Ruminants vs. Pseudo-ruminants vs. Equines
Conclusions

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Over the past six issues, we have looked at the major digestive organs in cattle, camelids, and equines. It is clear from this brief review that these mammals are superbly evolved to acquire and digest vegetation. Despite differences in organ shape and size, as well as primary fermentative location, there are more similarities than disparities between these groups.

Dexterity of lip manipulation allows camelids more selective eating habits than either ruminants or equines. The number and location of teeth is correlated to the ability to routinely regurgitate and re-chew food (ruminate). Horses, which lack this ability, have the greatest number of teeth and must depend on thorough mastication on the first pass.

Likewise, a well-developed fermentative stomach is also correlated to rumination. Both ruminants and pseudo-ruminants have evolved copious, multi-compartmentalized rumens that promote microbial degradation. The stomach compartments play similar roles in both groups — a main fermentation chamber, an area for expressing and recycling the vast quantities of water necessary for this process, and another dedicated to digestion by hydrochloric acid. The latter is analogous to the simple equine stomach.

Microbial fermentation generates most of the energy utilized by both cattle and camelids. Aside from hay and pasture, the rumen ferments simple carbohydrates (grain), as well as protein. These should be supplied via supplement when extra energy and protein are needed to meet the demands of growth and reproduction. This is especially necessary when the rumen is underdeveloped or when the requirements of late gestation and lactation exceed its mature capacity.

Although equines lack a rumen, they have evolved a highly developed large intestine that is actually more efficient at fermenting roughage. However, equines derive little benefit from the mass of microbial protein generated in the colon. Cattle and camelids are able to utilize this protein source because the rumen complex is immediately followed by the small intestine. Protein contained in billions of microbial bodies is enzymatically digested and absorbed by the ruminant/pseudo-ruminant small intestine. It is these animals' primary source of protein.

The role of the equine stomach is less clear. Some protein is probably broken down by pepsin and absorbed in the small intestine. Roughage is basically held until it passes to the colon for fermentation. Grain is enzymatically digested and absorbed through the lining of the small intestine. More energy is generated by enzymatic digestion than by fermentation.

The rumen microorganisms preferentially ferment soluble carbohydrates (grain) before roughage (hay and pasture). The fermentation of large amounts of grain generates a huge burst of lactic acid and volatile fatty acids or VFA. These end-products must travel to the liver, via the bloodstream, where they are converted into usable energy. With such an overdose, there is potential for acidosis, which can make the animal very ill or die unless treated promptly.

The digestive physiology of cattle, camelids, and equines suggests a predominantly roughage diet. Mature, non-reproductive alpacas, and miniature horses and cattle should receive lower protein diets with little or no added grain to prevent excess weight gain. Animals in all three groups that are in late gestation and early lactation usually require a protein and energy supplement to prevent excess weight loss.

Supplementation of most B- or water-soluble vitamins is not necessary for healthy adult ruminants and pseudo-ruminants. These vitamins are generated by fermentation. However, B-vitamins are required by young animals with underdeveloped rumens. Severe illness or death can result from B-vitamin deficiency when a calf or cria which lacks the ability to ferment roughage abruptly stops nursing.

Herbivores such as ruminants, pseudo-ruminants, and equines have developed marvelous digestive systems that utilize a symbiotic relationship with microorganisms. The microbes digest vegetable matter that is indigestible by mammalian enzymes. Unfortunately, roughage digestion does have its limits. Knowledge of these limitations can allow producers to safely and productively exploit comparatively less expensive feedstuffs.

About the author:

Lark Burnham received a B.S. in Animal Science (1979), from Kansas State University and a M.S. in non-ruminant nutrition (1995) from Kansas State Universtity, Manhattan, and a Ph.D. Doctorate in ruminant nutrition (2004) from Texas Tech University, Lubbock. Her special interests are comparative nutrition, the role of the micro flora in all mammals, fiber digestion, and probiotics. Lark currently works for Natur's Way. Inc., Horton, KS, which produces MSE probiotics.