

How to Feed a Horse: Understanding Basic Principles of Horse Nutrition

Kylee J. Duberstein, Ph.D.
Department of Animal and Dairy Science, University of Georgia
Edward L. Johnson, Ph.D.,
Department of Animal Sciences, University of Florida



Introduction

How do you properly feed a horse? With so many feed, supplement and hay choices available, many people find themselves wondering exactly what their horse needs for good health and nutrition. Many horse-feeding opinions and myths make deciding what to feed even more difficult. The law requires commercial horse feed manufacturers to put information concerning their feed on a “feed tag,” which is either attached to or printed directly on the bag. This tag provides essential information on what the horse will be eating. However, most horse owners either don’t understand or don’t take the time to read this information. This publication explains your horse’s nutritional needs, common guidelines to observe when feeding your horse and how to determine if your horse’s nutritional requirements are being met.

Basic Nutrients

When feeding horses, it is important to recognize that there are six basic nutrient categories that must be met: carbohydrate, protein, fat, vitamins, minerals and water. Often, feed companies will balance the first five nutrients for us; however, it is critical not to forget about water. A normal, healthy horse will consume 5-15 (or more) gallons of water per day depending on temperature, humidity and activity level. Clean water should be provided daily, and ideally, should be available at all times for the horse to drink when it is thirsty. If this is not possible, horses should be watered a minimum of twice daily and allowed several minutes to drink each time. Horses that do not drink enough water are more susceptible to conditions such as dehydration, intestinal impactions and other forms of colic.

The rest of the horse’s diet should be formulated based on its requirement for each of the other five nutrients. These requirements differ from individual to individual and are influenced by the horse’s body mass, age, workload and metabolic efficiency. It is a very useful skill to be able to look at a feed tag and determine if that feed is going to meet your horse’s requirements. Let’s look at each category of nutrients you will encounter when evaluating your feeding program.

Overview of Basic Nutrients

Carbohydrates: Carbohydrates will most likely be the largest part of the horse's diet. They can be divided into two groups: structural (fiber) and non-structural (sugars and starches). Structural carbohydrates are found in the largest amounts in the roughage that the horse eats (e.g., hay, grass) and are able to be digested thanks to the design of the horse's intestinal tract. Following digestion in the stomach and small intestine, the horse's digestive material enters the large intestine (hindgut), which in the horse consists of the cecum and colon. The cecum and colon contain microorganisms that are capable of breaking structural carbohydrates down into an energy source that the horse can absorb. This is why horses get so much nutritional value from grass and hay.

It is important to feed good quality hay that is free of mold and dust and is cut at an appropriate length and stage of maturity. Hay that has too coarse a stem or hay that is too fine can cause digestive problems such as impactions. Hay that is overly mature when it is cut has little nutritional value to the horse due to an increase of a component called lignin, which is completely indigestible for the horse or the microbes in the gut flora.

Horses can easily digest nonstructural carbohydrates, mostly in the small intestine. These sugars and starches are primarily found in grains (e.g., corn, oats, barley) and provide a more concentrated form of energy than structural carbohydrates (thus, the term "concentrates" is often used when referring to grains and grain mixtures). It is important to recognize that the horse's digestive system evolved to process a roughage-based diet; therefore, concentrates should be used as supplements to meet energy requirements that cannot be met by forage alone. The horse should always be fed a minimum of 1 percent of its body weight in forage (on a dry matter basis); the ideal is 1.5 to 2 percent of its body weight. Feeding less roughage than this can lead to health issues such as colic and ulcers.

Protein: Protein, which is necessary for body growth and maintenance, is a nutrient that is poorly understood by many horse owners. Proteins are broken down in the small intestine into amino acids that are recombined to make proteins in the body that make up muscle, hair and hoof. It is important to realize that proteins are composed of amino acids, and the proteins that the body makes have very specific

amino acid sequences. The amount of protein that the body can synthesize is limited by the amino acid that basically runs out of supply first. For horses, this is generally lysine. Therefore, on many bags of horse feed where the protein percentage is listed, it might also say "added lysine" and list an additional percentage for the lysine content. This, in essence, improves the protein quality without increasing the total amount of protein in the feed.

