B vitamins and vitamin K.
  - ✓ Rumen pH typically ranges from 6.5 to 6.8.
  - ✓ The rumen environment is anaerobic (without oxygen).
  - ✓ Gases produced in the rumen include carbon dioxide, methane, and hydrogen sulfide.

Interior lining of the rumen, revealing papillae

- The reticulum:
  - ✓ It is called the "honeycomb" because of the honeycomb appearance of its lining.
  - ✓ It sits underneath and toward the front of the rumen, lying against the diaphragm.
  - ✓ The main function of the reticulum is to collect smaller digesta particles and move them into the omasum, while the larger particles remain in the rumen for further digestion.
  - ✓ The reticulum also traps and collects heavy/dense objects the animal consumes. When a ruminant consumes a nail, wire, or other sharp heavy object, it is very likely the object will be caught in the reticulum. During normal digestive tract contractions, this object can penetrate the reticulum wall and make its way to the heart.

"Honeycomb" interior lining of the reticulum

- The reticulorumen is home to a population of microorganisms (microbes or "rumen bugs") that include bacteria, protozoa, and fungi. These microbes ferment and break down plant cell walls into their carbohydrate fractions and produce volatile fatty acids (VFAs), such as acetate (used for fat synthesis), priopionate (used for glucose synthesis), and butyrate (it is a preferred energy source of the rumen epithelial cells. Butyrate has the ability to promote the development of epithelial cells and inhibit epithelial breakdown). The animal later uses these VFAs for energy.

The omasum:

- ✓ It is spherical and connected to the reticulum by a short tunnel.
- ✓ It is called the "many piles" in reference to the many folds or leaves that resemble pages of a book.
- ✓ These folds increase the surface area, which increases the area that absorbs nutrients from feed and water.
- ✓ Water absorption occurs in the omasum.

Interior lining of the omasum, revealing the "many piles" tissue folds

The abomasum:

- ✓ It is the "true stomach" of a ruminant.
- ✓ It is the compartment that is most similar to a stomach in a nonruminant.
- ✓ The abomasum produces hydrochloric acid and digestive enzymes, such as pepsin (breaks down proteins), and receives secreted digestive enzymes. These secretions help prepare proteins for absorption in the intestines.
- ✓ The pH in the abomasum generally ranges from 3.5 to 4.0.
- ✓ The chief cells in the abomasum secrete mucous to protect the abomasal wall from acid damage.

Interior lining of the abomasum, the "true stomach"

- The small and large intestines follow the abomasum as further sites of nutrient absorption.
  - ✓ Digesta entering the small intestine mix with secretions from the pancreas and liver, which elevate the pH from 2.5 to between 7 and 8.
  - ✓ This higher pH is needed for enzymes in the small intestine to work properly.
  - ✓ Bile from the gall bladder is secreted into the first section of the small intestine, the duodenum, to aid in digestion.
  - ✓ The intestinal wall contains numerous "finger-like" projections called villi that increase intestinal surface area to aid in nutrient absorption.
  - ✓ Muscular contractions aid in mixing digesta and moving it to the next section.
- The large intestine absorbs water from material passing through it and then excretes the remaining material as feces from the rectum.
- Immature ruminants, such as young, growing calves from birth to about 2 to 3 months of age, are functionally nonruminants. The reticular groove (sometimes referred to as esophageal groove) in these young animals is formed by muscular folds of the reticulum. It shunts milk directly to the omasum and then abomasum, bypassing the reticulorumen.