

Researchers at Virginia Tech examined the effect of dietary protein quality on growth of Thoroughbred foals and yearlings. The authors proposed that the quantity of protein may be decreased by an improvement in protein quality, such as digestibility and amino acid profile. Protein quality may be improved by supplementation with amino acids that are limiting to protein synthesis. Lysine was identified as the first-limiting amino acid and Threonine was found to be the second-limiting amino acid. Protein status and growth were studied in 22 Thoroughbred foals from birth to 14 mo of age. The control supplement contained 14% CP. The experimental supplement was similar in ingredient composition except that it contained 9% CP plus 0.6% L-lysine and 0.4% L-threonine. This study found that an improvement in the quality of protein fed to growing horses would enhance growth rates. The authors reported 1) no difference between treatment groups over the observational period for any of the indicators of protein status and 2) periods of nutritional stress marked by greater weight gain in the group fed the amino acid-fortified feed. This evidence substantiates the role of protein quality in maintaining growth and suggests that fortification with lysine and threonine will permit a decrease in quantity of protein fed while promoting optimum growth in Thoroughbred foals.

*Staniar, W.B., D. S. Kronfeld, J. A. Wilson, L. A. Lawrence, W. L. Cooper and P. A. Harris. 2001. Growth of thoroughbreds fed a low-protein supplement fortified with lysine and threonine. J ANIM SCI, 79:2143-2151.*

ultimately allows performance horses to work time of year is beginning to decrease in energy content. Many horses will do fine on pasture until the pasture begins to mature and then they will begin to drop weight. For these horses, supplemental forage (hay) and additional grain with vegetable oil will help the horse maintain body weight.

## New From Poulin Grain: Decade Alpha Balance

Decade "Alpha Balance" is a vitamin, mineral and amino acid supplement for all classes of horses. "Alpha Balance" is the low protein (14%) supplement pellet, designed to be fed along with good quality hay. It is fortified with amino acids to maximize the quality of protein in the diet. "Alpha Balance" is also low calorie and low carbohydrate as a result of the small (2 lbs/horse/day) daily feeding rate. "Alpha Balance" contains stabilized flax (a source of omega-3 fatty acids), as well as live cell equine yeast, chelated trace minerals and organic selenium (selenium yeast). Alpha Balance can be added to unfortified grains such as oats to form balanced diets for all types of horses. The perfect supplement pellet - we think so.



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## Protein: Friend or Foe in Equine Diets?

*Dr. Tania Cubitt, Performance Horse Nutrition*

The word protein was derived from the Greek word proteos, meaning "of primary importance," an appropriate name in light of all of the critical roles that proteins play in the body. Protein makes up approximately 15% of total body mass, with the muscle containing the largest portion of the body's protein. Some of the key functions of proteins include providing structure, nutrient transport in the bloodstream, nutrient transport across cell membranes, regulation of metabolic function, as a component of the immune system, and as a buffer to minimize fluctuations in body pH.

Proteins are composed of units called amino acids. Although there are 21 different amino acids that are needed for protein synthesis, several can be made by the tissues of the body. Amino acids that must be provided in the diet are referred to as indispensable (essential) amino acids, and amino acids that the animal can make through its own metabolic pathways are termed dispensable (non-essential) amino acids. In horses, the amino acids that are classified as essential are histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan and valine. Lysine is the amino acid most often lacking in growing horse rations. The lysine requirement for weanlings is 0.6 - 0.7% of the diet and for yearlings 0.5% of the diet. No other amino acid requirements have been determined for the horse.

Considering all of the critical roles of proteins and amino acids in the horse, it is important to ensure that adequate amounts of protein and amino acids are provided in the diet. In order to provide adequate dietary protein and amino acids, it is important to have an understanding of how protein is digested and absorbed, the different dietary sources of protein available to the horse, and the protein and amino acid requirements for horses of various ages and physiological states.

