INSULIN RESISTANCE

Part 2 - Management with Dr Jennifer Stewart

Jenquine
BRINGING SCIENCE TO YOUR FEED BIN

Dr Jennifer Stewart explained in the previous issue just what insulin resistance was and now covers prevention and treatment of this condition. Management of insulin resistance is all about diet and exercise. The horse, like humans and other animals, will eat the amount of feed needed to meet its energy requirements. But, if the feed is palatable and high in energy density, some horses – like individuals of all species – will eat more than is needed to meet energy requirements and, again as in all species, excess energy is stored as FAT.

EQUINE VETERINARIANS AUSTRALIA

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Many owners view a degree of obesity as normal, acceptable, desirable and in certain disciplines horses are judged competitively by their physical characteristics.

Obesity is an under-recognised but common problem in horses. In one study, 45% of 319 randomly selected horses were scored subjectively as either 'fat' or 'very fat.' Interestingly, the owners of the same horses generally underestimated the health consequences for overweight horses and couldn't recognise its development in their animals. An acceptance of the signs and an understanding of the consequences of obesity in horses lags the recognition of obesity in human medicine.

REDUCING BODY WEIGHT

In horses that are overweight, steps should be taken to reduce body weight and to lower the intake of high glycaemic feeds (carbohydrates that break down quickly). Weight reduction will occur on a diet of late-cut hay, a hay-straw mixture (maximum one third straw to prevent constipation/impaction) or grass straw. The feeding rate can start at 1.5% of current body weight, gradually reducing to 1.5, then to 1 to 1.25% of the ideal body weight (not the actual current body weight) in dry matter. Most hays are around 10% moisture and 90% dry matter. Obese horses/ponies that are resistant to weight loss will likely need to be fed at 1% of ideal body weight. For example, if a horse weighs 500kg – but its ideal, optimum weight is 400kg, then start with 7-8kg of hay per day and gradually decrease to 4-5kg per day.

However, this amount of roughage may not satisfy the need of horses to chew — which is met by a feeding rate of at least 1.5% of ideal body weight. Providing palatable twigs (willow, saltbush, dogwood, Alder, birch, blackberry, gorse, hawthorn, poplar, raspberry and some species of bamboo) can meet the time and chewing requirements in such cases. Many shrubs and trees can be used for browse – but do first check whether the plants are safe for horses. Weight loss should be 0.5–1% of body weight per week and the effectiveness monitored regularly either by weighing or measuring body or girth circumference — aiming for a reduction of 1 to 2 cm per week.

HAY SELECTION

Try to find hay that is less than 12% NSC (nonstructural carbohydrates – which equals the amount of sugars and starch). If the horse is insulin resistant, ideally hay should be less than 10% NSC. Many producers are now analysing hay to assist owners. Grass and lucerne hay can be fed as long as the NSC content is known because it's impossible to estimate the NSC – or overall nutritional value of hay – by its type or appearance.

However there are some general guidelines that can be useful:

- hays made from wheat, rye, barley and oats tend to be high in NSC especially when cut just before heading
- stress of drought or weather extremes can drive up the sugar content and hay cut from grasses that have been stressed will be high in NSC
- the more mature hay when it is cut, the lower the sugar and calorie content (NSC) and the higher the fibre

- perennial rye, fescue, and brome generally are higher in NSC
- the lowest-sugar hays tend to be warm-season grasses grown in cloudy, humid climates
- if the hays was rained on between cutting and bailing (and isn't mouldy!) It will generally have a low sugar content

SOAKING & HAY ALTERNATIVES

NSC/sugar content can also be reduced by soaking hay at room temperature for one hour or in hot water for 30 minutes — this removes around 30% of the sugar. The more water used, the more sugar removed. The water is drained off and discarded before feeding the hay to the horses. Unmolassed beet pulp is also low in NSC and can replace around 40% of the hay in the diet. Half a kilo of dry beet pulp is equivalent to around a kilo of hay.

'WEIGHT WATCHER'S' PADDOCK

Restricting intake in horses at pasture can be challenging. Horses will eat beyond their nutritional needs when given the opportunity, with some gobbling down a massive 3.3% of their body weight (in dry matter) while grazing pasture. The average pasture is around 70% – 80% water and 20 to 30% dry matter. This means an enthusiastic 400 kg horse can eat almost 20kg of pasture a day. Enthusiastic ponies have been found to eat up to 40% of their daily feed requirements in three hours at pasture. And, as we have all experienced, spring is a high-risk time for pasture-associated laminitis. The sunny days and cool nights of spring cause NSC to accumulate in pasture, so access for at-risk horses must be restricted. Confining a fat horse and a companion to a small grass paddock around a 3rd to ½ an acre is another strategy that can be effective.

