



# THE GRAIN DILEMMA: an overview of alpaca nutrition

BY LARK L. BURNHAM, PH.D.

**M**any alpaca producers contend that because grain and alfalfa are not native feeds for pseudo-ruminants, alpacas are unable to digest and utilize them.

(Pseudo-ruminants are mammals that have pre-gastric fermentative organs but are not true ruminants). Alpaca breeders believe that these feedstuffs are harmful to their animals. A discussion of this quandary requires an overview of alpaca digestion and some of the very real concerns involved with feeding grain and alfalfa. This is only the first in a series of articles that will discuss issues involving these feeds.

## Digestion in the rumen/C1 (pre-gastric fermentative organ in alpacas and llamas)

The key to understanding pseudo-ruminant nutrition is summarized with this axiom: alpacas ingest feed, microbes digest feed, then alpacas digest the microbes. This is simplified, of course, and not necessarily true of all nutrients. However, it is true for the vast majority of soluble carbohydrates (including sugars and starches contained in grain) and for proteins (contained in alfalfa).

Digestion in the pseudo-ruminant is a team effort. The animal procures the feed, masticates it several times to reduce particle size, and the rumen/C1 keeps it all well-mixed. The rest of the team is made up of billions of microorganisms that ferment the ingested feed.

Not all nutrients are fermented at the same rate. Soluble carbs, such as sugars and starches, and proteins ferment comparatively quickly. Because these nutrients are easily degraded, they yield energy in as little as one to two hours. The carbohydrates found in forages are insoluble and take two to four days to break down. Solubility, or ability to absorb moisture, determines energy accessibility. Microbial fermentation can only occur in an aqueous environment.

Soluble carbohydrates produce more energy output with less energy input than insoluble carbs. Put more simply, they deliver more “bang for the buck.” Proteins, which are long chains of amino acids, are similar to soluble carbohydrates in that a) they are easily degraded; and b) they yield more energy than forages.

Whether the feedstuff being fermented (degraded) is soluble or insoluble carbohydrate, the end result is the same: volatile fatty acids, or VFA. These are short-chain fatty acids that ruminants and pseudo-ruminants readily absorb through finger-like projections on the walls of the rumen. The quantity and rate of that release differs between roughages (a gradual release over three to four days) and sugars, starches, and proteins (a burst of energy in as little as one to two hours).

By controlling the diet, producers control the availability of feed energy. In most cases, alpacas will do well on a diet that is mostly roughage (hay and/or pasture). Additional energy may be necessary during lactation and after weaning.





Photo © 2011 Eric Lorraine and Chris Barby



Photos © 2011 Eric Lorraine and Chris Barry

Like any change in feed, introducing alpacas to lush pastures should be done gradually to allow rumen microbes to adjust.

### A little about microbes

Although there are over 400 species of microbes (good, bad, and indifferent) that inhabit the rumen/C1, only a handful dominate. These few species are the most successful at procuring nutrients and living space under conditions in the animal at that particular time. Dominant species may be replaced by weaker (and often pathogenic) ones if the diet changes or the animal experiences stress such as birth, weaning, transportation, shearing, or showing. Prolonged or chronic stress can prevent the repopulation of beneficial species. The results may include diarrhea and poor growth.

Microbes have a very short replication time (the time it takes for one microbe to become two). This can range from 40 minutes to a few days. Combine short generation interval and the fact that many microbes swap DNA, and the result is lightening-fast (comparatively speaking) evolution and adaptation.

Microbial populations naturally shift and change

as alpacas grow and develop. Crias start out with microbes received from their mothers at birth. Other microorganisms are picked up from the environment and from other animals. As crias add solid food to their diet, the rumen/C1 begins to enlarge and microorganisms proliferate. After weaning, all feed is processed through the now-mature organ. Microbial populations continue to shift every time the diet changes, or when the animal experiences significant stress.

Alpaca survival is dependent on a diverse collection of mainly beneficial rumen microorganisms. Although only a handful dominate at any one time, changes in diet, weather, or location may force a rearrangement. Any diet change should be made slowly for this reason, over a minimum of two weeks. Sudden alterations in diet and weather cause stress and may promote the proliferation of pathogenic species. Many diseases start with stress.

The above discussion is not meant to either repudiate the nay-sayers or justify those who already feed grain and alfalfa. To many alpaca producers, “grain” means “pelleted supplement”. The latter usually contain grain, or more likely, grain by-products, but can also contain other ingredients such as alfalfa meal, roughage by-products, soybean meal, vitamins, and minerals. The combination seems harmless, however there are inherent problems with combining pelleted supplements with free-choice minerals.

For the purpose of this article, and all others by this author, the term “grain” refers to the seeds of plants such as corn, wheat, oats, and barley. As defined, grain is mainly a source of energy.