There are advantages to improving protein quality without increasing the total protein amount. It is a commonly held misconception in the horse industry that higher protein is associated with higher energy. In reality, proteins are the most difficult energy source for the horse to digest and convert to usable energy. Protein requirements for growth and maintenance vary depending on age and workload. In general, growing horses need a higher percentage of protein than mature horses. A growing horse generally needs between 12 and 18 percent crude protein in its diet for proper growth and development. Horses need more protein when tissue is being laid down for growth (i.e. young horses in rapid growth phases, gestating mares in their last trimester, and lactating mares that need to produce large quantities of milk). Mature horses will most likely do fine on a lower protein percentage (8 to 12 percent), depending on their workload. Horses that are in intense training need more protein than the maintenance horse because they are developing muscle tissue; however, most will still do well on a 12 percent protein feed. Feeding horses higher levels of protein than they need simply means that the horse breaks down the excess protein and excretes it as urea in its urine, which is rapidly converted to ammonia. This is not desirable since excess ammonia can lead to respiratory problems in stabled horses.

It is important to recognize that forage is also a source of protein. Select hay that will help meet the horse's protein requirement. Hays can be categorized as either grass hays (e.g., bermudagrass, timothy) or legume hays (e.g., alfalfa, peanut, clover). In general, legume hays are higher in protein than grass hays. Good quality legume hay can have roughly 18 to 22 percent crude protein, while good quality grass hay can have 10 to 16 percent crude protein. Again, quality and growth stage at harvest determine how digestible the hay is and influence how much protein the horse receives from it.

Fats: Feeding high-fat diets is a relatively new trend in the horse industry. It has been demonstrated that horses can tolerate a fairly high level of fat in their diet. Fat is an excellent and easily digestible source of energy. Commercial feeds that are not supplemented with additional fats contain approximately 2 to 4 percent fat. Many commercial feeds are now supplemented with fat in the form of some type of stabilized oil. These feeds can contain anywhere from 6 to 12 percent fat. Since adding fat to a feed increases its energy density and the horse will require less feed, it is important to be sure that all other nutrients (i.e., protein, vitamins, minerals) are also high enough to meet your horse's requirements. While commercial feeds will be nutritionally balanced, if you are increasing the fat in your horse's diet by simply pouring some type of oil or fat supplement on the feed, it is important to be sure that you are meeting his other nutrient requirements and not just his energy requirement.

Vitamins: Vitamins are critically important organic compounds. They must be present in the body to enable important reactions to take place that allow the animal to live. Vitamins are divided into two categories: the water-soluble group consists of the B-complex vitamins (e.g., B1, B2) and the fat-soluble group is comprised of vitamins A, E, D and K. Some vitamins also have associated names (for example, B1 is also known as thiamine). It is important to check your feed and be sure that all of your horse's vitamin requirements are being met since vitamin deficiencies can lead to various health problems. However, it is also important to realize that extreme excesses in these vitamins are not desirable either, particularly regarding fat-soluble vitamins. Excess water-soluble vitamins are generally excreted in the urine; however, fat-soluble vitamins are stored readily in the animal's fat tissue and therefore can build up to high levels if fed in excessive amounts. Since excessively high levels of vitamins can lead to toxicity, it is important to use good judgment when feeding nutritional supplements that are high in particular vitamins. In most cases, a good forage program combined with a well-formulated concentrate will provide adequate vitamins to meet your horse's requirements.

Minerals: Minerals are critical inorganic materials that must be present in adequate amounts for the body to function properly. Minerals are another item that can be found in supplements on feed and tack store shelves. It is important to understand that mineral needs will change depending on your horse's age and status (i.e., if the horse is working, gestating or lactating). Most commercial feed companies balance

their feed to meet the mineral requirements of different classifications of horses. Forage will also provide minerals. In some cases, additional supplementation of some minerals may provide desirable results. For example, biotin, zinc and copper supplemented above requirements have been shown to improve hoof strength. However, care should be taken because excessive amounts of minerals may also cause toxicities, lead to serious health conditions or interfere with absorption of other minerals.

If your horse does not receive a commercial concentrate or eats very little of it, it may be important to supplement additional vitamins/minerals to his forage diet by feeding a product called a ration balancer. Ration balancers are manufactured by many feed companies and are designed to be fed at a low level (approximately 1 pound per day) that contains the needed vitamins, minerals and protein. It is also possible to meet vitamin and mineral requirements by providing a free-choice loose salt-vitamin-mineral mix. Horses are inefficient lickers, so loose mixtures tend to work better than salt blocks. Also, mineral blocks are generally less than 5 percent mineral and more than 95 percent salt, so they do little to provide for the horse's vitamin/mineral requirements. A loose vitamin/mineral premix or a ration balancer is a good option for horses maintained on pasture and adapted to eating all-forage diets. If providing a loose mixture, a general rule of thumb is to expect horses to consume 1½ to 3 oz. per day.

