

METABOLISM WOES

Researchers Focus on Equine Metabolic Syndrome



PHOTOGRAPHS | MARK LEWELLYN

Equine metabolic syndrome (EMS) is usually characterized by regional adiposity, a term that describes fat accumulation in localized areas. Fat deposits are observed along the crest, over the croup and near the tailhead, and less frequently along the ribcage. EMS is often first recognized when laminitis develops.

The Equine Science Society Symposium is a gathering place for prominent researchers involved in all aspects of equine health and well-being. For more than two decades, Kentucky Equine Research (KER) has presented findings from its nutrition and exercise physiology studies. At this year's event, more than 160 studies were presented at this symposium in the areas of nutrition, exercise physiology, genetics, reproductive physiology, production and management, and teaching and extension. A major focus of the symposium was equine metabolic syndrome (EMS).

EMS is one of several disorders affecting horses that is either triggered or aggravated by excessive starch and sugar intake. EMS is characterized by obesity, regional adiposity, and insulin resistance (IR), and it has become a hot topic of late for a number of reasons. First, as in humans, obesity has become a major problem in the modern equine population. In a recent survey conducted by Virginia Tech's veterinary college, 19% of a randomly selected population of mature horses was considered obese.

Similar studies in Scotland of pleasure riding horses reported an even higher prevalence of obesity. Secondly, EMS is similar in many ways to metabolic syndrome in humans, which is also characterized by obesity and which often results in diabetes. The most significant clinical manifestation of EMS is laminitis. Ponies and certain horse breeds such as Morgans and Paso Finos are particularly vulnerable to EMS although it can occur in any breed.

Two excellent invited papers presented at ESS addressed EMS and human metabolic syndrome. Dr. Nicholas Frank from the University of Tennessee College of Veterinary Medicine reviewed the definition, presentation, pathophysiology, and diagnosis of EMS and offered management and treatment advice for affected horses and ponies. Management of EMS com-

monly revolves around decreasing caloric intake to reduce obesity and lowering sugar and starch intake. Since laminitis in horses and ponies is often associated with pasture consumption, restricting or eliminating pasture intake is mandatory for severely affected animals.

Dr. Frank also recommended exercise as an important management tool to combat EMS and suggested a “more-is-better” approach can be taken to exercise if the horse is not suffering from laminitis. In support of this recommendation, KER presented data at this conference that suggests horses can carry greater body condition without suffering from IR if they are exercised. In this study, 181 horses and ponies in training in Wellington, Florida during the winter show season (February) were evaluated and sampled. These horses included dressage horses (n=39), show hunters (n=38), show jumpers (n=26), pony hunters (n=23), and medium- to high-goal polo ponies (n=55). Body weight, withers height, body condition score (BCS), and neck crest adiposity as cresty neck score (CNS) were measured. Blood samples were taken before each horse’s morning meal and analyzed for plasma glucose, insulin, and triglycerides.

Dressage horses, show hunters, and show jumpers carried significantly more body condition than polo ponies, but had similar resting insulin, glucose, and triglyceride values. Pony hunters were significantly fatter than dressage horses, show hunters, show jumpers, and polo

ponies, and had significantly higher resting insulin and significantly lower resting plasma glucose values. (A thorough review of this KER study appears in *EquineWeek* 11:4.)

Virginia Tech researchers have measured BCS and CNS in sedentary ponies and horses and found that 50% of horses and ponies with BCS ≥ 7.0 were hyperinsulinemic (insulin ≥ 30 mU/L). In the Wellington study, only 2 of 24 individuals (8%) with BCS ≥ 7.0 had insulin ≥ 30 mU/L. In the Virginia Tech study, 43% of sedentary horses and 50% of sedentary ponies with cresty necks (CNS ≥ 3) were hyperinsulinemic. In the present study, none of the 17 individuals (12 horses and 5 ponies) with CNS ≥ 3 were hyperinsulinemic. Therefore, it appears that overweight sport horses and ponies are less likely to be hyperinsulinemic than sedentary horses and ponies.