### Health problems related to diet

Founder is a metabolic disease initiated by an overdose of rapidly-fermenting carbohydrates, including grain (either as the actual seeds or in pellets) and fast-growing pasture (common in the spring and after a prolonged drought). If an animal is suspected of such over-consumption, especially if they develop hot and swollen feet, they need to see a vet, ASAP. Avoid founder by keeping grain supplements in a secure location. Also be aware of pasture conditions. A lush green pasture may look inviting and harmless. Think kids in a candy store—adult supervision is required.

The industry is already plagued with the growing problem of obesity. Although many stridently deny that pellets are to blame, the fact is that they are, at the very least, part of the problem. Obesity can cause lameness, poor fleece quality, reduced fertility, dystocia (difficult birth), fatty udders, and decreased survival of crias.

Just as in humans, obesity has serious consequences in health and reproduction. All mammals have

evolved the ability to store any unnecessary dietary energy, usually in the form of fat. If the energy surplus continues, fat will be added both subcutaneously and internally around organs. This includes the udder. Fatty udders may lead to limited or nonexistent lactation capability.

Excessive energy intake during gestation can also lead to large crias and increased possibility of dystocia. Dystocia often requires veterinary assistance and may result in the death of dam and/or cria.

### How to avoid obesity in alpacas

A tool is available to the industry, and is already in use by many producers. Body condition scoring (BCS), sometimes called “body scoring,” is a scale of either 1 to 5 or 1 to 10, whereby each animal is graded on condition. A score of one is extremely thin, and one of either 5 or 10 is extremely fat. Hopefully, you will never see any alpacas with either score. Animals should be separated (at least during feeding time) depending on stage of reproduction and BCS. A protein and energy supplement (described below) should be reserved for lactating females and any animal that is underweight.

What about those alpacas which are already obese? Fortunately, nature provided a sure-fire way for females to lose weight, providing they first deliver a healthy cria and their udder is functioning. Lactation is probably the biggest energy drain in a female’s life. Weight loss in early lactation can occur because it is difficult for the dam to eat enough to meet energy needs.

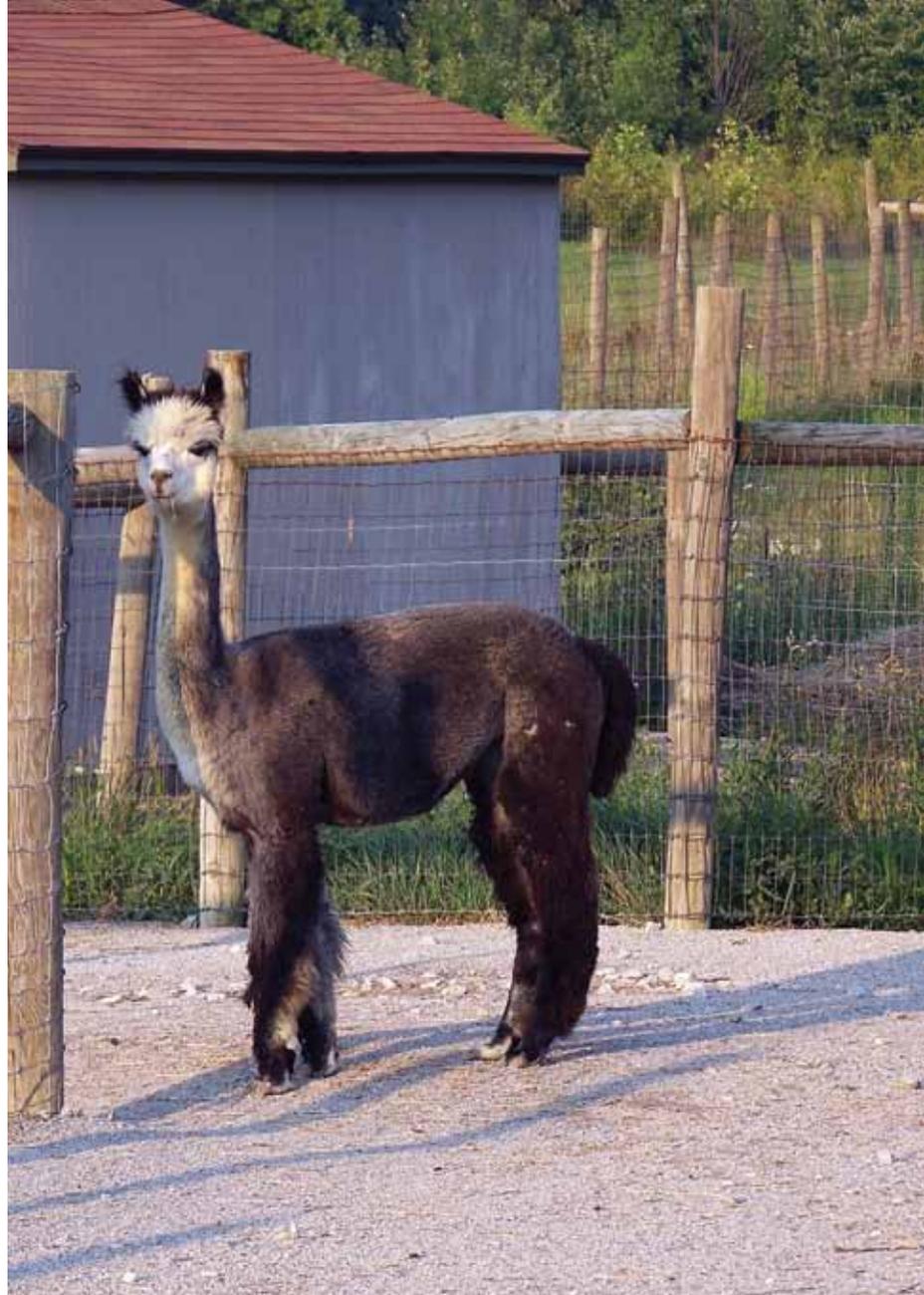
Lactation aside, there are other mechanisms to encourage weight loss. Obese animals should be restricted to hay (preferably grass hay) or pasture and mineral mix. Some may need to have grazing time restricted as well. Eliminate access to pellets or other energy supplements.

