



Creating the Right Mix: Understanding Nutrients in a Horse's Diet

By feeding your horses the correct balance of nutrients, you can ensure you are providing your horse a healthy diet.

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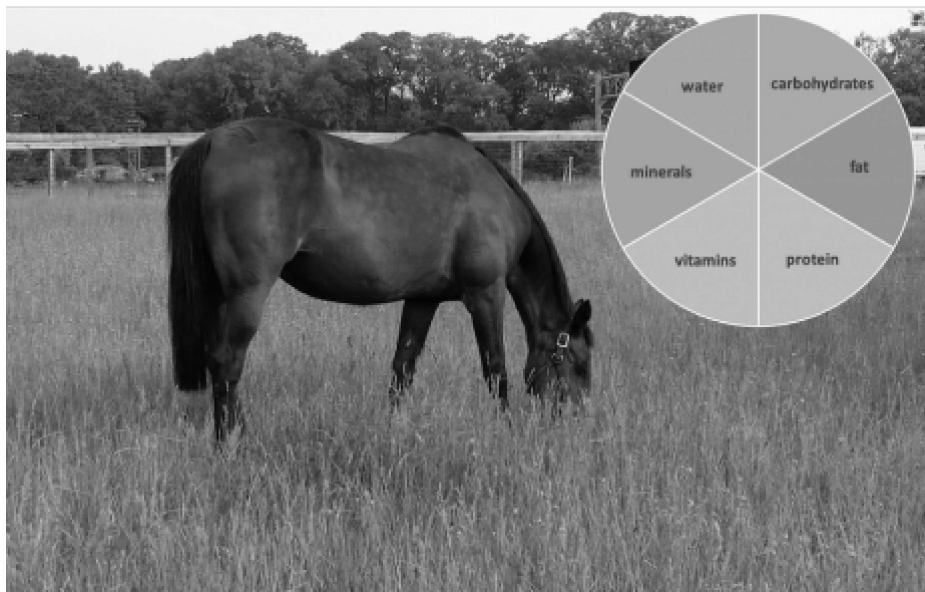


Photo credit: Laura Kenny, Danielle Smarsh, Penn State

One of the most important aspects of keeping your horse healthy is feeding a balanced, appropriate diet. But similar to the options you might find a grocery store for your family, the options of what to feed your horse can seem overwhelming. Understanding what nutrients are found in specific types of forages and grains can help you decide the best diet for

your horse.