In the second invited presentation at ESS, Dr. Matthew Hickey from Colorado State University presented an excellent review on the regulation of insulin action by diet and exercise in humans. His presentation underscored the importance of exercise as a tool to manage insulin resistance and diabetes in humans. He reported that experimentally a single bout of exercise can improve insulin sensitivity by mediating the same glucose transporter in muscle that is responsive to insulin. A large study with glucose-intolerant humans showed that 150 minutes of moderate exercise per week combined with a low-fat, low-calorie diet reduced the incidence of diabetes by 58%.

There is a movement afoot within the feed industry to mandate the labeling of the carbohydrate content of equine feeds, either as starch and sugar or as total nonstructural carbohydrate (NSC). Much of the rationale used to justify this revolves around the need to inform

Access to pasture must sometimes be restricted or eliminated for horses and ponies diagnosed with EMS.





Daily exercise plays prominently in the treatment of EMS. When combined with appropriate diet changes, exercise can induce weight loss, which will help reduce the likelihood of laminitis and other problems.

owners of EMS horses how to select a feed suitable for their horses or ponies. However, reducing the focus of managing EMS to a single nutrient risks trivializing the complexity of the syndrome.

Yes, the amount of starch and sugar in a feed affects a horse's glycemic response and a large influx of blood sugar stimulates insulin secretion, but there are several other factors that affect glycemic response that have little to do with the total carbohydrate content of the feed. Research at KER has shown that glycemic response is greatly affected by level and rate of intake. In another study, the addition of vegetable oil to a grain meal reduced glycemic response significantly, most likely by delaying gastric emptying.

The current conventional wisdom is that EMS horses should receive hays and feeds that contain 10% or less NSC. However, this is a fairly gross approximation since the quantity of NSC that an individual can tolerate is highly variable. Dr. Frank reported that horses with severe EMS had high insulinemic responses even when fed a 10% NSC hay. In humans, there are a number of other dietary factors that affect insulin secretion including different types of protein and fat. It is likely the same is true in horses.

It is worth noting the majority of horses do not suffer from EMS. They not only tolerate higher levels of NSC in their rations, but they often thrive on higher sugar and starch intakes. Healthy performance horses require NSC as a substrate for glycogen synthesis, and when they are fed extremely low-starch diets for an extended period, their performance is diminished.

In addition to NSC, an equally useful parameter to place on a feed tag would be an estimate of the feed's energy density. Although digest-

ible energy (DE) cannot be measured directly, a reasonable estimate can be made using regression equations developed from multiple digestibility studies in horses. The NSC-to-energy ratio is much more relevant to dietary management of EMS than NSC alone.

Equine nutritionists have struggled for years to educate horse owners that a single nutrient value such as the percent protein in a feed is not the only factor that should be considered when selecting a feed for their horses. Instead, an appropriate feed should contain a balanced concentration of multiple nutrients to complement the forage the horse is being fed. The same philosophy should be applied to feeding and managing the EMS horse.

More research is needed to determine what other factors besides sugar and starch affect insulin response in horses. Most importantly, horse owners need to be educated about the danger of obesity in their horses and the benefits that even moderate exercise can provide.

Would You Like To Know More?

KER devoted much of its 2008 nutrition conference to discussion of metabolic problems that affect horses. Dr. Nicholas Frank, mentioned in the accompanying article as an authority on equine metabolic issues, coauthored a paper that is featured in the conference proceedings. The paper, titled "Pathology of Metabolic-Related Conditions," was written with Dr. Frank Andrews, and details the intricacies of EMS and other metabolic conditions of horses. To order the proceedings, go to www.ker.com and click the Store tab on the right-hand side of the page. Once on the new page, click on KER Conference Proceedings. This will take you to a page that includes many of KER's publications. Choose 2008 Equine Nutrition Conference Proceedings. 