# Ruminants vs. Pseudo-ruminants vs. Equines

## By Lark Burnham, Ph.D., Ruminant Nutrition

The nutrition of any mammal can be deduced by studying the gastrointestinal tract (GIT) and digestion of that species. When the digestion of all mammals is compared, one discovers that there are actually more similarities than differences. The differences often reflect adaptations that allow fuller utilization of the nutrients available in a specific ecological niche.

Ruminants (cattle, sheep and goats), pseudo-ruminants (alpacas and llamas), and equines (horses and donkeys) are all herbivores; they derive most of their energy and other nutrients from roughage. Fiber, a generic term used to describe these feedstuffs, contains long chains of glucose molecules, which is also a characteristic of starch. The difference between starch and fiber lies in the nature of the chemical bond that joins these glucose molecules.

Mammals do not secrete the enzymes necessary to break the bonds between the glucose molecules in fiber, but microorganisms that inhabit their GIT do. Mammals and microorganisms have evolved together to form a symbiotic relationship, thus allowing the former group to benefit from fiber. All mammals rely on microorganisms to some extent, but herbivores most of all. Microbes are dependent on a steady stream of incoming nutrients and the maintenance of a narrow range of environmental conditions, including pH. In turn, herbivores are made more vulnerable to conditions that impact microbial viability, such as changes in diet and stress. An understanding of the care and feeding of GIT microorganisms is directly related to the health and well-being of herbivores such as ruminants, pseudo-ruminants and equines.

The generic mammalian digestive system consists of the mouth and teeth, esophagus, stomach, small intestine, and large intestine or colon. Significant amounts of microbial fermentation occur in the stomach and large intestine; feed generally traverses the esophagus and small intestine too quickly to allow microbial replication. Whether one or the other of these fermentative organs dominates in a particular species depends on a number of factors.

The primary factor involves the type of fibrous feedstuffs on which that species evolved, and their particular adaptation to meet their protein and energy needs. Herbivores have evolved different strategies (Van Soest, 1994) to extract nutrients from mature, highly lignified material such as grasses and browse. One method, employed by ruminants and pseudo-ruminants, involves long-term fermentation in a compartmentalized stomach aided by regurgitation and rechewing. Equines, on the other hand, rely on the consumption of greater quantities of the same feedstuffs, which are then fermented for a shorter length of time in an enlarged colon. The result is faster transit through the equine GIT and less energy extracted per unit of feed.

Ruminant and pseudo-ruminants have the greatest capacity for long-term fermentation, followed by equines. The former two groups both have a specialized compartmentalized stomach that allows feed to ferment up to four days. According to Fowler (1998) and Van Soest (1994), ruminants and pseudo-ruminants evolved at the same time from a common ancestor. This means they accomplish the same task through extensive fermentation, but with some anatomical differences.

The equine, on the other hand, relies on an enlarged large intestine, instead of an enlarged stomach, for fermentation. The placement of this fermentative organ after the stomach and small intestine prohibits extensive use of microbial protein, as in ruminants and pseudo-ruminants. The equine has the greatest capacity for fiber fermentation of most non-ruminants.

The next installment of this series will look at the mouth and esophagus of ruminants, pseudo-ruminants, and equines. The mouth and teeth are the beginning of the GIT, and their primary roles are in feed acquisition and particle size reduction. The extent of particle reduction will determine the degree of its eventual microbial degradation in the fermentative organs.

**About the Author:**

**Lark Burnham received a B.S. in Animal Science (1979) and M.S. in nonruminant nutrition (1995) from Kansas State University, Manhattan, and a Doctorate in ruminant nutrition (1994) from Texas Tech University, Lubbock. Her special interests are comparative nutrition, the role of the microflora in all mammals, fiber digestion, and probiotics. Lark currently works for Natur's Way, Inc., Horton, KS, which produces MSE probiotics.**