



The overview of the digestive system of the calves

Alison Pfau | MS. Regional Extension Dairy Educator
UW-Madison Extension | Dane, Dodge, Jefferson, Rock and Walworth Counties

Around the world exist a variety of domestic and non-domestic forage eaters called ruminants (e.g., cattle, sheep, goats, bison, buffalo, reindeer, yak, etc.). According to their geographic distribution, these species have diverse evolution history that classified them by their capacity to adaptation to different feed resources (Concentrate selectors, Intermediate feeders, and Roughage grazers). Ruminants play an important role in sustainable agricultural systems and as a provision of food to humans. They can convert forage, pasture crop residues, and other feed sources into food edible by humans. This situation has incited an interest to know the nutritional conditions and understand the rumen development that make them survive in their territories.

The Ruminant stomach

The stomach of ruminants is made up of four compartments: rumen, reticulum, omasum, and abomasum. Each compartment has a very specific characteristic and function to help the digestion and absorption of essential nutrients to the animal. The rumen allows for fermentation and digestion of forage type feeds. The reticulum acts as a sieve, moving smaller particles further down the digestive

system and larger ones back into the rumen for further digestion. The omasum absorbs water and other substances from the digesta, and the abomasum breaks down proteins through acid digestion and functions similar to the human's stomach.

Figure 1. Percentage's calf stomach at first week of age

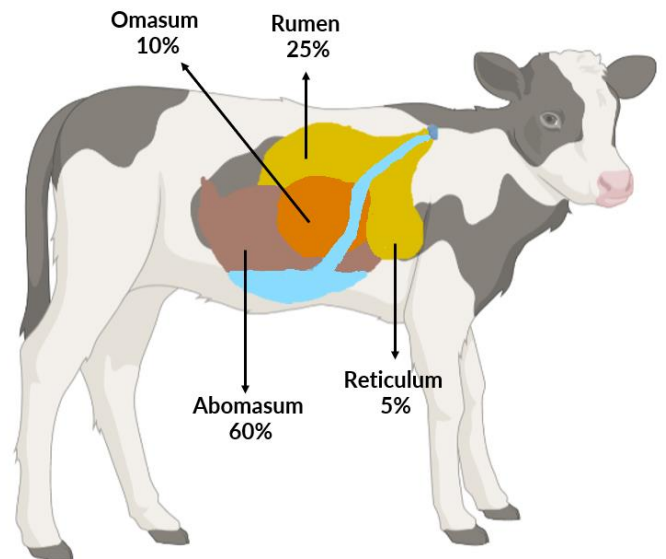


Photo credit: A. Pfau

The Rumen development

At birth, the dairy calf's digestive system is underdeveloped. Different to cows, calves' birth to 2 weeks of age are considered monogastric, or simple-stomached, due to a

non-functioning rumen. The stomach of the calf contains the same four compartments mentioned above, but the reticulum, rumen and omasum of the calf are inactive and underdeveloped. The only compartment that is active and functional is the abomasum and works similar as the human's stomach. This compartment represents 60% of the newborn calf's stomach capacity and when the animal is mature, the capacity percentage of this compartment changes to just 8%. The capacity of the other compartments is 25% for rumen, 5% for reticulum and 10% for omasum at birth and will change as the rumen develops to ferment and digest forages to 80%, 5% and 8%, respectively.

