

Ruminant stomach of *Bos* sp.

In ruminants the stomach is highly specialized. It has four chambers, although the first three the Rumen, reticulum and Omesum –arise from the esophagus and only the fourth Abomesum-is an actual derivative of the stomach. The ruminant stomach occupies most of the left hand side of the abdomen. The rumen holds approximately 80%, reticulum 5%, omasum 8% and abomasum 7% in *Bos* sp.

- 1. Rumen:** The rumen is the largest compartment of the ruminant forestomach, holding up to 40 gallon in a mature cow. The rumen is thin walled and lined with numerous projecting papillae that increase its absorptive surface area. The nonglandular mucosa of the rumen is composed of keratinized stratified squamous epithelium. The rumen does not contain a muscularis mucosa. pH in this chamber is ranging from 5.5-7.
- 2. Reticulum:** The reticulum is composed of long primary and shorter secondary folds that form a honeycomb like pattern. The primary folds of the reticulum contain bundles of smooth muscle within the lamina propria also called lamina muscularis mucosa. Reticular mucosa also composed of keratinized stratified squamous epithelium. The reticulum holds up to 5 gallon in a mature cow. A small tissue fold lies between the reticulum and the rumen, but the two are not separate compartments. Together they are termed as the reticulorumen, which is separated from the omasum by a sphincter, the reticulo-omasal orifice.
- 3. Omesum:** The third compartment of the ruminant stomach is the omasum. The internal wall is in the form of deep, thin folds like the pages of a book, called lamina. Folds in the omasum contain smooth muscle as well as connective tissue and the surfaces of the folds are covered by a keratinized stratified squamous epithelium. The omasum holds up to 15 gallons, in the mature cow.
- 4. Abomesum:** The final compartment of the stomach is the abomasum. The three distinctive types of mucosa like cardia, fundus and pylorus are found in abomesum and this is the direct equivalent of the monogastric stomach. The abomasum has a thick glandular epithelial lining which is responsible for the secretion of the acid (HCL) and pepsinogen and the chief cells in the abomasum secrete mucous to protect the abomasal wall from acid damage. The abomasum holds up to 7 gallons, in the mature cow. The pH in the abomasum generally ranges from 3.5 to 4.0.

Digestion in ruminant stomach: Among the mammals ruminants are specialized foregut fermenter. In ruminants, a specialized stomach act as a fermentation chamber in which symbiotic microorganisms eventually digest cellulose, and this process is termed as gastric fermentation. Because microbial fermentation is relatively slow and cellulose relatively resistant, these chambers are often quite extensive and lengthy.

1. Role of Rumen:

- i. Initially, ruminant animals clip plant material, mix it with saliva, roll it into boli, and swallow it into the rumen which serves as a large holding and fermentation vat. 1 mL of rumen fluid contains 10-50 billion microbes and over 1 million protozoa. These bacteria attach to the food particles to digest the food.
- ii. The microbes in the rumen digest cellulose and hemicellulose into 3 volatile fatty acids (VFA's) like : acetic acid, propionic acid, and butyric acid and also produce a high quality protein, and B vitamins; and detoxify toxic compounds.
- iii. Cycle of contraction pass through the rumen and reticulum to circulate and mix the ingested food with microorganisms. This mixing also results in physical separation of coarse and fine food particles. Small particles sink into the fluid that accumulates ventrally within the rumen. Large undigested plant fibers float on top of this fluid. Methane gas that forms during fermentation collects above this fluid and plant fiber and is belched up.
- iv. Poorly masticated food is regurgitated for remastication in the mouth and swallowed again. The peristaltic contractions sweep the digesta up the esophagus into the mouth, so the animal can rechew the undigested plant material. The process of regurgitation and remastication is termed as ruminating, occurs repeatedly until most of the material is broken down mechanically. The amount of time the animal spends in ruminating depends proportionately on the fiber content of the food. In grazing cattle, this may occupy up to eight hours per day and involve rumination of each bolus 40 to 50 times.

2. Role of Reticulum:

- i. Ingesta flow freely between the reticulum and rumen. The main function of the reticulum is to collect smaller digesta particles and move them into the omasum,

and subsequently prevent the entry of large particles which remain in the rumen for further digestion.

- ii. Heavy or dense metal objects like, nail, wire etc eaten by the cow drop into this chamber.

3. Role of Omasum:

- i. Eventually the rechewed food travel through the reticulum into the omasum. This compartment acts like a filter.
- ii. The numerous folds of the omasum serve to squeeze out the water from the digesta, so that the majority of the water doesn't 'escape' into the rest of the digestive tract and remains in the rumen.
- iii. It also absorbs VFAs and ammonia.
- iv. Omasum moves smaller food particles into the abomasum.

4. Role of Abomasum:

- i. In this compartment the enzymatic and acidic hydrolysis of food particles takes place.
- ii. Microbial protein plus indigestible intake protein (*e.g.* by-pass protein) from the food is broken down and these amino acids absorbed by the animal in the small intestine.

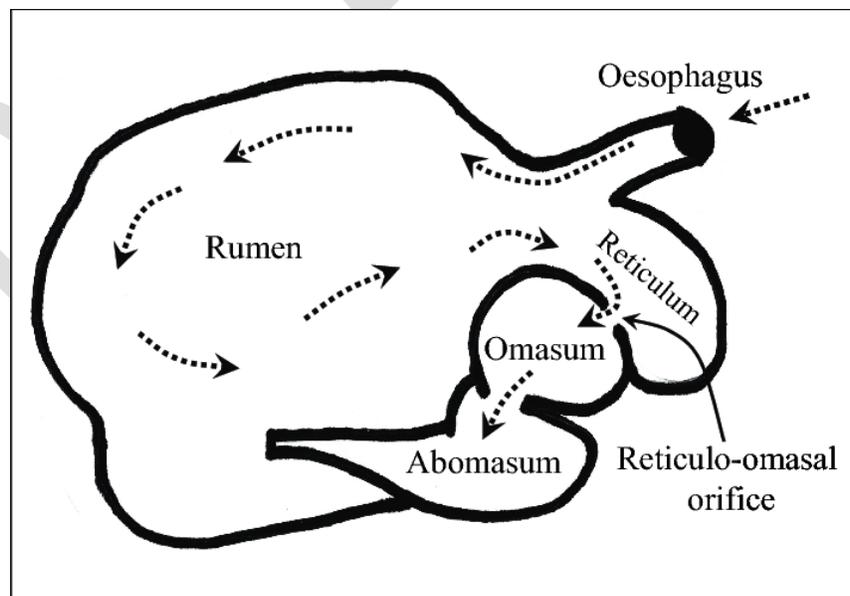


Figure 1: Ruminant stomach of *Bos sp.*

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