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EQUINE INSULIN DYSREGULATION

Equine insulin dysregulation (ID) is currently considered to have 2 components; 1) hyperinsulinaemia which can occur in the basal, fasted state and/or after the consumption of non-structural carbohydrates (NSC; sugars, starches and fructo-oligosaccharides) and 2) insulin resistance (IR) which involves tissue resistance to the effects of insulin. A horse can have either, or both, of these manifestations of ID. Equine metabolic syndrome (EMS) is the major endocrine disease in which ID occurs. Currently, the EMS phenotype is described as including regional or generalised obesity, ID and an increased risk of developing laminitis.

Dysregulated insulin secretion in response to oral NSCs is associated with a disruption of the enteroinsular axis. After consuming a meal that contains a high concentration of NSCs, the absorbed glucose simulates insulin secretion from the pancreas. However, this insulin response to NSC is further increased by the secretion of small gastrointestinal peptides called incretins that are released in response to glucose in the intestinal lumen. In animals with ID the incretin response is greater, compared to healthy horses, which results in an inappropriately large insulin response to eating NSCs.

An increased insulin concentration measured in a fasted state may indicate that the horse has IR, where tissue resistance to the effects of insulin is occurring. That is, the insulin is less able to promote glucose uptake into insulin-sensitive tissues, such as muscle. However, animals with normal fasting insulin concentrations can also have IR, and specific tests (usually performed in a referral setting) are required to accurately diagnose IR. The development of tissue IR is often preceded, or accompanied, by disruption of the enteroinsular axis as described above.

It is thought that ID can occur at any age, and it is often diagnosed in association with an episode of laminitis. However, early detection of ID is important, as reducing circulating insulin concentration can help to reduce the risk of laminitis. The diagnosis of ID consists of a combination of clinical examination of the patient, clinical chemistry and the use of a dynamic test of the enteroinsular axis called an oral glucose test (OGT). Clinical examination findings may include the identification of fat accumulation along the crest of the neck, on the tail head, shoulders, prepuce/mammary region and in the supraorbital region. Alternatively, the animal may be generally obese, which can mask the easy identification of regional adiposity. An accurate assessment of a horse's body condition and cresty neck score can provide valuable basic information about the animal's type and extent of obesity, which is useful for patient monitoring.

Clinical chemistry findings from a horse with ID can include an elevated fasting insulin concentration (>20 µIU/mL), increased triglycerides and a low adiponectin concentration. However, it is important to note that a normal insulin concentration does not rule out ID. An OGT (an oral sugar test in preferred some regions) is required to detect a dysregulated insulin response to oral NSC. During an OGT 0.75-1 g/kg bodyweight of glucose powder is mixed with a small amount of bran (~200 g) and lucerne chaff (~0.3% bodyweight) and fed as a morning meal. The glucose is usually dissolved in water and mixed with the bran, but alternatively it can be administered via a naso-gastric tube providing the patient doesn't become stressed. Two blood samples are taken, one before and the second 2 hours after the meal is offered/consumed. Any meal refusals need to be noted so that the result can be interpreted correctly. The post-prandial serum insulin concentration is considered to be normal if it is <80 µIU/mL. While this test is frequently used in practice, and has been demonstrated to be reasonably repeatable, the test meal does need to be promptly and fully consumed, which can be a problem with horses that are reluctant to consume a very sweet meal. In these cases the glucose can be substituted with another source of NSC, such as cereals, although further research on the use of more palatable test diets is required. Finally, the binary test cut-off value of 80 µIU/mL is not absolute, and some careful interpretation of results close to this value needs to be made by the clinician, while considering the clinical examination and other biochemistry findings. Repeating the test may be useful in horses that have an unexpected result, particularly if it is considered that stress may have adversely affected the test, since cortisol may antagonise the effects of insulin.

The OGT has been shown to be predictive of the insulin response to consuming NSC in pasture, which should make it a useful test for estimating the degree of ID during grazing, and therefore it may be useful for determining the optimum amount of pasture access in patients with ID. Further, dysregulated insulin responses during an OGT, elevated fasting insulin concentrations and low adiponectin concentrations have all been reported to be predictive of laminitis risk, which makes these tests useful in predicting the likelihood of laminitis occurrence, or recurrence, in a particular patient.