

CARBOHYDRATES AND HORSES — WHAT DO I NEED TO KNOW?

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The statement, “I want a low carbohydrate feed for my horse”, has become popular in recent years. The reasons, or potential reasons, for wanting a low carbohydrate horse feed could include the desire to influence or modify behavior, or a sensitivity to so-called carbohydrate diseases including: Tying-up, Cushing’s, Laminitis or Insulin Resistance. But before we try to eliminate all the carbohydrate, we should understand more about the carbohydrates in horse diets.

Carbohydrates found in horse diets can be roughly divided into two types: Structural and Non-structural.

Structural carbohydrates are often referred to as fiber. Fibrous carbohydrates are resistant to enzyme digestion in the small intestine and must be fermented by bacteria in the horse’s large intestine. Bacterial fermentation of fiber yields volatile fatty acids (VFA’s). VFA’s travel to the liver and are converted to energy substrates for the horse. Hay, mature pasture grass, beet pulp and soybean seed coats are good sources of fibrous carbohydrate.

On the other hand, non-structural carbohydrates are sugars, or carbohydrates that can be broken down to simple sugars, by enzymes in the horse’s small intestine. These sugars are absorbed from the small intestine and circulate in the blood as glucose. The hormone insulin removes glucose from the blood and stores it in the liver and in muscle as glycogen or when an excess amount of carbohydrate is consumed, it is converted to fat and stored throughout the body. Common examples of non-structural carbohydrates in horse diets include starch from grain (oats, corn, barley, etc) and molasses.

Sugar in Hay and Pasture?

Before going too far in trying to reduce the non-structural carbohydrate content of your horse’s diet, a bit of reality is in order. Hay and/or pasture, the one ingredient that all horses require, contains fibrous carbohydrate which is essential for normal gut function, but hay and pasture also contain sugar and starch. Therefore, complete elimination of sugar and starch from the horses’ diet is not possible. It is a normal function for plants to produce sugar when they grow. In a process called photosynthesis that occurs during daylight hours, carbon dioxide, water and energy from the sun are utilized by the plant to form sugar. Sugar is then utilized by plants at night, in a process called respiration, to form more complex fibrous carbohydrates.

When photosynthesis outpaces respiration, such as during cool nights in the spring and fall, plants accumulate sugar. Plants also accumulate sugar if they are stressed by drought, or by nutrient deficiencies.

The sugar content of forage contributes to the total non-structural carbohydrate content of the diet. When horses are diagnosed with carbohydrate related diseases, the sugar content of the total diet must be minimized. To minimize sugar content of hay, it should be cut in the early morning hours, prior to photosynthesis, beginning at first light. If horses are to have access to pasture, they should graze early in the morning when the sugar content of the grass is the lowest. If you have already purchased hay, the sugar content can be reduced by soaking the hay in water prior to feeding it to the horse. Soaking hay in water prior to feeding for 30 or 60 minutes will significantly decrease (by 18 – 30%) the sugar content of forage.

Simply selecting the type of hay fed will not always guarantee a low sugar content since sugar content is greatly influenced by environment and plant health. However, the sugar/starch content of alfalfa hay is less than it is in cool-season grasses such as timothy, orchard and rye.

Typical Carbohydrates in Feeds and Hays

Since most grain concentrates contain a combination of corn, barley, oats, wheat or molasses, it should come as no surprise that non-structural carbohydrate content is high. To minimize non-structural carbohydrate, feed more good quality sources of forage. Table 1 shows, on average, the percentage of non-structural carbohydrates in different forage and feed types.

	NSC%
Alfalfa Hay	11.4
Grass Hay	13.3
Beet Pulp	12.2
Oats	50.7
Barley	63.1
Corn	77.0
Molasses	58.4

**Table 1: Dairy One Forage Laboratory, Ithaca, New York.

Disorders Associated with Non-structural Carbohydrates

Cushing's disease is a problem showing up in many horses, primarily old horses, which may be influenced by the non-structural carbohydrate content of the diet. Cushing's disease is the result of a tumor in the pituitary gland. Two recognized complications of Cushing's are laminitis and diabetes mellitus. Laminitis and diabetes mellitus both appear to be the result of insulin resistance. Since insulin is required to clear the blood of high amounts of glucose following a meal, diets high in non-structural carbohydrate (sugar) may make diabetes mellitus worse and increase the risk of laminitis in horses with Cushing's. Therefore, it is common for veterinarians and nutritionists to reduce the amount of non-structural carbohydrate in the diets for horses with Cushing's, laminitis and insulin resistance.

Tying-up, characterized as severe muscle pain and cramping after exercise, is also thought to have a link to dietary carbohydrate. For horses that have chronic episodes of tying-up, two separate problems have been identified. One problem is a muscle sugar (glycogen) storage disorder characterized by accumulation of a non-bioavailable sugar in their muscle. This disorder is called polysaccharide storage myopathy (PSSM) or

equine polysaccharide myopathy (EPSM). For other horses that chronically tie-up, a problem with muscle contractility is to blame. This problem is called recurrent exertional rhabdomyolysis (RER). For both groups of horses, dietary modifications that include a reduction in non-structural carbohydrate and increases in fat and fiber have shown to be beneficial in minimizing the occurrence of tying-up.

Summary

The desire to create a low carbohydrate diet is really a method to control the amount of non-structural carbohydrate (sugar) in the horse's diet. Structural carbohydrate (fiber) should not be the target for elimination since fiber is essential for proper function and motility of the horse's digestive system. It is still recommended that horses receive a minimum of 1.5% of their body weight per day in dry forage to provide essential fiber. To reduce the non-structural carbohydrate content of the diet, consider eliminating grain, soaking hay prior to feeding it to the horse or selecting a hay that is known to have a lower non-structural carbohydrate content.

