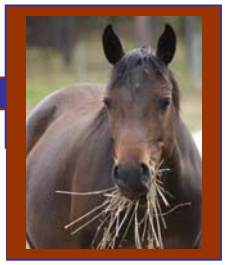
Dietary Management of the Insulin Resistant Horse



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Although documented in ponies over a quarter century ago, the existence and clinical significance of insulin resistance in equidae have only recently become widely recognized and accepted.

While insulin resistance can be induced in any horse by pregnancy, corticosteroid therapy or pituitary pars intermedia dysfunction (Equine Cushing's Disease), it appears there may also be a genetic basis. Insulin resistance should be thought of as a metabolic type rather than a disease state per se in those horses. Whether IR actually becomes a significant health issue depends on the interaction between this metabolic type and the environment, specifically diet and exercise.

Clinical Characteristics of IR Horses Include:

- Easy Weight Gain/Obesity
  (even with low caloric density)
- Regional Adiposity
  (fat deposit above eyes, crest, etc.)
- Lethargy
  (may be associated with hoof pain)
- History of laminitis

These horses may also be predisposed to allergic or exaggerated inflammatory reactions because of elevated levels of inflammatory cytokines. These problems, rather than weight issues, may be what brings the horse to the attention of the veterinarian. The worst case scenario is the acutely laminitic horse with uncontrolled insulin resistance.

IR Influences Laminitis Development

- Distal Blood Vessel Constriction
- Exaggerated Inflammatory Response
- Platelet Stimulation
- Decreased Digital Circulation

Diagnosing IR

A presumptive diagnosis of insulin resistance can be made by testing blood insulin levels after the horse has been fed nothing but pasture or hay from the evening before the day of testing. Although there is some disagreement regarding the upper threshold, an insulin value in the range of 12 - 20 IU/mL or greater is considered positive under these conditions. Thyroid function should also be checked as this is often secondarily suppressed. In this case, supplementation can assist achievement of normal body weight in obese horses. Levothyroxine (e.g. Thyro-L, LLOYD, Inc., Shenandoah, IA) supplementation also plays a role in establishing normal insulin sensitivity. The cornerstone of long term maintenance and complication prevention with insulin resistant horses however, is the diet.

Emergency Dietary Measures

While awaiting formal diagnostics and implementation of a safe and balanced diet, all high sugar and/or starch sources should be withdrawn. These horses should be fed only a quality, mature cut of grass hay pre-soaked for 30 to 60 minutes to leach out simple sugars. This, along with proper nutritional supplementation, leads to significant improvement in hoof comfort. Starvation rations should be avoided, even if the horse is obese, as this will only worsen the insulin resistance. The animal should be fed hay at a rate of 1.5% of the current body weight or 2% of the ideal body weight, whichever is greater.

Optimizing the Diet for IR Control

Controlling the consumption of simple carbohydrates is essential. In the acute phases it is usually necessary to restrict the combined dietary intake of simple sugars (ethanol soluble carbohydrates – ESC on analyses) and starch to 10% or less. Pastures often exceed this amount. Because sugar/starch levels fluctuate constantly over the course of the day and in response to weather conditions, there is no way to guarantee any grazing strategy is consistently safe.

For reasons that are not entirely clear, some laminitic horses are sensitive to alfalfa. This may be because some amino acids can trigger an insulin response, or it may be related to the higher starch and glucose in alfalfa hay. Horses on alfalfa that do not respond well should be switched to grass hay. Even grass hays should be analyzed to ensure safe levels of sugar and starch and determine protein and mineral intakes. Diets should be formulated to provide approximately 150% of the 2007 NRC minimum requirements.

Vitamin E

The supplementation regimen should include high dose vitamin E (2 IU per pound of body weight), an important antioxidant lost in cured hay.

Biotin

Biotin and folic acid are important to the generation of nitric oxide, a key cellular messenger for keeping peripheral blood vessels dilated and for insulin signaling in skeletal muscle.

Magnesium

Hay magnesium is often low and requirements may be higher in horses with IR. Adequate magnesium plays an anti-inflammatory role and is important for insulin sensitivity.

Iron

Iron should be avoided as adult equine iron deficiency does not occur and insulin resistant horses are often iron overloaded.

Manganese

Manganese is also rarely deficient in these animals.

Copper & Zinc

Copper and Zinc are very common deficiencies across the USA. These two minerals play pivotal roles in hoof quality and are essential for maintaining normal levels of the endogenous antioxidant enzyme system superoxide dismutase.

Selenium

Borderline to deficient selenium is a common problem and detrimental to the functioning of the glutathione antioxidant system. Selenium is also required for the conversion of T4 to the active T3 hormone, while adequate iodine is needed for the manufacture of thyroxine.