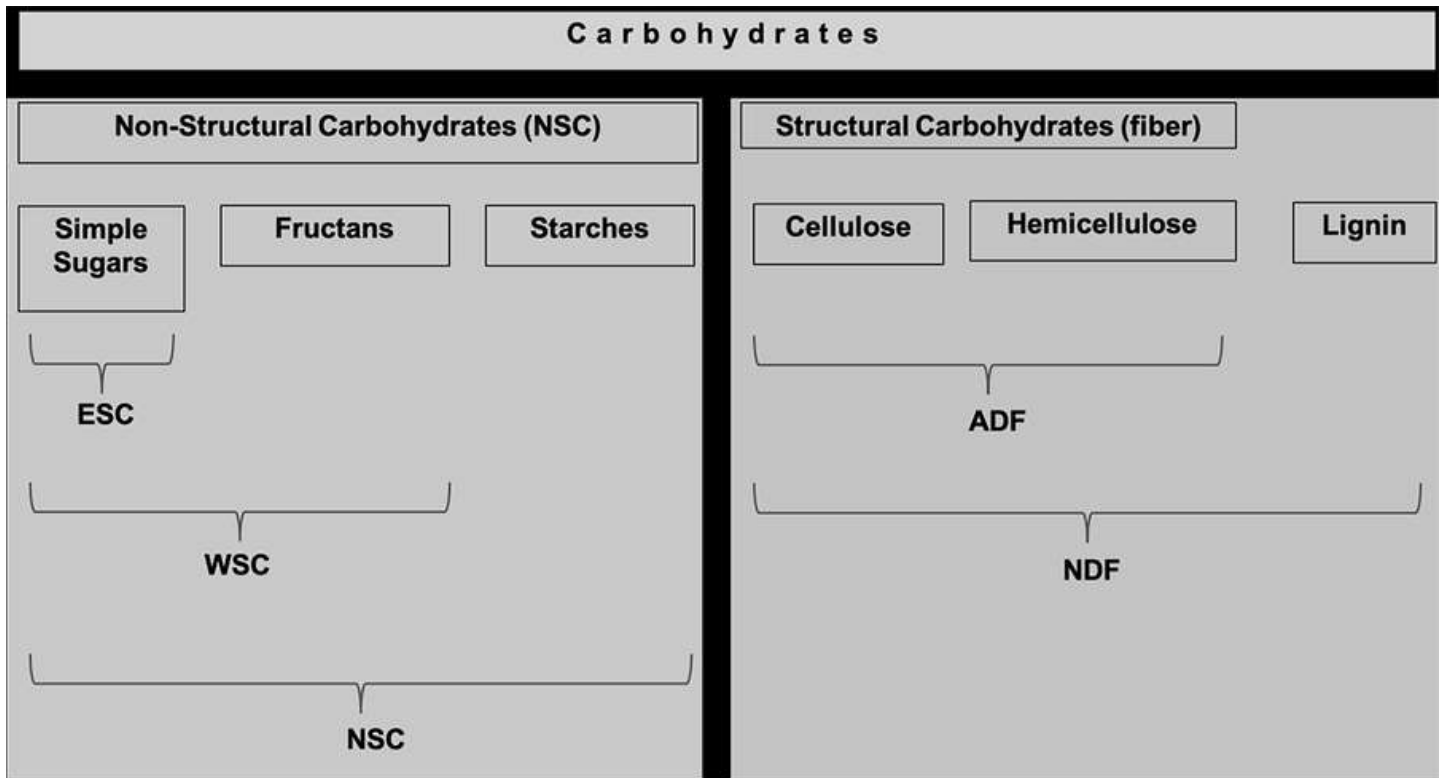
The six nutrient classes

A nutrient is something that is consumed in the diet and is essential to the animal's body. You will find a variety of nutrients in every feed and forage given to a horse, but the specific amount and types of nutrients will vary. There are six key classes of nutrients: carbohydrates, fats, proteins, vitamins, minerals, and water. Let's review each class of nutrients and explain why they are important for the healthy horse, and where in the diet you will find them.

Carbohydrates

Carbohydrates are one of the two main sources of **energy** for the body. Carbohydrates also provide **fiber** to the diet. There are many different carbohydrates, and they can be categorized in several ways. One way is to consider their chemical structure, and whether they are used to create structure for a plant or not. For example, hemicellulose and cellulose are complex, large carbohydrates used to maintain the structure of a plant. These carbohydrates are known as **structural carbohydrates** and give plant stems their rigidity. When we think about fiber in the horse's diet, hemicellulose and cellulose are a big part of that fiber component. Structural carbohydrates are digested by microbes in the horse's hindgut. When we analyze feed for carbohydrates, cellulose and hemicellulose are measured in acid detergent fiber (ADF) and neutral detergent fiber (NDF).

On the other hand, glucose and fructose are very small carbohydrates and are examples of **simple sugars**. This molecule is not used for plant structure but as an energy source (both for the plant and the horse that eats it). There are also more complex sugars, such as disaccharides (2 simple sugars bonded together), oligosaccharides (3-10 simple sugars), fructans (a long chain of fructose sugars), and starch (a long chain of glucose sugars). All of these molecules provide energy and are considered **nonstructural carbohydrates (NSC)**. These carbohydrates are found in all plants but are particularly high in grains such as corn, oats, barley, etc. They are digested in the horse's foregut (the small intestine, specifically). When analyzing feed, these nonstructural carbohydrates can be measured as part of several different fractions, including ethanol soluble carbohydrates (ESC), water soluble carbohydrates (WSC), or simply as NSC.



Description of the different types of carbohydrates, and the different fractions that are measured on a feed analysis. Illustration credit: Laura Kenny, Penn State.

Carbohydrates are key components of plants, and so, it is really impossible for a horse to have a “low-carb” diet since their whole diet is made of plants. From pasture grass to hay, to oats and pelleted feed, carbohydrates are everywhere in a horse’s diet. It is possible to create a diet for a horse that is low in *NSC*. This is needed for horses that have metabolic issues, such as chronic laminitis or metabolic syndrome. But for a healthy horse with no diagnosed metabolic issues, *NSC* is an important source of energy in the diet.

Fats

Fats are the other key source of **energy** for the horse. In fact, fats provide approximately 3 times as much energy as carbohydrates do – which can be a good thing or a bad thing, depending on the horse. For a horse that is working hard or needs to gain a little weight, fat in the diet can be very helpful. For a horse that is overweight, fat might not be needed.

