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Feeding Metabolic Horses: Risky Business or Simple Solutions?

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The characterization of Equine Metabolic Syndrome (EMS) has evolved over the last decade, from its emergence in the veterinary field as "Peripheral Cushing's Syndrome" (Johnson, 2002) to new data potentially linking the development of EMS to environmental toxic exposure (McCue, 2015). Over the years, the tools used to diagnose EMS have also grown, from single blood samples along with subjective guesswork to more useful glucose and insulin response testing (Eiler, 2005) and phenotypic descriptions to help predict horses at risk for EMS (cresty neck score, Carter, 2009). But even with these recent advances and increased scientific interest in Equine Metabolic Syndrome, the disease can still be difficult to pinpoint, with many horses suffering the unintended consequences of acute and recurrent laminitis as a result of the condition. Nutritional therapies for EMS can be helpful and should ideally be implemented prior to secondary complications such a chronic laminitis and severe insulin resistance. If diagnosed and treated early, with ongoing management and oversight, many horses can lose weight (Morgan, 2015) and remain useful. This paper will focus on the nutritional management of EMS, while the in-depth focus on diagnosis, genetics and other factors are published elsewhere (Frank et al. 2010; McCue et al, 2015; Morgan et al., 2015).

In order to properly feed an EMS horse, it is helpful to briefly review the characterization and hallmarks of the disease. Equine Metabolic Syndrome is associated with obesity, regional adiposity, insulin resistance, inflammation and laminitis. It can at times be difficult to distinguish from PPID/Cushing's Disease, with anecdotal reports suggesting that EMS horses are predisposed to developing Cushing's later in life (Frank, 2010). The relationship between obesity, IR and EMS can also be tricky, as not all obese horses are IR and develop EMS. In addition, some horses with metabolic syndrome are not overtly obese or insulin resistant, but when faced with a stressor such as a sudden change in feed or trailering, the condition reveals itself. Fortunately, through ongoing, in-depth research in this area, the interplay between the genetics, environment and management of susceptible horses is revealing itself as the key to understanding this disease and putting preventive measures in place to address it.

Feeding Obese Metabolic Horses

Whether a horse has been definitively diagnosed with EMS or is simply obese to begin with, the critical first step is to reduce body weight in these horses. Many of them resist weight loss and can be difficult to manage and therefore all steps must be taken to encourage weight reduction. Compliance from the owners and managers is of utmost importance and at times, is difficult as well. The hallmarks of the weight loss program are calorie control, reducing glucose and insulin response to feeding and exercise, if possible. It is important not to starve these horses, and to provide complete nutrition along with enough fiber to keep the digestive tract running smoothly (Gordon, 2008). When all methods of weight reduction are employed, a loss of 1-1.5 lbs per day can be expected with a reduction of 1-2 BCS units in 12 weeks (Gordon, 2009).

One of the biggest offenders in an obese horse's diet is pasture. Despite its favorable nutrition content, opportunity for exercise and convenience, it can contribute to the downfall of many metabolic horses.

Although there is not a direct, definitive, causative link between pasture and laminitis at this time, many factors make pasture a likely suspect. Foremost, intake control is difficult and some, if not many, horses will eat past their caloric requirement on grass, predisposing them to obesity and IR. Efficient horses and ponies with access to pasture can meet almost half of their DM intake requirement (0.8%) in only 3 hours per day of grazing (Longland, 2011) and some horses have been shown to consume pasture at a rate of 5.2% of BW per day (Marlow, 1983). Further, the type of grass (C3 versus C4), stage of maturity, weather conditions, and nutrient profile, can affect the soluble carbohydrate content of the pasture (Longland, 2006), and in turn, continually elevate glucose and insulin concentrations in horses (McIntosh, 2007). The fructan sugar found in grasses has been suggested as the causative agent in pasture-associated laminitis, and research has shown that horses can consume substantial amounts of fructan grass via daily grazing (Longland, 2006). However, it is important not to overlook the overall sugar (sucrose + glucose) and starch content found in grasses and the resultant higher insulin levels found in grazing horses versus horses eating hay (McIntosh, 2007). In addition, higher insulin levels (along with BCS and CNS) are predictive of laminitic episodes in ponies with access to pasture (Carter, 2008). In order to mitigate access to high levels of non-structural carbohydrates in pasture, recommendations have been made to turn susceptible horses out only during early AM hours, on cloudy days and in well-managed, shady paddocks, but this can obviously be a challenge. A grazing muzzle can be helpful with restricting grass intake, with one study showing an 83% average reduction in dry matter grass intake with a properly fitted muzzle (Longland, 2011). However, some horses (especially ponies) can become easily adapted and over-indulge in pasture despite the muzzle. Horses wearing muzzles must be monitored carefully for rubs, hole enlargement and safety. Overall, putting a metabolic horse out on unrestricted pasture is risky and until these horses lose weight and have normal insulin levels, turnout on drylots is recommended.