REINTRODUCING PASTURE

Horses/ponies that have persistent insulin may need to be held off pasture altogether until, after effective dietary adjustments and exercise, insulin returns to normal. These animals may need to be reintroduced to pasture gradually and the insulin response monitored. Gradual reintroduction can be managed with a grazing muzzle, strip grazing or limiting the grazing time to between 3 AM and 10 AM when grass sugar levels are at their lowest. Generally, Australian native grasses such as speargrass, wallaby grass, tussock grass, weeping grass, rat's tail grass, Red grass, wheatgrass, Mitchell grass and Kangaroo grass are lower in NSC than introduced, exotic grasses such as rye, kikuyu, fescue and phalaris.

MINERAL & VITAMIN REPLACEMENT

Finally, with any dietary restriction vitamin and mineral intake must be assured and supplementation may be necessary because feeding only roughage and soaking hays (which reduces levels of some minerals) as a management strategy can result in nutritional deficiencies. Any supplements need to be low in energy and should supply minerals, vitamins and amino acids that are deficient in the diet.

HARD FED HORSES

The management and prevention of insulin resistance in hard-fed horses also requires consideration of the amount of starch and sugar in a hard feed — as these affect their glycaemic (glycaemic index, GI- Table 2) and insulin responses to feeding. In human nutrition, the glycemic index is useful for developing diets for patients with insulin resistance or noninsulin-dependent diabetes. Trends in human nutrition towards 'low carb diets' have fed broad support for low starch feeds for horses. But because much of this information has not been studied for horse feeds, the focus is on restricting starch and simple sugar intake.

Some companies in the horse feed industry manufacture feeds that claim to be low in starch and to reduce the risk of grain/starch/sugar-associated diseases. It is important to remember that not all feeds purported to be low GI actually achieve this goal. The starch/sugar/NSC levels for commonly used feeds are shown in table 1. Feeds with the lowest starch and the lowest NSC should be fed as they have the least effect on blood glucose.

Table 1. Sugar, starch & NSC levels in common feeds and feedstuffs.	SUGAR (range g/kg)	STARCH (range g/kg)	NSC%
Alfalfa Hay	8.90%	1.9% (0.9 - 2.9)	11.3% (8.8 - 13.9)
Alfalfa Pellets	7.20%	2.3% (0.27 - 5.4)	9.30%
all-4-feet®	3%	2.1%	9.5%
Barastoc Calm Performer*		25%	30.70%
Barastoc Cool Command*		37.40%	43.40%
Barley	6.00%	63.7% (54 - 66)	61.70%
Barley Hay	14.90%	5.80%	20.4% (13 - 26)
Beet pulp	7.6% (1.4 - 14.3)	7.0 - 17.5	
Beet Pulp (no molasses)	10.70%	1.4% (0 - 2.55)	12.3% (7 - 17.5)
Brewers grain dry		7.8% (2.3 - 14.5)	7.4 - 15.1%
Carrots		3.2 (0 - 6.6)%	
Cool-season grasses		5-40% DM depending on season and sunlight	level rise in morning, peak in afternoon so horses grazing in afternooon can eat up to 4 times more fructan
Copra (coconut meal)			10.6% (6.6 - 14.7)
Corn	3.70%	70.3% (68 -78)	73.3% (69 - 77)
Corn gluten feed	0.8% (0.7 - 4.4)	15.5% (12 - 22.3)	27.90%
Cottonseed hulls		4.2% (1 - 5)	5.50%
Cottonseed whole		0.3	0.10%
Extruded rice		69%	
Flax seed (linseed) meal		2.9% (0.3 - 5.4)	4.8% (3.9 - 5.7)
Grass Hay	11.10%		13.8% (9 - 18.4)
Grass Pasture	10.30%	2.56% (0.12 - 5)	15% (8 - 21)
Horsepower Equestrian*		26.70%	33.40%
Lucerne/clover pasture**		1.9% (1 - 3)	14.5% (11 - 18)
Lupins	2.5%	1.7%	
Mi-Feed EasiRider Cool Mix*		40.30%	46.00%
Mitavite Economix*		23%	31.50%
Mitavite Formula 3*		28.50%	42.20%
Mitavite Gumnuts*		22.30%	33%
Mitavite Xtra Cool*		25.50%	33%
Molasses	62%		62% (48 - 76)
Nutririce Show and Competition*		28.70%	35.40%
Oat Hay	16.00%	6.3% (1.6 - 8.6)	22.1% (15 - 29)
Oats	4.80%	44.4% (38 - 62)	54.1% (41 - 68)
Omega Weight Gain*		9.80%	16.20%
Pryde's EasiResult*		26.30%	42.60%
Rice Bran	6.20%	22% (9 - 36)	25% (16 - 34)
Sorghum	1.4% (0.7 - 2.4)	74.5% (70 - 79)	61.3% (39 - 83)
Soybean Hulls	4.30%	1.4% (0.14 - 2.75)	6.3% (3 - 9.4)
Soybean Meal	14.30%	2.1% (0.4 - 3.2)	16.2% (12.3 - 18)
Stance CoolStance*		1%	10.30%
Straw	11.70%	2.33% (0 - 5.3)	9.6% (3 - 16)
Weightlifter Calm*		29.60%	40%
Wheat		62% (55 - 69)	
Wheat Bran	7% (4 - 9.5)	23% (15 - 30)	31.1% (22.8 - 39)

* Nerida Richards (2008) THE NON-STRUCTURAL CARBOHYDRATE CONTENT OF SOME COMMERCIALLY AVAILABLE HORSE FEEDS IN AUSTRALIA Proceedings of the AUSTRALIAN EQUINE SCIENCE SYMPOSIUM Volume 2

**Wilted clover and lucerne have around 30% less NSC than fresh

Feeds & feedstuffs that are high in starch, sugar or NSC should not be fed to insulin-resistant or at-risk horses.