Figure 2. Percentage's calf stomach at three to four months of age

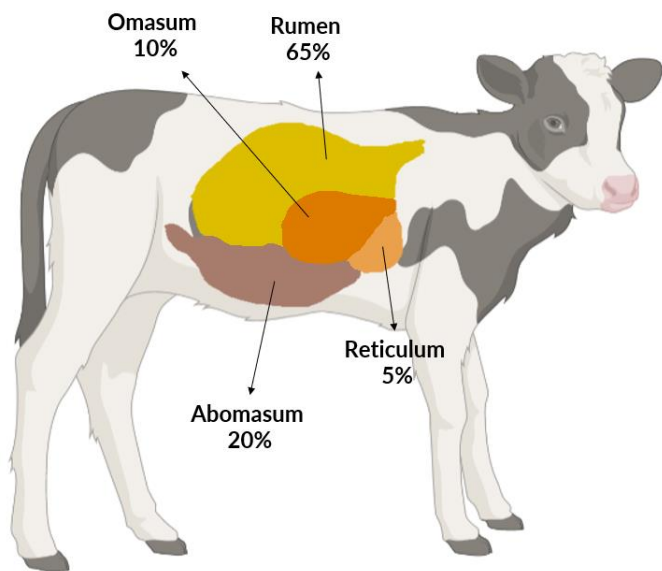


Photo credit: A. Pfau

With the help of the consumption of different feedstuffs and the growth and development of the calf, the stomach compartments also grow and change accordingly. At 4 weeks old, the calf continues to be fed milk or milk replacer as its main source of nutrition, and the growth in size of the abomasum increases. Because of

the liquid diet and the digestion and absorption of milk in the abomasum, the rumen is not able to development, remaining proportionately small and growing slower. Then, by keeping a liquid diet (milk/milk replacer) for a long time will restrict rumen growth, affecting the development of the rumen not to develop to ferment and digest forages, thus decreasing the calf's growth rates after weaning.

As the calf starts to eat dry feeds (starter grain) the rumen begins to ferment and breakdown the feed for digestion. The environmental conditions of the rumen favor the growth of microbes that breakdown the feed and produce byproducts called volatile fatty acids (VFAs): butyrate, propionate, and acetate. It is these byproducts, VFAs, that is absorbed through the lining of the rumen which helps to stimulate the rumen papillae growth, creating more surface area for nutrient absorption. Once the calf starts to eat more grain, by three weeks old, the rumen will establish enough bacteria to assist in the fermentation of feed to contribute a substantial amount of energy, and rumen microbial protein, a highly digestible protein similar to the protein profile of milk).

The final stage of development occurs at weaning when the rumen becomes the most important part of the digestive system and allowing the calf to digest forages and converting the feedstuffs into energy and protein.

Figure 3. Percentage's calf stomach at maturity age

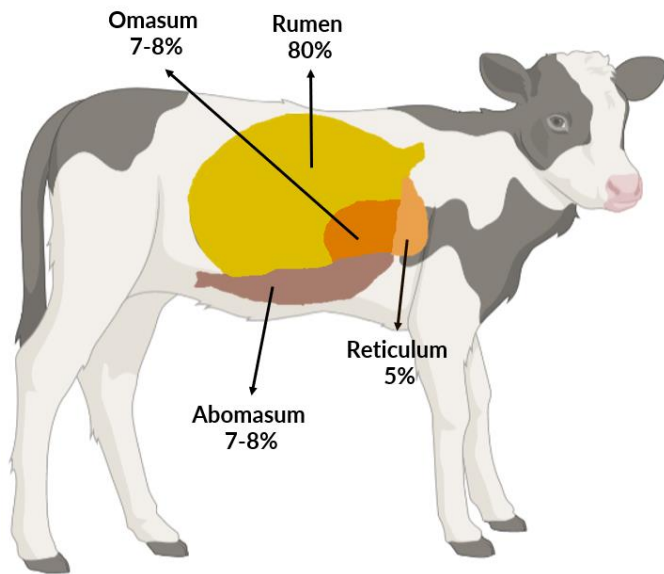


Photo credit: A. Pfau

Summary

Is necessary to understand the key features and purpose of the different sections and structure of the four compartments of the digestive system in calves. Each compartment is essential in maintaining a healthy digestive process and must work together efficiently to turn the calf's feed into energy for the animal. Besides, the development of the rumen is fundamental in terms of efficiency and economy. In young calves by starting with small amounts of grain along with water will start the fermentation process and the production of VFAs. This process in return develops a more functional rumen that can better digest grain, and later in life, this calf will become a high milk production cow will digest forage and silage.

*Developed by UW–Madison Division of Extension
Regional Dairy Educator Alison Pfau.*