Effect of Diet on Insulin Sensitivity in Horses

What is Insulin Sensitivity in horses?

You are what you eat. It's as true for horses as for people, so we all want to give our horses the best feed possible. We want to try to improve their condition, their performance, the health of their hooves, even the shine of their coats. But sometimes we go too far.

Horses evolved without hard feeds. They thrived on plenty of gentle exercise, foraging for grasses and water over many miles. Today, our horses face different demands, and to help them meet those demands we've tampered with their diets. All too often we spend a lot of money on expensive high energy feeds, in an attempt to make our horses look better, jump higher, or run faster. We often – for reasons of practicality or availability – restrict their access to natural pasture and we try to make up for this with grains and protein-rich hays and haylage. The result is we put our horses' digestive systems under unnatural strain – and sometimes we do much more harm than good.

The consequences of overfeeding with high energy foodstuffs can be severe, such as colic, laminitis, even death. Even in mild cases of overfeeding a horse can become obese. In overweight horses, the horse's metabolism may be struggling more than it shows, and ultimately reveal symptoms of significant damage. One of the more common, but difficult to detect consequences of overfeeding is a reduction in the horse's insulin sensitivity, and its resultant – sometimes severe – complications.

Insulin sensitivity is the ability of insulin to stimulate glucose uptake. Insulin is a hormone secreted by the horse's pancreas in response to elevated blood glucose concentrations. For example, after a horse eats a meal high in sugars and starches, blood glucose levels rise, and insulin is released from the pancreas to help stabilize the blood glucose levels. *Insulin sensitivity* is the ability of the pancreas to respond to high blood glucose levels, and effectively stimulate tissues with insulin to take up the excess glucose, thereby returning blood glucose levels to normal.

When insulin does not stimulate glucose uptake effectively, the horse has low insulin sensitivity, called *insulin resistance*. Insulin resistance results in blood glucose levels remaining too high – called *hyperglycaemia*. Hyperglycaemia is serious – it causes the inflammation associated with laminitis and other conditions. Continually responding to hyperglycaemia puts excessive strain on the pancreas, and eventually it may not be able to produce insulin at all, resulting in diabetes. Although diabetes is rare in horses, it does occur. Insulin resistance is also associated with several other conditions including Cushing's Syndrome and Equine Metabolic Syndrome, characterized by obesity and recurrent laminitis.**[i]**

For more information or to order CoolStance/PowerStance, please call 803-647-1200 or e-mail Claudia@stanceglobal.com

How do I know my horse has Insulin Sensitivity?

How can you determine if your horse is insulin resistant? First, you will be looking for symptoms of low insulin sensitivity. Common symptoms include frequent 'tying up', or severe pain, sweating and discomfort upon exercise, unusual or inconsistent behavioral symptoms, such as aggression, hyperactivity or lethargy, recurrent laminitis, and stiffness or inflammation in the joints (especially the hind legs).

If your horse is exhibiting any of these symptoms, there are several tests available that you can use to determine if your horse is insulin resistant.**[ii]** However, they are complicated, and many are not practical, because getting any degree of accuracy will involve frequent blood samples to monitor blood glucose and insulin levels over a period of time.

The Euglycemic Hyperinsulinemic Clamp (EHC), and the Minimal Model Analysis (MMA) are the most effective ways to determine insulin sensitivity. These are complex tests for the average veterinarian, because they take several hours and require several blood samples and specialized equipment, however most equine hospitals will offer them. An oral glucose tolerance test is more suitable for horses, but this test isn't precise enough determine insulin sensitivity alone.

Identification of insulin resistance in people is commonly done by taking fasting blood samples (blood glucose tests taken after the subject has gone without food for 12 hours). This test also works for horses, and using three or more samples from different days**[iii]** has shown good correlation with insulin sensitivity tests done using EHC or MMA methods.

Whatever method you choose, getting an accurate assessment of your horse's insulin sensitivity is difficult. And, as yet there is no defined level of insulin sensitivity that determines a horse to be 'insulin resistant'.**[iv]** The best measure is always going to be your horse's condition and performance, but if you suspect your horse may be insulin resistant, talk first with your vet to make the best determination possible for you.

What causes Insulin Sensitivity in horses?

There are many possible causes of insulin resistance in horses. Some breeds are more predisposed to insulin sensitivity, especially some pony breeds. However, it is not known whether this is an inherent factor for the breed itself, or if the breed is simply more predisposed to obesity.**[v]** Some genetic conditions associated with insulin resistance may also be specific to certain breeds, such as Equine Polysaccharide Storage Myopathy (PSSM) in quarter horses,**[vi]** but these conditions are unusual. Insulin resistance can vary too, such as during pregnancy or lactation in mares.**[vii]**

There are other factors too that may cause insulin resistance, although for some conditions it is not known if they are caused by, or cause insulin resistance. Cushing's Disease and recurrent laminitis are often associated with insulin resistance, but not all horses that are insulin resistance have Cushing's Disease, and not all cases of laminitis are caused by insulin resistance. Insulin resistance is thought to be a causal factor in other conditions too, such as equine metabolic syndrome and osteochondrosis dissecans (OCD), although these conditions may have other causes too.