Since pasture is going to be substantially restricted or eliminated for metabolic horses, they will need to meet their roughage requirement through hay. In general, the minimum amount of hay these horses should be offered is 1.2% of BW, split into multiple meals. The hay can be offered via a mini-hole haynet or other feeding device shown to slow consumption rate and extend eating time (Gluck, 2014). The hay can also be spread around the drylot to encourage movement by the horse. Usually grass hay of moderate quality (relative feed value of at least 75) is recommended (Hay Market Task Force). Legume hays can also be used but they tend to have higher calorie contents and can be consumed more quickly, which can be problematic for hungry horses needing to lose weight. In addition, recent research showed that alfalfa hay was associated with higher glucose levels after consumption versus grass hay (Collins, 2015). Soaking grass hays has been found to reduce the water soluble carbohydrate levels (WSC = sugars + fructan, Longland, 2009; Martinson, 2011) and various studies have looked at soaking time, water temperature, hay type, etc., and results can be very variable. However, since there is agreement that soaking can reduce WSC, and this may be helpful for horses sensitive to soluble carbohydrates, this step is recommended. In addition, since soaking can also leach other nutrients from the hay (Martinson, 2012), it is important to balance the total diet with a supplement or small amount of concentrate. The maximum amount of soluble carbohydrates in hay that is suitable for a metabolic horse, has been recommended to be less than 10% NSC (NSC = sugars + starch + fructan), and this is probably reasonable. However, due to variability in hay, digestibility, soaking, and individual animal response, it is less about an exact number, and more about taking multiple steps to reduce NSC intake in susceptible horses. Overall, source hay that is at least less than 12% NSC, soak it and feed in multiple mini-meals with some type of mechanism (hay net, bag, barrel) to slow intake and help satisfy the horse.

Due to the restricted amount of forage in the diet, along with most forages' inherent nutrient deficiencies, a mineral supplement, ration balancer or low sugar/starch feed should be incorporated to balance the total ration. Horses with active laminitis that are very sensitive to dietary change can start on a mineral supplement such as Free Balance® Mineral, fed according to recommendations (2 oz per day for 1000 lb horse). This will provide much needed minerals to support the body and help repair tissue. From there, easy keeper horses do well on a ration balancer such as Enrich Plus®.

With a feeding rate of 1 lb per 1000 lb body weight, it can be split into two small meals of 1.5 cups each. The balancer has a very low sugar/starch content (~15% NSC) and has been shown to have a low glucose and insulin response to feeding in healthy horses (Vineyard, 2010). For horses (and their owners) seemingly struggling with the small feeding rates of restricted hay and a ration balancer, a low-calorie, extruded feed such as WellSolve W/C® (Weight Control) can be helpful. Reducing forage to 1% BW, along with 0.35% BW in W/C (3.5 lbs for 1000 lb horse) can provide larger concentrate meals to the horse, while also extending meal time. The glucose/insulin response to W/C is very low and overweight horses on a weight loss program lost an average of 50+ lbs in 90 days on W/C without exercise. These horses also had improvements in cortisol, leptin and insulin response to glucose infusion. Further weight loss was seen (90+ lbs) when horses were exercised (Gordon, 2009). Another option is WellSolve L/S®, shown to have a very low glucose and insulin response to feeding in research trials. Additional studies demonstrated the benefit of providing mini-meals (~ 2lbs of L/S) to further lower insulin response to feeding (Gordon, 2007). This feed contains added benefits of a therapeutic level of biotin, along with higher levels of omega 3 fatty acids to support these horses in the recovery process.

There is a myriad of supplements that can be fed to metabolic horses, from magnesium to chromium to psyllium and more. Although they may help in theory, good data showing efficacy is lacking, with anecdotal reports providing most of the "evidence." Some research has shown that psyllium can help reduce insulin response to feeding (Moreaux, 2011), and insulin concentrations in normal horses consuming cool season pasture (Rohrs, 2013). Preliminary field trials showed some benefit via reduced insulin concentration in an IR pony, but no change in borderline insulin resistant mares (Vineyard, 2013). A supplement named Heiro has been part of metabolic horses' programs with improvements in insulin seen in multiple animals (Frank Reilly, DVM, personal communication). A study examining the effects of a cinnamon extract and omega-3 fatty acids showed no improvement in insulin sensitivity in healthy mares (Earl, 2011). An additional study looking at chromium and magnesium supplementation in laminitic, obese horses showed no improvements in insulin sensitivity and other morphometric measurements (Chameroy, 2011). The takeaway remains that supplements may have a place, but they truly are supportive in nature and not stand alone. The steps of pasture restriction, calorie control, lowering the glycemic index of the diet, and supporting the horse nutritionally throughout the process are all required. There is no magic bullet supplement. Medications are best left to the discretion of the veterinarian, with levothyroxine sodium showing benefit in studies to encourage weight loss and improve insulin sensitivity (Frank, 2008). Metformin (Durham, 2008) and other pharmaceuticals may prove helpful in certain horses, but more details on pharmacokinetics, scheduling, and subject selection are needed.