Beyond providing energy to the horse, fat can provide a number of other benefits to your horse. A higher fat diet can give your horse a nice shiny coat. Adding liquid fats, like oils, to concentrates can help reduce dust, thus lowering irritation for

horses sensitive to dust in their environment. Fat can also be used to replace calories for horses that must be on a low-NSC diet.

Horses on a forage-only diet will consume very little fat. Grass and hay simply do not contain a lot of fat. Similarly, grains also do not contain a lot of fat. So where do we find fat in the horse's diet? Pelleted feed is one source, and the amount of fat will vary depending on the product (typical range is 5-15% fat). There are certain products that are designed to add a lot of energy to the diet, which are typically sold as high-fat products and can contain up to 30% fat. The fat found in pelleted feed can come from sources such as flaxseed or rice bran. Oil is another excellent way to add fat to a horse's diet; while there are many types of oil you could use, most commonly vegetable, corn, or canola oil is used. This oil can be used to top-dress grain or pellets.

There has been recent interest in specific fats called omegas. **Omega-3** (alpha-linolenic acid) and **omega-6** (linoleic acid) are **essential fatty acids**, which means they are required by the horse and must be supplied by the diet. As long as your horse is receiving a balanced diet, they should be receiving enough omegas in their diets. But omega-3 and omega-6 are of special interest due to their roles in the inflammatory pathway in the body. Omega-3 is considered anti-inflammatory, while omega-6 is considered pro-inflammatory. Both are necessary in the body for normal physiological processes, but current research is ongoing to see if there are health benefits to adding additional omega-3 fats in the diet of horses.

If adding extra fat to your horse's diet, it is important to do so slowly. It should take up to 2-3 weeks for you to add fat to the diet. When adding oil, start with $\frac{1}{4}$ cup total each day, and gradually add an additional $\frac{1}{4}$ cup every few days until the desired amount is reached. Divide the total fat evenly between meals. No more than 1-2 cups of oil or 20% of the dietary energy needs of the horse should be added. If using rice bran, make sure to select stabilized rice bran, as unstabilized rice bran can go bad quickly. Follow the same protocol to add it to the diet gradually.

Proteins

Proteins play a variety of important roles in the body. While many people associate proteins with their part in building muscle, proteins in the body are also important for communication (as hormones and enzymes), structure (as muscle and collagen), transport of nutrients in the blood, and buffering the pH (acidity) of the body. Proteins are composed of chains of amino acids; while some amino acids are made

by the horse, other amino acids must be provided in the horse's diet, and these are known as **essential amino acids**. Essential amino acids include histidine, leucine, isoleucine, lysine, phenylalanine, threonine, tryptophan, methionine, and valine. On many feed tags for commercial horse feeds, you will find some of these essential amino acids listed, in particular lysine.

Protein can be found in many different places in the horse's diet. While forage will contain protein, the amount can vary based on the species and maturity of the forage. In general, legumes (such as alfalfa or clover) will contain more protein than cool season grasses (such as orchardgrass or timothy) and warm season grasses (such as Bermuda grass). In terms of maturity, protein amounts are usually highest when the plant is more immature and in a leafy, vegetative state (compared to mature, stemmy plants with seed heads).

Protein can also be found in grain and concentrates. The amount of protein found in each grain will vary, but generally, grains have less protein on a dry matter basis as compared to forages. However, the largest amount of protein will be found in seed meals, which are the by-product created when oil is extracted from oil seeds (such as canola, soybean, and sunflower). The most common one used in equine diets is soybean meal; it is also a legume, and legumes in general also have higher levels of protein. Concentrates (such as sweet feed or pelleted feed) that are high in protein often contain some soybean meal.



Soybeans, when made into soybean meal, are one of the most common sources of protein in concentrates. Photo Credit: Andrea Kocher, Penn State.

Vitamins

A vitamin is defined as a compound that is required in small amounts in the diet for essential body functions. Vitamins are typically grouped by their *solubility* – in other words, how well a substance dissolves in water or fat. Vitamins A, D, E, and K are considered fat-soluble, while vitamin C and the many B vitamins (thiamin, riboflavin, biotin, etc.) are considered water-soluble.

Each vitamin plays an important role in the body. For example, vitamin A is vital to healthy vision, while vitamin D is important for healthy bones. Deficiencies in many of these vitamins cause disease, and, less commonly, excess amounts can also cause disease.