So-called “ration balancer” grain substitutes often bring intakes of individual minerals up to acceptable limits but do not provide an adequate job of balancing the minerals. This can lead to secondary deficiencies by minerals competing for absorption pathways. These substitutes may also have unacceptably high levels of simple carbohydrates. Recent research has shown that the inclusion of fiber in a meal to dilute the total concentration of simple carbohydrates does not blunt the blood glucose response. The same is often true of “low” or “reduced” carbohydrate feeds. Only unmolassed beet pulp, soy hulls, brewers' dried grains and some hay meals can meet the requirement for a combined total of less than 10% sugar and starch in the diet.

While some nutritionists and researchers have advocated feeding fat to insulin resistant horses, the safety of this dietary strategy has not been established in insulin resistant horses. In all other species, feeding fat can induce or worsen IR. Fat also has a very high caloric density, something these horses do not need. Because fats are considered empty calories (devoid of protein, vitamins or minerals), they should be avoided.

TARGET MINERAL RATIOS

Ca.P.Mg
2.1.1

Fe.Cu*
1.1

Cu.Zn.Mn
1.3.3

Exercise

Exercise is a potent insulin stimulator and should begin as soon as deemed safe in a recovering laminitic horse. If the horse is fortunate enough to have been diagnosed before laminitis sets in, regular daily exercise should be a pivotal part of the treatment plan. At least 30 minutes of exercise a day is sufficient to double the heart rate.

As insulin sensitivity improves, working horses will usually be able to tolerate higher levels of soluble carbohydrates, and actually require them to keep glycogen stores in muscle at adequate levels. Each horse's tolerance will be different and will increase as exercise intensity increases. Owner complaints that indicate the horse's diet may need to be liberalized slightly include observations that the horse tires easily/“hits the wall” after a certain period of time/exercise intensity yet does not seem to be getting any fitter. Blood sampled immediately after exercise will show lower blood sugar than prior to exercise, rather than the unchanged/higher level that would be expected.

*The iron to copper ratio can be up to 10:1 if the horse is confirmed by ferritin, TIBC and serum iron as not iron overloaded.

The safest way to reintroduce slightly higher carbohydrate intake is to feed a 50:50 mixture (by dry weight) of plain oats and beet pulp or a 20 to 25% sugar plus starch reduced carbohydrate feed within an hour after exercise has stopped. The capacity of muscle to take up glucose is highest at this time. Start with small amounts, about 1 pound total, working up to 2 to 3 pounds if needed. The horse should not be fed these higher simple carbohydrate feeds at any other time or on days there is no formal work.

Target IR

Based on the Equine Cushing's & Insulin Resistant Group recommendations, LLOYD Inc. has developed a targeted hay supplement to simplify optimal nutritional management of IR horses.

This clinically proven, highly palatable supplement was designed for ideal balance and maximum bioavailability for the life of the insulin resistant horse.

Conclusion

Proper management of insulin resistance requires simple and consistent environment and dietary adjustments. Adherence to these special needs is indispensable for optimal care and health of the laminitis horse.

Target IR: *Turning Hay into Nutritional Gold*

Target IR Ingredient	Mode of Action
Phosphorus	Instrumental in bone formation. Often deficient in hay.
Magnesium	Critical anti-inflammatory necessary for energy generation and storage.
Zinc	Critical to antioxidant/anti-inflammatory defense and immune system function. Provided in zinc oxide form to avoid excess sulfates.
Copper	Critical to antioxidant/anti-inflammatory defense and immune system function. Provided in a polysaccharide-coated form for improved absorption.
Manganese	Trace mineral necessary in enzyme formation. Available in borderline/low levels in alkaline soil geographies.
Selenium	Important antioxidant, required for normal thyroid function. Often deficient in soil.
Iodine	Required for normal thyroid function. Often deficient in soil.
Vitamin E	1,000 IU/day recommended for IR horses. Provided as a water soluble/dispersible form for optimal absorption.
Biotin	Important in the structural integrity of the hoof. Essential co-factor in nitric oxide production (critical in maintaining open blood vessels/deficiencies implicated in IR).
Vitamin A	Vital for efficient metabolic processes. Often deficient in older hay supplies.
Methionine	An amino acid (not synthesized by the horse) essential for hoof strength and general antioxidant defense mechanisms.
Arginine	Amino acid vital to nitric acid formation. Often depleted in stress and illness.
Flax Seed Meal	Rich source of essential fatty acids (omega 3 and omega 6). Deficient in dried/cured hays.
Red Beet	Rich Source of antioxidants and folate essential to nitric acid formation. Also serves as a highly appealing flavoring agent.

References

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