One common mineral ratio you will see when looking at a bag of feed is the calcium:phosphorus ratio. It is important to check that both commercial feeds and vitamin/mineral premixes have a calcium:phosphorus ratio between 1:1 and 2:1. If the phosphorus levels are high in relation to calcium, calcium will be pulled from the bone into the blood stream to balance the calcium:phosphorus ratio. This is not typically a problem for grazing animals since phosphorus is fairly low in grasses, but grains are very high in phosphorus and commercial feeds are generally supplemented with some form of calcium. Feeding single grains, such as oats, can cause an inverse calcium:phosphorus ratio if calcium is not supplemented in some form. Another important mineral consideration is your horse's sweat loss. Horses that are in moderate to intense work and are sweating heavily lose electrolytes in their sweat. For these horses, it may be necessary to supplement both salt and additional electrolytes (such as potassium). A balanced electrolyte mix can be added to the horse's grain mixture as needed.

Simple Calculations to Determine Nutrient Intake

Nutritional requirements vary from horse to horse and it is important to be able to examine a feed tag and assess whether or not that feed will meet your horse's needs. Manufacturers typically put feeding instructions on the tag to help buyers determine if the feed is appropriate for their horses and how much of it should be fed to each individual. However, it is beneficial to be able to look at a particular feed and understand why it is or is not a good choice for your horse.

If you want to examine your feeding program more closely, the most in-depth listing of requirements can be found in the National Research Council (NRC) recommendations for horses (Nutrient Requirements for Horses 6th Edition, 2006). Approximate nutritional requirements based on a horse's age, workload and status are listed along with the nutritional value of different grains and hays. This resource is based on scientific research and is updated periodically to stay current with recent findings. To access this database on-line, go to <http://nrc88.nas.edu/nrh/>. This Web site allows you to select the age, weight, status and workload of a particular horse (under "Animal Specifications") and determine its specific nutritional needs for macronutrients (given in the table at the bottom of the web page) as well as vitamin and mineral needs (under "Other Nutrients"). This program also allows you to select certain forages and other feedstuffs (under "Dietary Supply" — click on "New" to change feedstuff) to determine how much of your horse's requirements are being met by a particular feed or combination of feeds (you must input the weight of each feedstuff being consumed).

Learning *for* **Life**

Sample By-Hand Calculation

If a mature horse weighs 400 kg and is not exercising, maintaining his weight and body condition will require approximately 504 g of protein (according to recent NRC guidelines). If the horse is eating 1.5 percent of its body weight in coastal bermudagrass hay, it is eating approximately 6 kg of hay each day (400×0.015). The average coastal bermudagrass hay contains approximately 10.4 percent crude protein. If you multiply 6 kg by 0.104, you get 0.624 kg, or 624 g. Therefore, in this instance, the horse's protein requirement is being met through the forage it is consuming.

As another example, if that same 400 kg horse is working at a very intense level, it will require approximately 804 g of crude protein. If the horse is eating the same 1.5 percent of its body weight in coastal bermudagrass hay, it will be short 180 g of protein (804-624) necessary to meet its needs. Therefore, a concentrate (grain) must be provided to make up the difference, and/or hay with higher protein content (e.g., alfalfa) can be fed instead of coastal bermudagrass. (Special note: When allowing the NRC computer program to calculate the dietary supply a certain foodstuff you are providing, it will often calculate slightly lower than when you calculate by hand. This accounts for losses that are difficult to determine by hand calculations; however, hand calculations will still give a fairly accurate estimate as to whether your feeding program is meeting your horse's requirements).

Calculating whether a feeding system meets a horse's nutrient requirements can be done on virtually every nutrient (including digestible energy that is provided primarily by carbohydrates and fats). Commercial feeds typically provide recommendations based on the horse's weight, age and activity level. These recommendations are based on NRC recommendations as well as the composition of their feed. Because there are many myths surrounding the practice of feeding horses that really have very little or no truth, it is important to understand your horse's nutritional requirements and be able to apply your knowledge in a practical manner.