### The dilemma presented by supplements

Supplements, which have been a big part of the industry for many years, are convenient to buy, store, and feed. However, no supplement can be formulated to supply all necessary vitamins and minerals, and the correct proportions of energy and protein, for every alpaca, no matter what the label states.

Nutrient requirements vary with age and stage of reproduction. Many supplements are formulated specifically for gestating/lactating females, yet the same feed is often given to the entire herd. The result is mineral imbalance and obesity.

In addition to pellets, many alpacas also have access to a free-choice mineral mix. When fed along with pellets, additional minerals can cause either mineral deficiencies or toxicities. For example, a deficiency of



the trace mineral zinc, often caused by excess calcium and/or phosphorus intake, can lead to infertility in both sexes. Calcium and phosphorus are common ingredients in pellets.

A relationship exists between most minerals. Increase the amount of one, and the availability of the related mineral decreases. Toxicities can also result. Ideally, mineral mixes are formulated for each farm, based on an analysis of pasture and forage.

Mineral deficiencies and toxicities can be avoided by feeding an energy and protein supplement, instead of pellets. A simple 15% crude protein supplement can be formulated, mixed, and bagged at many local feed mills. Ingredients include grain of choice, soybean meal and/or alfalfa meal, beet pulp and/or flax seed, and a small amount of molasses to control dust and keep fines from sorting out. Call local mills and ask if they do custom-mixing, if they can formulate diets, and if they have the ingredients you would prefer to use.

**Paddocks and fencing allow owners to control the amount of grazing, important in preventing founder and obesity.**

Another option to feeding pellets is to feed crimped oats, with or without beet pulp. Although not as high in energy as corn, oats are high in both protein (> 13%) and fiber. It is difficult for an animal to founder on oats. These supplements should only be given to animals that need extra energy and protein, including lactating females and animals that are underweight. A good mineral mix should be available at all times.

One important note: an energy-protein supplement should not be fed at the same rate as pellets. This is because such a supplement will not provide the same amount of energy and/or protein for a given quantity or weight. The best method to determine whether your energy/protein supplement is right for each animal is to body score on a regular basis. This means after parturition,

midway between parturition and weaning, at weaning, and midway between weaning and the next parturition.

By the same token, different grains contain more energy than others. Always gauge the success or failure of a feeding regimen on BCS. Gender, age, and stage of reproduction are different for each animal; therefore, their dietary needs will also vary.

### Using mineral mixes

Some producers complain that their animals will not eat mineral mixes. This may be because the product being fed has been exposed to the weather and has turned to rock. Fresh mineral mix (loose form only) should be put out every week or so, in the amounts which the animals in that pen would be expected to consume within that timeframe.

Mineral intake may be lower than expected when animals are on pasture. Two tricks to seduce intake include the addition of a small amount of grain and location of the mineral dispenser near the water source. Animals in dry lot (a term for areas with no pasture where alpacas are fed hay instead of grazing) may have the reverse problem. Like humans, alpacas eat because they are bored. Intake may be controlled by adding small amounts of salt. Mineral supplement already contains salt. By adding more, it is possible to cross a tolerance threshold and actually decrease intake.

Whatever the situation, be aware of mineral disappearance and replenish frequently.

In many cases, the use of a standardized mineral mix would suffice, especially for small farms. However, farms in areas with high copper content in the soil should select sheep mineral mixes. These are formulated without copper. Large farms should consider having their forages analyzed and a custom mineral mix formulated. Analysis does not routinely include copper, so ask for it specifically.

### Putting it all together

A feeding system that uses an energy-protein supplement (rather than pellets) and BCS not only saves money, it helps avoid obesity and all its related issues. Don't let the fleece fool you—get up close and personal. Be aware of the condition of your animals and what they are eating, including the mineral mix. Pen bullies should be fed separately.



Photo © 2011 Jen Clark

Lark Burnham received a doctorate in ruminant nutrition from Texas Tech University in 2004. She now lives in northeastern Kansas where she works as a free-lance nutritionist. Please send all comments and questions to: [lark@natures-way.com](mailto:lark@natures-way.com).