### Protein Digestion:

In order for the horse to be able to utilize dietary protein throughout the body, they must first be digested into individual amino acids and small peptides. Protein digestion begins in the stomach, with the release of acid and digestive enzymes which breaks down the protein chains. Protein digestion continues through the small intestine by the activity of enzymes secreted from the pancreas into the small intestine. The end product of the small intestinal protein digestion processes are free amino acids, which are available for absorption into the bloodstream to be used for various functions throughout the body. The absorption rates of individual amino acids are highly dependent on the protein source.

### Protein Requirements:

In comparison to other species, relatively little is known about essential amino acid requirements of horses, or how these change throughout the lifespan, and therefore protein requirements for horses are generally expressed on a crude protein basis. To date lysine is the only amino acid that has an assessed requirement in horses. Table 1 outlines the crude protein and lysine requirements for different activity levels and life stages in horses.

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## Success Story - Allerage Farms

Allerage Farms has been in the Standardbred breeding industry since the late 1980's and has 2 breeding facilities; one in Stanfordville, NY and another in Sayre, Pennsylvania. Owners Jeff and Paula Gural operate Allerage Farms. Jeff is also the Chairman of American Racing and Entertainment who owns and operates Tioga Downs and Vernon Downs. Mr. Gural will be taking over the lease of the Meadowlands Racetrack in NJ as of September 1st of this year.

Allerage Farms has over 60 horses at their New York farm including mares, foals, yearlings and racehorse layups. In 2010, Allerage had a crop of 19 yearlings at the sales-and in 2011 there will be 23. With a wide range of horses and a busy schedule, it is important to use a feed that can suit the requirements of all the horses. Allerage's Stanfordville Farm has been using Poulin Grain feeds for over a year with some of their employees using it for over 5 years. "Poulin is the perfect feed for our stock - we use EQUI-PRO® E-TEC™ for the weanlings, yearlings, and broodmare. We have found we don't have to use different feeds for the different age groups, and that is wonderful. We also use E-TEC™ for the pleasure horses and babysitting horses. For yearling prep it has proven to be the best; our yearlings looked the best they have looked in years."

Allerage Farms was also the birthplace of millionaire trotting mare FERN (1:52.3 \$1,245,502), who won the Hambletonian Oaks, the Classic Series Final and many more on her way to 23 wins in sixty lifetime starts.

Poulin Grain is proud to have Allerage Farms as a client and wishes them much success in the future.



Table 1. Crude Protein and Lysine Requirements for Horses with an Expected Mature Body Weight of 1100 lb

	Crude Protein (g/d)	Crude Protein (%)	Lysine (g/d)
Maintenance (average)	630	6	27
Light Work	699	7	30
Medium Work	768	7	33
Heavy Work	862	7	37
Very Heavy Work	1004	8	43
Pregnant – 5 mo	685	7	30
Pregnant – 8 mo	759	8	33
Pregnant – 11 mo	893	9	38
Lactation – 2 mo	1530	12	84
Lactation – 4 mo	1398	11	75
Growing – 6 mo	676	13	29
Growing – 12 mo	846	11	36

(Data from National Research Council 2007; % CP based on feed intakes of 2.5% of BW for heavy, and very heavy work, lactating mares, and growing horses; 2.25% of BW for medium work; and 2% of BW for all other classes)

**Protein Deficiency:**

Symptoms of dietary protein deficiency in horses are similar to the symptoms in other mammals: general non-thriftiness, depressed feed intake, weight loss, and poor hoof and hair coat quality. If an essential amino acid is deficient in growing horses, this will be reflected by lower rates of average daily gain, whereas a limiting amino acid during lactation could reduce milk protein and amino acid content and reduce rates of foal growth. Other studies have also reported reduced milk production, increased weight loss in mares and reduced rates of foal growth if insufficient dietary protein is provided during lactation. Because exercise training appears to increase lean mass and total nitrogen retention, athletic horses that do not consume enough essential amino acids to maintain their increased muscle mass or replace nitrogen losses in sweat will begin to deplete the plasma amino acid pool or lose muscle mass, resulting in increased nitrogen excretion.