IMPROVING INSULIN RESISTANCE

Dietary supplements such as psyllium (90-270g/day) have been found to improve insulin resistance in some horses. It has also been proposed that short-chain fructo-oligosaccharides (scFOS) may have a beneficial probiotic effect that may benefit insulin sensitivity. FOS are found in blue Agave,bananas, onions, chicory root, garlic, asparagus, leeks and Jerusalem artichoke.

Other herbal agents such as Panax (ginseng, japoncicus, quinquefolius, eleutherococcus, Asian ginseng, Radix ginseng); glycine (found in soy); grapefruit; beetroot; brindleberry (Malabar Tamarind); Vitex agnus-castus (Chaste tree, Chasteberry, Monks Pepper); Silibum marianum (Milk Thistle, St. Mary's Thistle; curcumin; fenugreek; Aloe vera; Konjak, Konnyaku, Konjaku, Devil's Tongue, Voodoo Lily, Snake Palm or Elephant Yam; Prickly Pear Cactus; cinnamomum cassia (Chinese Cinnamon or Cinnamomum aromaticum); Grifola frondosa (Maitake, Sheep's Head, Ram's Head or Hen of the Woods); Berberine -Mormordica charantia (Bitter Melon, Bitter Gourd); Corosolic Acid (Glucosol, Banaba) and Indian Kino Tree have been suggested but more extensive and applied scientific research is necessary to investigate and confirm their efficacy and measure potential clinical effects and safety.

ADD EXERCISE

Dietary therapy alone may not be sufficient to reverse insulin resistance and exercise can be very beneficial. Insulin sensitivity is increased (i.e. insulin resistance is decreased) in horses after seven days of moderate exercise training, and in obese ponies after two weeks. Exercise has been shown to increase glucose uptake in skeletal muscle, which is the principal site of insulin resistance. Current recommendations are to begin training with 2 to 3 sessions of 20 to 30 minutes trotting. This can be gradually increased to 5 – 7 sessions per week.

OVERALL TREATMENT

Once a management plan of diet and exercise is in place, there are several drugs that can counter insulin resistance, including levothyroxine, pergolide and Metformin. The choice of treatment requires veterinary advice especially in horses that cannot be exercised due to laminitis.

IR in HORSES WITH NORMAL BODY WEIGHT

Insulin resistance in horses with normal body weight can also be a challenge and the first question is whether the horse is suffering from PPID (pituitary pars intermedia) dysfunction, so horses over 10 years of age should undergo testing for both PPID and insulin resistance. These decisions are best discussed with your equine veterinarian.

Because the symptoms of insulin resistance are diverse and individual, treatment needs to be individualised and what works for one horse might not work at all for another. Whether a horse is treated with diet and exercise and whether certain drugs or supplements, or combinations thereof, are required, should be based on veterinary advice and monitoring the response to treatment. As our knowledge of insulin resistance in horses and on the glycaemic and insulin responses to feeds and feedstuffs improves, so too will our ability to prevent and manage this important horse disease.

GLUCOSE & INSULIN RESPONSES TO COMMON FEEDS	Glycaemic index	Insulin index
Glucose solution	100	100
Barley	100	100
Barley (ground)	79	143
Barley (popped)	150	106
Barley (steamed)	64	120
Barley (steam-flaked)	127	188
Beet pulp	24	
Beet pulp shreds hydrated	72	
Beet pulp shreds + molasses	92	
Beet pulp washed	34	
Corn	100	
Corn cracked	100	73
Corn ground	109	105
Corn micronised	92	118
Corn extruded	104	91
Corn steamed	91	99
Corn steam-flaked	93	101
Grass hay	49	
Lucerne hay	46	
Oats crimped	74	
Oats ground	102	164
Oats groats	62	67
Oats steamed	99	126
Rye grass hay	47	
Rice bran	16	
Soy hulls	6	
Wheat bran	57	
Sweet feed	106	

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Dr Jen Stewart has been an equine veterinarian for more than 40 years & an equine nutritionist for more than 10 years. Jen has been developing premium formulas for studs, trainers & feed companies in Australia & around the world & regularly consults to leading international studs & trainers in various countries. Jen has spent a fair bit of time researching & being involved in nutritional management of developmental orthopedic diseases, colic, tying-up, laminitis, performance problems, post-surgery & other conditions. And is currently the only practicing equine veterinarian & clinical nutritionist in Australia. ***Jen's promise is to continue to BRING SCIENCE TO YOUR FEED BIN***

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