Feeding Metabolic Horses at Maintenance and Above

Once weight loss is underway, it is important to monitor the horse closely via body condition score (Henneke, 1983) and weight tape, and make adjustments as necessary to the program. Ideally, horses should stabilize at a body condition score between 4 and 5, with more sensitive, chronically laminitic horses maintained towards a 4. Some ponies are practically impossible to get to a 5 or less, with a body condition score of 6 acceptable, especially if they started at an 8. Once the horses or ponies reach a healthier BCS, the ration can be altered for weight maintenance. Usually, just increasing the forage portion of the ration to 1.5-2.0% of body weight daily will stop weight loss. Stabilized horses may be able to tolerate small amounts of grass (restricted time, restricted grazing via muzzle or both) but they must be monitored carefully via blood work, body condition, body weight and cresty neck score. These horses will be at repeated risk for insulin resistance and laminitis, and therefore owners must be vigilant.

If metabolic horses need to gain weight, the calories should come from fat and fiber in the diet and not soluble carbohydrates. The amount of hay fed can be increased, along with providing larger meals of a low sugar/starch feed such as WellSolve L/S®. For horses that are exercising, added fat from oil is especially helpful as it adds significant calories without increasing meal size or glycemic response. Oil should be added slowly as horses adjust to the

absorption and taste. We have successfully fed a metabolic Grand Prix dressage horse in full work with WellSolve L/S® and 5 cups of oil per day. Premixed fat supplements such as Amplify may be suitable for some metabolic horses, but it depends on their insulin status and sensitivity to soluble carbohydrates. This decision can be made based on body condition score, blood work and calorie needs.

Metabolic Threshold Theory and Prevention

It stands to reason that metabolic at-risk horses have a threshold of stressors or events that they can either tolerate or not at any given time, depending on how close they are to the threshold. Triggers and risk factors such as genetics, obesity, insulin resistance, access to large amounts of soluble carbohydrates, and stress from trailering, sudden exercise or weather changes, may push these horses over the edge into symptomology and overt disease. Many of these horses can be greatly assisted by dietary intervention, which usually accompanies substantial management and housing adjustments. For horse owners unwilling to make necessary changes to support these horses, it is in the horses' best interest to find them a suitable new home.

It makes sense that if EMS can be partially or sometimes completely controlled by dietary intervention, then an EMS preventative diet could be helpful for at-risk horses. Such a dietary program could include controlled access to pasture, low NSC hay, low NSC concentrate feeds, and restriction of concentrate meals to small mini-meals of <2 pounds per feeding. Through all of these measures, it is important that the horse's base nutrient requirements are met including protein, vitamins and minerals. However, the hallmark and most important factor of a prevention plan is the avoidance of obesity. The subsequent insulin resistance and systemic inflammation from being grossly overweight can be difficult to overcome once the cascade has begun. Educating horse owners on obesity prevention needs to remain a priority. In addition, ongoing research is elucidating more genetic and environmental risk factors along with practical nutritional management for these horses. If we can identify at-risk horses early on, implement sound nutrition and management programs, and monitor them closely throughout their lives, we can improve their health and quality of life.

Options for feeding horses that are overweight and/or have EMS:

Condition	Goal	Forage	Feed Options	Notes
Obesity BCS >/= 7 Insulin status = normal	Weight loss BCS = 5-6	Restrict Pasture 1.0-1.2% BW grass hay, small hole haynet	WellSolve W/C® Enrich Plus	Monitor with weight tape and BCS, go slowly, exercise if possible
Obesity BCS >/= 7 Insulin status = Elevated/Resistant Laminitic	Weight loss, mitigate glucose/insulin response to meal	**Eliminate Pasture** 1.2% BW grass hay, small hole haynet, soak hay with NSC > 12%	Free Balance® Mineral Enrich Plus® WellSolve L/S® or W/C®	Feed as many small meals, slow rate of intake, make changes very slowly, monitor with weight tape and BCS, exercise if possible
Weight Maintenance BCS 4-6 No IR or laminitis	Weight Maintenance	Monitor and restrict pasture access 1.5 – 2.0 % BW grass hay	Enrich Plus® WellSolve L/S® Strategy® Healthy Edge® or Equine Senior® Active®	Monitor horse closely for increases in BW, BCS, cresty neck, IR status, laminitis
Weight Gain Goal BCS 5-6	Increase calories, gain weight	Monitor Pasture Access 1.5 – 2.0 % BW grass and/or some legume hay	Add calories via fat – oil or Amplify® WellSolve L/S® + fat Strategy® Healthy Edge®, Equine Senior Active®, Ultium®	Monitor horse closely for excessive increases in BW, BCS, cresty neck, IR status