**Protein Sources:**

Not all protein sources are the same – some are of a higher quality than others. Quality of a dietary protein is determined by the amount and proportion of essential amino acids it provides. To increase the quality of protein in commercial horse feeds the amino acids Lysine, Threonine and possibly Methionine are most likely to be added.

**Seed meals –**

When oil is extracted from the oil seeds such as soybean, sunflower, canola, cottonseed, flaxseed, etc., the remaining seed meal is a high protein by-product that may be used in livestock feeds. Soybean meal is the most commonly used seed meal in horse feeds because it is widely available and relatively inexpensive. It has 44 - 48% crude protein (CP) content on an as-fed basis. Soybean meal is especially high in lysine, which is commonly low in most grains. Soybeans should not be fed to horses in their raw form. In the raw form they contain an inhibitor of protein

digestion in the horse. The amino acid profile of soybean meal is superior to most other seed meals. Cottonseed meal, sunflower seed meal, safflower meal, peanut meal, canola meal and sesame meal are all comparatively low in lysine.

**Cereal Grains and Grain By-Products -**

Cereal grains are incorporated into horse diets for energy, but they do provide protein some amino acids as well. Cereal grains do not contain high quality protein. Consequently grain by-products often contain moderate or low quality protein, even though they may be relatively high in crude protein. Therefore the amino acid content of by-product feeds should be considered when they are incorporated into horse feeds, especially if their inclusion reduces the use of ingredients with higher quality protein.

**Forages -**

Forages (hay, pasture, bagged forage products, etc.) are important components of horse diets and can be excellent sources of protein and amino acids. However, forages can also be extremely variable in nutrient content. Legumes that are used as forages for horses include alfalfa, various types of clover, lespedeza, and varieties of peanut, pea, lupin and soybean that have been selected for forage production. Alfalfa is a high quality source of protein due to its elevated lysine content compared to most other forages. The crude protein concentration in common legume forages will usually exceed 14% on a dry matter basis. Grasses are usually lower in crude protein than legumes. Crude protein content of forages is highest when the plant is in a vegetative stage of growth and is lowest when the plant is in a late stage of maturity.

**Animal Proteins –**

Meat scraps or blood meal are not acceptable in horse rations as they are unpalatable, have limited digestibility and can manifest toxic bacteria and ultimately cause death.

**Summary:**

Horses receive their dietary amino acids from three key sources: forage, cereal grains and seed meals. There are also many supplements currently being marketed for a variety of purposes that contain individual amino acids; however, at this time there is insufficient data to verify the majority of the supplement claims.

**Quick Facts**

**Simple Protein Calculation**

When comparing the amount of protein supplied by different products we often just discuss protein concentrations as a percentage. When in fact we should also be taking into consideration the feeding rate of the products we are comparing. Some people become very concerned by products that they perceive to contain high amounts of protein for example, supplements that contain 24% protein that are meant to be fed at a rate of 1 to 2 lbs per day. Some simple calculations can help determine how much actual protein is being gained from a product if we take into account protein percentage and amount of the product being fed.

For example: a concentrated protein, vitamin and mineral supplement such as Poulin Grain’s MVP has a feeding rate of 1 lb for an average 1000 lb mature horse – MVP contains 24% protein – now let’s put this in perspective.

24% of 1 lb = 109 g of protein

If we were to choose a “lower protein feed” such as a typical 12% concentrate with a feeding rate of 4 lbs and do the same calculation – we get double the amount of actual protein:

12 % of 4 lbs = 218 g

Forage is typically where most of the horses protein actually comes from – but its protein content is often overlooked. Average grass hay contains approximately 8% protein and we would usually feed about 15 lbs per day

8% of 15 lbs = 544 g of protein

If one is looking to increase the protein content of the diet for a broodmare or growing horse, alfalfa is generally the best option. Average alfalfa contains 17% protein; the addition of 5 lbs of alfalfa can really boost the quantity and quality of protein provided.

17% of 5 lbs = 385 g of protein

Take home message – remember to consider the amount of a particular product that is being fed and NOT just the protein percentage.