However, the single biggest factor in insulin resistance is obesity – from diets high in starch and sugar and insufficient exercise. The sugar and starches in feed are called the Non Structural Carbohydrates (NSC). Feeds high in NSC, or overfeeding, puts a continual strain on the pancreas to produce insulin to regulate blood sugar levels. Over time, the cells may become desensitized to insulin. The horse then produces more insulin, and the cells become more resistant to the point the cells fail to take up glucose. This is insulin resistance.

Obesity is known to be a causal factor in equine metabolic syndrome, which is a form of insulin resistance. Obese horses have more fat cells, which produce the hormone cortisol, which interferes with the ability of insulin to trigger glucose take-up by the horse's tissues. For this simple reason, weight loss can improve insulin sensitivity.**[viii]** Whatever the cause, getting – and keeping – your horse at a healthy weight and making sure it gets plenty of exercise will improve insulin sensitivity.**[ix]** If your horse is obese, has recurrent laminitis, or is diagnosed with Cushing's Disease, you need to change your horse's diet.

A diet too high in NSC doesn't just cause obesity. Feeding horses too much NSC causes or aggravates several dangerous conditions. Pituitary tumours in older horses, causing laminitis, endocrine disorders in obese horses, and tying up in thoroughbreds, Arabians, and Standardbreds are all linked to the high glycaemic release of diets high in NSC. The aforementioned PSSM in quarter horses, and OCD are also potentially caused by too much NSCs.**[x]**

How diet helps Insulin Sensitivity in horses

We all want our horses to feel good and perform well, and we know good quality feed is the best way to achieve that. But good quality feed doesn't mean a lot of feed, nor does it mean high protein or overly rich feeds. Many feeds – performance mixes in particular – are rich in NSC These feeds look good, smell good, and horses certainly like them. However, for all but the highest performing competition animals, they offer 'too much of a good thing'. The NSC in these feeds carry a lot of calories, leading to a fat horse.

Feeding little and often

How you feed can also affect your horse's insulin response. Feeding relatively large amounts of feeds high in starch and sugars in just one or two daily meals causes glucose 'spikes', and consequently an over-production of insulin. This puts excessive strain on the pancreas, and can lead to insulin desensitization, a form of insulin resistance. If your horse is insulin resistant, or you suspect it has low insulin sensitivity, opt for several small meals to allow a steady release of glucose into your horse's bloodstream. This is also effective for active or high strung horses to minimize hyperactivity in the first few hours after a meal.

Manage NSC intake

Managing the NSC content of the horse's diet is complex. It is considered that for most horses, a NSC content of <12% is adequate to maintain insulin sensitivity. Active or lean horses need energy, or calories, and commonly this is provided through high protein hard feeds rich in sugars and starches. It is a common misconception that growing or active horses need these high-energy diets, and compounded

with insufficient meals during the day, the horse's metabolism becomes overwhelmed by glucose. For all but the highest-performing horses, there are dietary alternatives which can provide the horse with the energy it needs without putting undue strain on the pancreas, thereby preventing weight gain and insulin resistance.

Consider the hay and pasture

Opt for a higher proportion of hay and pasture grass in your horse's daily diet, in relation to hard feeds. However, remember that even natural pasture grasses can be very high in glucose-rich carbohydrates, or NSCs. **[xi]** For this reason, unless you have access to low NSC grasses, you may need to work with your feed supplier's nutritionists to find the most suitable forage for your horse.

Recommended Stance Horse Feed for Insulin Sensitivity in horses

Changing the type of 'hard' or grain feed you give your horse can help, especially if you have an active or lean horse that needs more energy than hay alone can provide. Look for feeds with a high content of digestible fibre, and low in sugar and starch, or NSCs. Select feeds with NSC levels below 12%,. These high fibre, low starch feeds have a low 'glycaemic index';**[xii]** in other words, they release glucose slowly and in small amounts, providing a steady stream of energy and keeping the gut active for longer.

The **Stance Equine Feeding System** outlines several low NSC feeds suitable for insulin sensitive horses.

These include

- **CoolStance** contains <12% NSC, which reduces the amount of fermentable sugars that can cause an increase in blood glucose and insulin.
- **CoolStance** and **PowerStance** contain MCT in the coconut oil,

Some feed additives, such as coconut oil, contain healthy fats (medium chain triglycerides MCT) that have been shown to reduce glucose absorption, helping the insulin resistant horse,**[xiii]** while at the same time providing a good source of calories. Stance Equine's CoolStance contains coconut oil already, or you can add it yourself to your horse's feed with palatable, powdered form like PowerStance.
Simply put, with the help of your vet and nutritionist, you can manage your horse's insulin sensitivity through diet and exercise. With intelligent feeding, you'll have a healthy, happy horse! If you require further information, please contact us at **info@stanceequine.com**

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