

MANAGEMENT AND TREATMENT OF EQUINE METABOLIC SYNDROME

Andy E Durham

BSc.BVSc.CertEP.DEIM.DipECEIM.MRCVS

The Liphook Equine Hospital

UK

Andy@TheLEH.co.uk



Equine metabolic syndrome (EMS) is primarily defined by obesity and insulin resistance (IR), which are both potentially reversible with management of diet and exercise, possibly aided by pharmacologic agents.

1. Diet

Key targets for dietary control are digestible energy (DE) and non-structural carbohydrates (NSC: sugars, starches and fructans). Reduction of obesity only occurs when DE intake is less than energy expenditure. Dietary NSCs may increase laminitis risk by promoting IR, and also by causing post-prandial hyperinsulinaemia and/or hindgut dysfermentation.

a. Quality

Total dietary NSC should be below 10%. High-NSC feeds (grass, cereals, cereal-containing mixes, carrots, apples) should be avoided. The diet should comprise forage supplemented by a "ration-balancer" to ensure adequate protein and micronutrients. Typically around 30% of water soluble carbohydrates are removed by soaking forage for an hour [1-3]. Straw may be mixed with hay for donkeys and ponies but straw-fed horses may be prone to impactions and gastric ulcers [4,5]. Low-NSC chaffs may be provided to conceal medications. Where higher DE intake is required then alfalfa, oil and non-molassed sugar beet pulp can be added.

b. Quantity

The National Research Council recommendation for daily digestible energy (DE) intake for "good-doers" is 127 kJ/kg BWT [6]. If the ration DE content is known then an initial target of 80-90% of the above (100-115 kJ/kg BWT) is reasonable although restriction to 70% (90 kJ/kg BWT) is often required to achieve weight loss, especially if exercise is limited.

All ration components must be weighed and dry matter (DM) intake restricted to 1.0-1.5% BWT daily (N.B. typically hays 85-90% DM, haylages 55-60% DM). Strict dietary control is impossible in grazing animals and turnout is only allowable on grass-free areas or with grazing muzzles. Allowance of 1.0% BWT DM daily of chopped chaff (88 kJ/kg BWT DE) was safe and led to 0.95% BWT loss/week in obese ponies [7]. Allowance of 1.25% BWT DM daily achieved 0.49% BWT loss/week in another study [8].

2. Exercise

If laminitis allows, exercise may improve IR via weight loss and possible direct effects. The beneficial effect of exercise on IR is well recognised in humans but conclusions of equine studies are mixed (e.g. [9,10]).

3. Drugs

a. L-Thyroxine

L-thyroxine at 0.1 mg/kg per os daily for 3-6 months is safe and decreases bodyweight and IR [11]. However, veterinary licensed products in UK are very costly.

b. Insulin-sensitising drugs

Insulin-sensitising drugs are widely prescribed in humans and some may be worth investigating in EMS cases [12]. One study found metformin at 15 mg/kg orally q12hours was safe and improved insulin sensitivity in the short term but long-term results were poorer [13]. Low bioavailability (4-7%) of metformin in horses has been found [14], although a further study found a single oral dose of 30 mg/kg metformin achieved plasma concentrations considered to be therapeutic in humans [15]. Other insulin-sensitising drugs are generally cost prohibitive although some preliminary equine studies of pioglitazone have been performed [16].



- [1] Warr EM, Petch, JL. Effects of soaking hay on its nutritional quality. *Equine vet Educ* 1992;5:169-71
- [2] Watts K, Sirois P. Soaking hay to remove excess soluble carbohydrate and potassium. <http://www.safergrass.org/pdf/SoakReport.pdf> 2003. accessed 31/12/2010
- [3] Longland AC, Barfoot, C, Harris, PA. The effect of water temperature on loss of water-soluble carbohydrates from hay soaked in water for up to 16 hours. In: Ellis AD, Longland AC, Coenen M, Miraglia M. eds. *The impact of nutrition on the health and welfare of horses*. Wageningen Academic Publishers. 2010; 238.
- [4] Cuddeford D, Pearson RA, Archibald RF, Muirhead RH. Digestibility and gastro-intestinal transit time of diets containing different proportions of alfalfa and oat straw given to Thoroughbreds, Shetland ponies, Highland ponies and donkeys. *Anim Sci* 1995;61:407-17
- [5] Luthersson N, Nielsen KH, Harris P, Parkin TD. Risk factors associated with equine gastric ulceration syndrome (EGUS) in 201 horses in Denmark. *Equine Vet J* 2009;41:625-30
- [6] National Research Council Energy. In: *Nutrient Requirements of Horses*, 6th edition. Washington: National Academies Press. 2007; 3-33
- [7] Dugdale AH, Curtis GC, Cripps P, Harris PA, Argo CM. Effect of dietary restriction on body condition, composition and welfare of overweight and obese pony mares. *Equine Vet J* 2010;42:600-10
- [8] Curtis GC, Barfoot CF, Dugdale AHA, Harris PA, Grove-White D, Argo CMcG. Comparison of two practical weight loss protocols for the management of overweight and obese horses and ponies. In: Ellis AD, Longland AC, Coenen M, Miraglia M. eds. *The impact of nutrition on the health and welfare of horses*. Wageningen Academic Publishers. 2010; 237.
- [9] Stewart-Hunt L, Geor RJ, McCutcheon LJ. Effects of short-term training on insulin sensitivity and skeletal muscle glucose metabolism in standardbred horses. *Equine Vet J Suppl.* 2006;36:226-32.
- [10] Carter RA, McCutcheon LJ, Valle E, Meilahn EN, Geor RJ. Effects of exercise training on adiposity, insulin sensitivity, and plasma hormone and lipid concentrations in overweight or obese, insulin-resistant horses. *Am J Vet Res* 2010;71:314-21
- [11] Frank N, Elliott SB, Boston RC. Effects of long-term oral administration of levothyroxine sodium on glucose dynamics in healthy adult horses. *Am J Vet Res* 2008;69:76-81
- [12] Durham AE. The pharmacologic basis for the treatment of endocrinopathic laminitis. *Vet Clin N Am (Equine Pract)* 2010;26:303-14
- [13] Durham AE, Rendle DI, Newton JR. The effect of metformin on measurements of insulin sensitivity and beta cell response in 18 horses and ponies with insulin resistance. *Equine Vet J* 2008;40:493-500
- [14] Hustace JL, Firshman AM, Mata JE. Pharmacokinetics and bioavailability of metformin in horses. *Am J Vet Res* 2009;70:665-8.
- [15] Tinworth KD, Edwards S, Noble GK, Harris PA, Sillence MN, Hackett LP. Pharmacokinetics of metformin after enteral administration in insulin-resistant ponies. *Am J Vet Res.* 2010;71:1201-6.
- [16] Wearn JG, Suagee JK, Crisman MV, Hulver MW, Corl BA, Hodgson DR, Geor RJ, McCutcheon LJ. Effects of the insulin sensitizing drug pioglitazone on indices of insulin homeostasis in horses following endotoxin administration. *J Vet Int Med* 2010;24:709