Because vitamins are found in such small amounts in the body, they can be hard to accurately measure. Generally, if you are feeding your horse enough moderate-to-good-quality forage and a commercial feed, and the horse is healthy, they are probably receiving sufficient levels of vitamins. If your horse has poor-quality forage (for example, if the hay is sun bleached, then it will have lower amounts of vitamins), then consider adding a ration balancer to your horse's diet. If your horse is not healthy, and a veterinarian thinks the issue is a vitamin imbalance, then you should work with a nutritionist to balance the diet.

Minerals

Minerals are essential elements needed by the body for essential life functions. Similar to vitamins, minerals are needed in very small quantities in the diet, and each mineral plays a specific role. For example, calcium is an important component of bone.

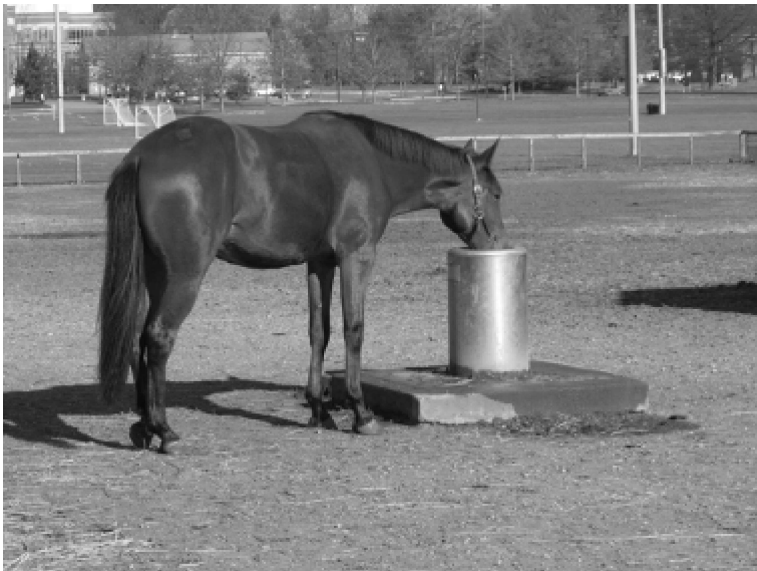
The list of minerals found in the horse's diet is lengthy and includes calcium, phosphorus, magnesium, selenium, sulfur, copper, iron, manganese, iodine, cobalt, and zinc. Three minerals – sodium, potassium, and chloride – are collectively known as **electrolytes**, and play an important role in helping maintain the correct balance of water in the body. Electrolytes are lost from the body when the animal sweats, which is why after strenuous exercise (particularly in hot, humid climates) it is

necessary to give a horse not just water but water with electrolytes so that they can recover more quickly.

Similar to vitamins, deficiencies and excesses in minerals can cause various diseases in the horse. If your horse is healthy and receiving good quality forage with a commercial feed, its diet is most likely balanced for minerals. If your horse is doing poorly, and you are unsure that the diet is balanced for nutrients, work with a veterinarian and nutritionist to determine which mineral might be the issue and how to adjust the diet to resolve the problem.

Water

Water is often overlooked as a nutrient, but it is the most important nutrient for an animal. About 60-70% of the adult horse's body weight is composed of water; this water is found both within cells and outside of the cells, in what is called the extracellular fluid. Many animals, if needed, could survive weeks with poor/minimal amounts of food, but no animal will survive longer than a few days without water. The average adult horse needs about 6-10 gallons of water a day, and that amount can increase based on the environmental conditions and exercise level of the horse. Mares that are nursing foals will have a higher water intake requirement. Horses fed a high-hay diet tend to drink more water than those with a concentrate/forage diet or those consuming lots of fresh pasture.



Horse drinking water from automatic waterer. Photo credit: Danielle Smarsh, Penn State.

Conclusions

When you take a closer look at the forage and grain that a horse eats over the course of a day, it is amazing to realize how many different nutrients they are consuming. By ensuring that your horse is getting enough feed each day (the feed should equal ~2-3% of your horse's body weight), and that the quality of the feed is good, you can be confident that your horse is likely to be consuming a balanced diet. Remember to consider the activity level and physiological status of the horse when analyzing the diet; for example, if the horse is being exercised 4-5 times a week, it will have a higher demand for most nutrients than the horse exercised just once a week. If your horse is having health issues, it is always important to assess the diet with a trained nutritionist to ensure that it is providing the nutrients your horse needs.