

Equine Metabolic Syndrome

Equine veterinarians have long recognized a related syndrome of obesity, insulin resistance and chronic laminitis affecting a somewhat younger group of adult horses. Although these horses were initially suspected to comprise a subset of equine Cushing's disease cases, a long hair coat is not a feature of the condition and tests of pituitary function (e.g. the dexamethasone suppression test and plasma ACTH concentrations) usually yield normal results. Furthermore, affected horses do not respond to medications such as cyproheptadine and pergolide, which are frequently of benefit in Cushing's disease.

Causes

Obesity appears to be the central problem in both humans and horses suffering from metabolic syndrome. Although body fat is commonly viewed as an inert substance that functions solely as a storage form for energy, nothing could be farther from the truth. Body fat (especially that stored within the abdomen, liver and skeletal muscle) contains cells that are very active metabolically and hormonally, and when present in excessive amounts their effects can trigger a cascade of metabolic disturbances leading to insulin resistance and persistent hyperglycemia. These abnormalities, in turn, exert a variety of deleterious effects on the cardiovascular system, cartilage and bone. One of these effects is increased synthesis and release of cortisol within the peripheral tissues of the body, which may account for the predisposition to laminitis in affected horses.

Diagnosis

Metabolic syndrome is usually first recognized when chronic recurrent laminitis becomes evident in fat horses lacking other founder triggers. Affected horses are often grossly obese, with excessive accumulations of fat in the crest of the neck, over the rump and around the tail head and in the sheath of male horses. There is no single test that can offer a definitive diagnosis of metabolic syndrome at present, but diagnostic tests that are helpful in arriving at a clinical diagnosis include measurements of insulin and glucose in the blood following a period of fasting, the intravenous glucose tolerance test and tests for equine Cushing's disease (e.g. the dexamethasone suppression test and plasma ACTH concentration). It is particularly important to distinguish cases of metabolic syndrome from early cases of Cushing's disease, because the latter horses can be expected to respond to therapy with pergolide while the former group probably will not.

In obese horses with advanced metabolic syndrome, fasting concentrations of insulin are almost always elevated, and blood glucose concentrations are frequently elevated. In less severely affected cases, the intravenous glucose tolerance test may be needed to demonstrate insulin resistance. This test involves serial measurement of blood glucose and insulin following intravenous administration of a standard dose of glucose. In normal horses, concentrations of both insulin and glucose rise initially, but return to normal within one to two hours. Insulin resistant horses, by contrast, show greater elevations in both insulin and glucose, and these higher levels are sustained for a longer period of time before returning to baseline values.

Treatment

At present, treatment strategies for equine metabolic syndrome focus almost exclusively on reversal of obesity and insulin resistance through strict dietary modification and implementation of an exercise program, if possible. Of course, horses suffering active bouts of laminitis cannot be exercised until founder has been brought under satisfactory control.

The most important principle of feeding affected horses is strict limitation of soluble carbohydrate in the diet. Nutritional requirements should be met with exclusively fiber-based feedstuffs such as good quality grass hay; 1.0 – 1.5% of bodyweight per day is a useful guideline for the amount to feed, but particularly thrifty horses may require further restriction before significant weight loss is achieved. Sources of soluble carbohydrate such as grain, sweet feed, carrots, apples and fresh pasture must be eliminated completely, as even very small amounts are likely to sustain insulin resistance. If horses must be turned out onto pasture, they should be fitted with grazing muzzles that have been partially or completely taped to prevent grass intake. If greater dietary energy is required once obesity has been brought under control and an exercise program has been initiated, grass hay should be supplemented with soaked beet pulp and/or fat (vegetable oil or rice bran) rather than grain. It is likely that a variety of commercial complete feeds targeting metabolic syndrome will become available in the near future, which will greatly simplify nutritional management of affected horses and eliminate the need for feed analysis.

If horses fail to respond to dietary management despite what appears to be an appropriate diet, analysis of the forage by a nutritional laboratory such as DairyOne (<http://www.dairyone.com>) is strongly recommended, as the nutritional composition and soluble carbohydrate content of grass hay varies significantly, depending on species, geography and environmental conditions during growth, drying and storage. Forage analysis also permits quantification of minerals such as calcium and magnesium, which can be used to guide their rational supplementation.

A variety of supplements have been advocated in the management of equine metabolic syndrome, but there is currently little scientific evidence to support or refute their effectiveness. As with Cushing's disease, supplementation with chromium picolinate and magnesium to achieve a dietary calcium: magnesium ratio of 2:1 is widely recommended, and equine nutritionists also recommend that dietary levels of calcium, magnesium, phosphorus, copper, zinc, manganese and selenium should be at least 150% of the levels recommended by the National Research Council. Analysis of the forage is required to balance minerals accurately in this manner. Cinnamon has recently been advocated as an adjunctive therapy; it exerts some beneficial effects humans with type 2 diabetes and is unlikely to be harmful in any way. One nutritionist has recommended administration at a rate of 4 tsp per 1000-lb horse per day.

Owners of affected horses are often tempted to deliver supplements such as minerals, cinnamon, and other medications in a small amount of grain, but this practice is strongly discouraged as it may be sufficient to prevent resolution of insulin resistance. Small amounts of soaked beet pulp that have not been treated with molasses are a much better choice. In humans, exercise and dietary control are frequently supplemented with medications that interfere with cortisol synthesis and increase insulin sensitivity, but these have not yet been evaluated in equine disease. Nevertheless, such medications represent additional options for valuable horses that fail to respond to conservative management.