Nutritional Requirements and Assessing Nutritional Status in Camelids

Robert J. Van Saun, DVM, MS, PhD

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- Llamas • Alpacas • Nutritional requirements
- Feeding management • Nutritional status

The practice of feeding animals is considered part science and part art. Unfortunately, when it comes to basic feeding practices for llamas and alpacas, we are short on science and long on art. Scientific reports documenting specific nutrient requirements for camelids are limited. Articles addressing some aspect of nutrition represented less than 15 percent of total citations on South American camelids covering the years 1943 to 2006 in a Web-based bibliography.[1] Most of the nutritional citations addressed digestive function, feed preference, comparative digestive efficiency, and nutritional disease with only a couple specifically addressing nutrient requirements. A substantial amount of nutritional research data can be found in South America; however, much of this information is not readily available through literature search engines in countries outside of South America.

Available camelid data suggest similarity of the digestive process and susceptibility to nutritional diseases with other domesticated ruminant animals. With a functional understanding of camelid digestive anatomy and physiology, one could make appropriate recommendations based on well-established databases for both cattle and sheep. A recent National Research Council (NRC) publication describing nutrient requirements for small ruminants includes suggested requirements for llamas and alpacas.[2] This article summarizes current nutrient requirement recommendations and provides some practical feeding recommendations, and methods and criteria for assessing nutritional status of llamas and alpacas will be described. The term "camelids" is used to refer generically to llamas and alpacas and is not inclusive of other members of the camelid family.

Department of Veterinary and Biomedical Sciences, College of Agricultural Sciences, Pennsylvania State University, 115 W.L. Henning Building, University Park, PA 16802-3500, USA
E-mail address: rjv10@psu.edu

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APPLIED DIGESTIVE ANATOMY AND PHYSIOLOGY

South American camelids are ruminant animals in that they have an expanded foregut to facilitate microbial fermentation of ingested feedstuffs and they chew their cud. However, camelids (suborder Tylopoda) are not considered true ruminants as a result of some very distinct anatomic and physiologic differences in their digestive tracts compared with the variety of species belonging to the suborder Ruminantia.

Foregut Anatomy and Function

The most striking difference between camelid and ruminant digestive tracts is anatomic; camelids have only three distinct compartments associated with the foregut and stomach as compared with the four-compartment ruminant organ.[3] Another unique feature of the camelid foregut is the presence of small saccules in both C-1 and C-2. These saccules are lined with a glandular (eg, secretory function) epithelium as compared with the stratified squamous (eg, protective function) epithelium of the remaining area.[3,4] A secretory function aiding fermentation-buffering capacity has been suggested.[5] However, other investigators have suggested that these saccules aid in rapid absorption of volatile fatty acid (VFA) fermentation end products and solutes.[4]

Though anatomically different, studies of fermentation characteristics show the microbial fermentation process and end-product VFA production for camelids is similar to true ruminants.[3,6] The microorganisms found in the camelid foregut are the same ones found in other anaerobic fermentation systems (eg, ruminant foregut and equine hindgut).[7] This observation is also supported by the clinical ability to transfaunate camelids with rumen contents from cattle, sheep, or goats.

Motility of the forestomach is a critical function with regard to continual fermentation activity. Foregut motility ensures constant exposure of the ingested feedstuffs to microbial fermentation and subsequent degradation. Similar to the true ruminants, foregut motility in camelids occurs in two distinct phases. Beyond this, foregut motility is dramatically different. In camelids, C-2 contracts strongly, followed by contraction of the distal aspect of C-1 (A phase). Phase B initiates when the cranial portion of C-1 contracts followed by contraction of C-2 and the caudal portion of C-1. This B phase may repeat itself three-to-six times during a cycle before a brief rest period and beginning of a new cycle.[8] Eructation may occur three-to-four times during each motility cycle. In comparison, camelids have greater forestomach activity compared with the single bi- or triphasic contraction per minute of true ruminants. This increased motility pattern found in camelids may also have some bearing on the observation that these animals are fairly resistant to foregut gas accumulation or bloat as opposed to true ruminants.

Another important difference between camelids and ruminants is rate of passage through the fermentation vat. Comparative studies found a slower rate of passage for feed particles, resulting in longer retention time, consequently allowing for greater degree of degradation.[9–11] In contrast, water passes through C-1 more rapidly compared with the rumen, potentially providing greater C-1 buffering capacity and increasing microbial yield.[12,13] Collectively, these factors provide an advantage to camelids for consuming poor-quality, low-protein forages compared with other ruminants. This competitive advantage is lost when consuming higher quality feeds.

Metabolic Differences

Although ruminant animals, camelids show unique aspects to glucose and amino acid (protein) metabolism compared with true ruminant animals. Glucose metabolism in