

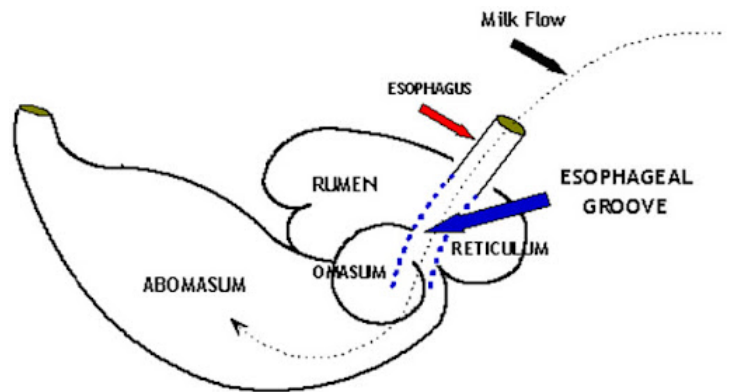
Rumen Development in the Pre-Weaned Calf

By Dr. Kalie Bernardo

A well-developed rumen is the foundation of a smooth weaning process. Effective transition from a milk diet to one of forages and grain requires proper management, as the rumen takes time to successfully develop. When a rumen is poorly developed, calves can experience stalled growth at weaning since the calf is ill prepared for its new diet.

Before a calf consumes solid food, they have an esophageal groove that ensures milk bypasses the rumen and goes straight to the abomasum. There, the abomasum digests the milk, which can then be absorbed.

Once solid feed is introduced, the food ends up in the rumen, not the abomasum. Although the rumen contains microbes from the environment of the calf, the introduction of solid food – usually a starter grain – really kickstarts the development. This initial grain allows microbial populations to grow and diversify. It is crucial to introduce solid feed early, as it takes 2 to 3 weeks for the microbial population to properly establish.



What Actually Happens in the Rumen?

The rumen is a large vat containing microbes that digest feed, creating byproducts the calf uses for energy. The inner surface of the rumen is lined with papillae, which are finger like projections that increase surface area for nutrient absorption. The number and size of papillae are directly proportional to the capacity of the rumen to absorb nutrients.

Many microbes in the rumen digest feed and produce byproducts called volatile fatty acids (VFAs). These are absorbed by the rumen and used as an energy source for the animal. The three most common VFAs are:

- Propionic acid – energy source for the calf
- Butyric acid – promotes rumen papillae growth
- Acetic acid – energy source for the calf

The bacteria that digest starch produce butyric and propionic acid, which are essential for rumen development. The bacteria that digest fiber produce mostly acetic acid. Butyric and propionic acid promote rumen papillae growth, as seen in the photos below.

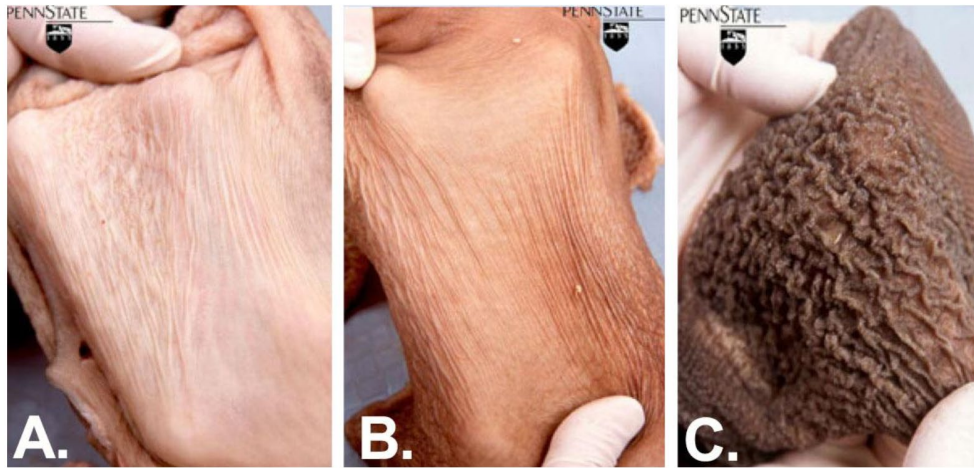


Figure 1. A: Milk only. B: Milk and hay. C: Milk and grain. Photos: Penn State Extension

A: Milk Only

B: Milk and hay

C: Milk and grain

Photo courtesy of Penn State University

What Encourages Rumen Development?

1) Starch

- Feeds the right microbes. The rumen has some microbes in it from the birthing process and the environment the calf was raised in. By feeding starch (through grain), we encourage the growth of the microbes that digest starch, releasing butyric acid (butyrate).
- Creates Rumen Growth. Cells in the rumen wall use butyrate for energy and growth. More butyrate = more papillae = better nutrient absorption.

2) Water

- Essential for Fermentation. Microbes depend on water to survive and ferment feed. Providing free choice water from the first week of life allows for the growth of microbes and production of VFAs.

3) Forage

- Promotes Rumen Motility and Muscle Development. While previously believed to cause “scratch factor” and promote papillae growth, it has since been realized that forages encourage rumen musculature, not papillae. Forages play a supporting role, but should not replace starter grain in your pre-weaning calves

In conclusion, successful rumen development starts with early and consistent intake of starter grain and water. Offering small amounts of fresh starter frequently will encourage calves to eat more. This will allow for healthy rumen development, leading to a smoother weaning transition, faster growth, and improved future performance. While forage plays a supportive role, it should not displace starter during the pre-weaning phase. By prioritizing these management practices, calves are better prepared for weaning, have smoother transitions, improved growth, and stronger long-term performance.