

## CARBOHYDRATES IN EQUINE DIETS

Carbohydrates have become very popular when talking about equine nutrition and health. However, many horse owners are concerned and confused when determining the adequate level of carbohydrates in horse's diets.

Carbohydrates in horse diets are provided from forages (hay and pasture), from supplements and from ingredients (oat, corn, barley, beet pulp, soybean meal, etc.).

In general, carbohydrates can be classified in three categories; structural carbohydrates, non-fibre carbohydrates, and non-structural carbohydrates.

**Structural Carbohydrates** are those that are resistant to the horse's digestive enzymes. They make part of the cell wall in plants and include neutral detergent fibre (hemicelluloses, cellulose, and lignin). These carbohydrates are fermented by bacteria and protozoa in the hindgut and provide volatile fatty acids used as energy source for the horse.

**Non-Fibre Carbohydrates (NFC)** are made up of organic acids, starch, sugars, oligosaccharides, polysaccharides, beta glucans, galactans, pectins and gums. NFC is calculated by difference (100-Water-Ash-Fat-Protein-NDF). They are generally more rapidly digested than fiber.

**Non-Structural Carbohydrates (NSC)** is the combination of total sugars (water soluble carbohydrates) and starch. **Water soluble carbohydrates (WSC)** are all monosaccharides (glucose, fructose, galactose), disaccharides (sucrose), oligosaccharides (fructans) and some polysaccharides. **Ethanol soluble carbohydrates (ESC** – mono- and di-saccharides) are part of WSC. Not all NSC are digested in the same part of the gastrointestinal tract in the horse. Simple sugars (ESC) and starch can be broken down by enzymes and absorbed from the small intestine as glucose, which is stored as glycogen in the muscles and in the liver and serves as source of energy. Fructans, which are commonly found in cool-season grasses (timothy, orchard grass, brome, and ryegrass) and hays, are fermented by bacteria and protozoa in the hindgut to produce volatile fatty acids. Thus, excess of high-sugar type feeds or high levels of fructans can upset the normal population of bacteria and protozoa affecting animal performance and health.

Because horses cannot tolerate large intakes of NSC in one meal, they must be controlled in the diet.

### EFFECTS OF HIGH NSC IN HORSE DIETS

It has been shown that excessive amounts of sugar and starch from feeding too much grain and concentrate or excessive consumption of fructans from pasture cause serious complications such as laminitis, colic and insulin resistance in horses.

When horses eat sugar and starch, and it is absorbed in the stomach and intestines as glucose, they also release insulin from the pancreas to help the uptake of glucose from the blood into cells where it is used and stored. If consistent high levels of sugar and starch are fed, the level of insulin rise and may not function properly to regulate glucose leading to high levels of glucose in the blood. This condition of not responding to insulin by the horse is called insulin

resistance which can also result in laminitis. High levels of insulin could cause a decrease in blood flow to the hoof or avoid the uptake of blood sugar into the laminae of the foot.

The microorganisms responsible for fermentation in the hindgut are sensitive to changes in the diet. When excess of sugar passes from the small intestine to the hindgut or when excessive fructans arrives at the hindgut, abrupt changes occur to the normal population of bacteria and protozoa promoting the development of acidophilic microorganisms that affect the balance of the fibre-digesting microbial population. Thus, the hindgut turns more acidic (lactic acid build up) and gas is produced by bacterial fermentation. The horse is incapable of belching, so the result may be colic, whereas the lactic acid accumulation drops the pH of the gut to a point that most normal prevalent bacteria die, releasing endotoxins into the gut which are absorbed into the bloodstream and lead to laminitis.

There are other metabolic conditions that are very sensitive to sugar and starch levels in the feed and will not be discussed here such as Gastric Ulcers, Cushings Disease, Equine Metabolic Syndrome, Osteochondritis dissecans (OCD), “Tying-up” syndromes like Polysaccharide Storage Myopathy and Exertional Rhabdomyolysis.

### **GOOD FEEDING PRACTICES**

Proper formulation of diets for horses depends on the adequate knowledge of their nutrient requirements, and whether it is exercising, pregnant, or lactating. However, the correct level of NSC to be fed to horses has not been defined and even the Nutritional Requirements of Horses published by the National Research Council (NRC) does not provide a definitive value of the NSC content on individual feeds or forages. What has been recognized is that horses can be sensitive to high levels of sugar and starch and that the NSC levels in the feed should be measured. This sensitivity is related to the fact that horses cannot tolerate large intakes of NSC in one meal and that feeding horses small amounts of high sugar/starch feeds (grains and concentrates) in frequent feedings is highly recommended. What it really matters is the total amount of NSC that enters the digestive system at one time.

Some of the questions to be answered to determine the adequate level of NSC in equine diets are: Is the horse healthy, sensitive to metabolic disorders, or diagnosed with a syndrome? What's the stage of development of the horse? What are the specific requirements for that horse and how much he needs to eat per day? What are the best ingredients in the diet for this particular horse?

Recommended levels of NSC in the diet can go from below 12% for sensitive horses up to 20%, provided that the level of exercise is high and an adequate energy balance is maintained. Diets with high levels of NSC in under working horses are the major factors contributing to horse ill health.

Studies have shown that feeding no more than about 0.5% of a horse's bodyweight of grain in one meal will reduce the risk of grain overload into the horse's hindgut, therefore reducing the risk of colic or laminitis.

SGS AgriFood Laboratories in Guelph offers the Equine Complete quality package for Hay which includes all nutritional information required to ensure a balanced and productive horse diet.