Ruminants vs. Pseudo-ruminants vs. Equines
Ruminant Nutrition

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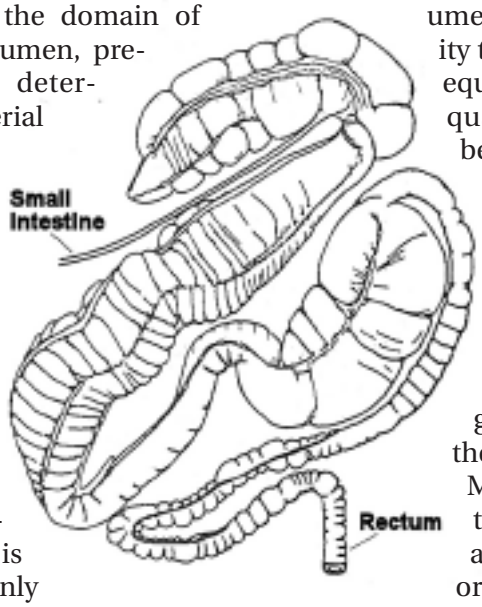
The final major segment of the gastrointestinal tract is called the large intestine or colon. It extends from the ileum, the last third of the small intestine, to the rectum. In most mammals, the colon can be equated to a biological garbage dump. Whatever is not digested in the upper tract, along with sloughed cells from the tract itself, ends up here.

Just as in the rumen, colon development and expansion begins with consumption of large amounts of roughage. The colon is also the domain of microorganisms. Also as in the rumen, predominant microbial species are determined by the nature of the material that needs to be fermented. In all mammals, roughage-rich diets insure a predominance of lactic acid bacteria, generally considered beneficial and very territorial.

These essential and usually under-appreciated microbes convert enzymatically-indigestible material to energy and microbial protein. However, unlike protein exiting the rumen, microbial protein generated in the colon is mostly unavailable to the host. This is because only a small amount, mainly in the form of individual amino acids, is absorbed through the large intestinal lining.



Equine Large Intestine

The mammalian colon is an expandable organ. It is generally lined with pouches called sacculation, to trap and hold indigestible material for fermentation. In addition, less frequent intestinal wall contractions and a longer transit time promote more microbial activity in the colon, as compared to the small intestine.

Energy contribution by the colon depends on the quantity and quality of roughage in the diet and whether it is preceded by a rumen. Although cattle and camelids consume large quantities of roughage, their rumens are very efficient. In these species, the large intestine processes anything that manages to escape the rumen and sloughed intestinal cells. Poor quality roughage, especially if consumed in large amounts, could potentially survive fermentation in the rumen to continue fermentation in the colon.

The equine large intestine is an elaboration of the standard mammalian model. It takes volume and enhanced fermentation capacity to the extreme. Both the rumen and equine colon efficiently process large quantities of roughage. However, because the latter is more elongated and has hairpin turns similar to the small intestine, it is more prone to blockage.

According to Alexander (1963), horses digest and utilize more dietary protein than ruminants. This is because feed is subjected to gastric and intestinal proteases, and then absorbed by the small intestine. Most dietary protein is fermented in the rumen of cattle and camelids and then converted to either energy or bacterial protein.

Generally speaking, the poorer the quality of the roughage, the greater the amount that needs to be consumed in order to meet requirements. Nutrient density of hay that was already mature at cutting, or exposed to the elements after baling may be so low that consumption to capacity is insufficient to meet maintenance requirements.

As with the rumen, increased feed intake prompts increased digesta throughput. Reduced transit time also means less bacterial fermentation. Horses rely on the increased in-and-out system to generate required energy. Fermentation in the equine large

intestine is actually more efficient than that in the rumen (Alexander, 1963). This means in equines, the same amount of energy is extracted from an equivalent amount of roughage in less time, as compared to ruminants and pseudo-ruminants.

Bacterial fermentation in the equine large intestine produces large quantities of B-vitamins. Whether or not these are absorbed prior to defecation has been discussed by Caroll (1949). Mature horses with ad libitum access to pasture or hay probably generate enough B-vitamins for maintenance. Growing animals, especially those with an immature large intestine, should be supplemented.

Ruminants, pseudo-ruminants, and equines all possess at least one major fermentative organ. The location of this organ in relation to the stomach and gastric digestion, determines how much protein and soluble carbohydrate can be used directly by the host. Fore or hindgut fermentation is also influenced by the quality and quantity of roughage and the selectivity of the species.

References:

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Carroll, F. D., H. Goss and C. E. Howell. 1949. The synthesis of B vitamins in the horse. J. Anim. Sci. 8:290.

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.