**Question & Answer with Dr. Tania Cubitt**

**Four Common Myths about Protein**

**Myth 1: "High Protein Feeds Make My Horse Crazy."**

The belief that behavior can be affected by feeding hays or grain mixes with a high protein content is probably one of the most common misconceptions among horsemen. There is no scientific data that suggests that protein intake has anything to do with mental attitude. However, high-spirited behavior has been directly linked to the energy content of the diet. The horse is unique in that it compensates for excess dietary energy by increasing physical activity. As a result, the horse that receives too much energy (calories) in the diet is more apt to be excessively high spirited. High protein does not necessarily mean high energy, and vice versa. Grains have 30 to 50% more energy than hays, but not necessarily more protein. Beyond the grain source, too much energy can also come from the hay. Alfalfa, although high in protein, is also higher in energy than most grass hays like Timothy. If the amount of alfalfa fed supplies more calories than the horse needs, it is the energy content of the alfalfa, NOT the protein content, causing his hyper behavior. The bottom line: too much energy in the diet (excess calories) = too much energy in the horse (hyper behavior). Protein level has nothing to do with it.

**Myth 2: "Performance Horses Need a High Protein Diet."**

Several surveys conducted on feeding practices have revealed that mature performance horses receive two to three times as much protein in their diet as they require. The common belief that once a horse enters training, or is ridden or shown extensively, the activity substantially increases the need for more protein in the diet is false. This myth likely

has its roots in human nutrition. For hundreds of years, it was believed that exercise and training involved the “tearing down of old muscle, and the building of new muscle.” Since muscle is primarily composed of protein, it was deduced that more protein was needed in the diet of human athletes to serve as the building blocks for new muscle. A significant amount of both human and equine research over the last fifty years has disproved this theory. Protein requirements do increase slightly with training and exercise, but this is insignificant in comparison to the protein needs of a young, growing horse, or a lactating broodmare. In most cases, we can meet the increased protein needs of performance horses when we adjust the diet to provide for the increased energy needs.

**Myth 3: "High Protein Diets Cause Development Problems in Foals."**

Genetics, exercise and nutrition all play a role in the development of healthy bones, and as a result, the same factors are also linked to the occurrence of developmental orthopedic disease (DOD) in young horses. Most confusion regarding DOD is related to nutrition. Mineral imbalances have been well-documented as a cause of DOD. Excessive protein was blamed as a cause in the 1970’s, but later studies disproved this connection. Feeding more protein than the foal needs does not increase growth rate above that achieved when the diet just meets protein requirements. Unfortunately, the diets of many young horses are kept quite low in protein for fear of causing developmental problems. Restricting protein will not result in improved bone growth and can actually be harmful to the foal by decreasing feed intake, growth rate and skeletal development. On the other hand, overfeeding *energy* may result in developmental problems, particularly if protein and mineral intake are not increased at the same time.

**Myth 4: "Alfalfa causes kidney damage."**

Although alfalfa may provide more protein than mature horses need, there is no evidence to suggest that a moderate dietary excess of protein is detrimental to healthy horses. Protein is made up of amino acids, which are composed of carbon, hydrogen, oxygen and nitrogen. When horses (or humans) consume more protein than they need, the carbon, hydrogen and oxygen from the amino acids are used for energy and the excess nitrogen is excreted in the urine. Horses consuming alfalfa (and other high protein feeds) have been noted to drink more often and urinate more than horses consuming lower protein diets. But there is no reason to believe that a horses’s kidneys will be damaged when this occurs. It’s only when a horse already has pre-existing kidney disease that the high calcium and protein in alfalfa can aggravate kidney dysfunction.

**Research Update**

**Protein Quality Not Quantity for Growing Horses**

It is not enough that a horse's diet contains an adequate amount of protein, but the quality of protein also becomes very important especially in young, growing horses and broodmares. Protein quality refers to the amount and ratios of essential amino acids. Protein quality and amino acid profile can alter how much protein the horse actually requires. While we often just discuss protein requirements generically as a percentage, the question still remains - can a lower total amount of protein be fed if it is of higher quality?

**Do you have a question on Equine Nutrition?**

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