Groundbreaking Equine Endocrine Research

Highlights from the 2025 Global Equine Endocrinology Symposium included never-before-presented study results on insulin dysregulation and PPID.

Kimberly S. Brown

An estimated one-third of the world's 60 million horses are over the age of 15. Considered seniors, this population is at higher risk of endocrine issues (Ireland et al. 2016).

In January 2025, researchers from around the world convened at the 6th Global Equine Endocrinology Symposium (GEES), held in Ocala, Florida, to deliver 37 presentations on this important topic. We were on-site to bring you notes from this exclusive gathering.

Forage NSC Increases Affect Horses With & Without Insulin Dysregulation

Key takeaway: Be cautious when determining if and when horses can graze on fresh forage that could be high in nonstructural carbohydrates (NSCs, or starches, sugars, and fructans).

Research showed that high NSC levels in pasture can affect horses both with and without insulin-dysregulation (ID, an inability to regulate blood insulin levels). Morgan Askins, a graduate student in the University of Kentucky's Department of Veterinary Science, Gluck Equine Research Center, presented these findings. Study co-authors included Pat Harris, MA, VetMB, PhD, DECVCN, MRCVS, of Waltham Petcare Science Institute; Erica Jacquay, MS, PhD, of Midway University; and Gluck Equine Research Center colleagues Brittany Kerley, MS, PhD, Maggie McClendon, MS, and Amanda Adams, MS, PhD.

Objectives

The researchers hypothesized that if and when the NSC content of fresh forage increases throughout the day, it will lead to heightened insulin

An estimated one-third of the world's horses are considered seniors and, therefore, at higher risk of endocrine issues.

responses in ID compared to non-ID horses.

The objectives of this study were to:

1. Determine changes in forage's nutritive content over 24 hours at two time points (late summer 2023 and spring 2024).
2. Examine how changes in fresh forage influence insulin concentrations in ID and non-ID horses.

The researchers also wanted to place the ID horses on a drylot with free-choice access to low-NSC hay (< 10% dry matter basis) to determine insulinemic response.

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Researchers from around the world convened at the symposium in Ocala, Florida.

Methods

The study involved 12 mixed-breed adult horses with an average age of 19 classified as being either ID or non-ID. They were housed on pasture in Central Kentucky in late summer 2023 (Phase 1) and spring 2024 (Phase 2). Immediately following Phase 2, the ID horses were housed on a drylot with low-NSC hay (Phase 3).

The researchers collected blood and pasture samples every two hours for 24 hours starting at 7 a.m.

The same pasture was utilized in late summer and spring. Horses were moved onto the pasture 24 hours before sample collection started. Blood samples were analyzed for insulin.

Phase 1 and 2 Results

In Phase 1 on the late summer pasture, NSC peaked at 15.4% at 7 p.m. It slowly decreased to 7.5% by 5 a.m. the next day.

The ID horses' blood serum insulin concentrations increased significantly from baseline at 7 a.m., and insulin was elevated significantly from 3 to 11 p.m. Serum insulin concentrations began to decrease overnight, starting with the 11 p.m. reading. The researchers deemed the safer turnout to be from 5 to 11 a.m.

During Phase 2 in spring 2024, the pasture NSC levels stayed consistently high and ranged from 19.0-24.7%, with a peak at 7 p.m. This resulted in ID horses' insulin remaining consistently high throughout the day.

Importantly, the researchers found four of the six non-ID horses also showed significant insulin responses during the day. Askins said three of the non-ID horses remained above the diagnostic cutoff.

In the forage analysis for Phase 2, the NSC levels were never below the currently recommended 10% NSC dry matter basis. Therefore, the research team deemed turnout unsafe for ID horses—and many non-ID horses—during this time on that type of pasture. Askins noted the individual variability in response to NSC in pasture.

None of the study horses displayed clinical signs of the hoof disease laminitis—a risk associated with high blood insulin levels.

Phase 3 Results

The ID horses from the first two studies were taken off pasture immediately after Phase 2 and placed on a drylot with low-NSC hay (8.9% dry matter basis). Within 24 hours of being on the drylot, their insulin levels lowered. The researchers said the extent and speed of the decrease varied depending on the individual.

Askins said it is "currently unknown at what NSC level do ID horses' insulin responses change from mirroring the NSC to remaining consistently high."

Effect of Day and Time on Pasture NSC and Insulin in ID Horses

Key takeaway: Trying to time turnout for ID horses can be difficult because of changing NSC levels in pastures, even at the same time of day.

Managing horses that are at risk for laminitis so they can have pasture turnout has been an important topic in the equine industry. Owners often ask their veterinarians for turnout recommendations for these horses.

To help address this question, Askins, Harris, McClendon, Adams, and Gianna Palmieri, DVM, and Alexandra Gregory, of Lincoln Memorial University, recently studied ID horses grazing on Kentucky cool-season pasture in early summer.

(*The authors noted this material is original and had not been presented elsewhere.*)

Objectives

Previous general recommendations for grazing horses at risk of laminitis on cool-season grasses after the spring flush has been to limit them to morning hours.

This is when NSC levels should be lowest. However, there had not been research to correlate early summer pasture NSC and insulinemic response in ID horses.

The researchers hypothesized that NSC content in pasture changes from day to day as well as by time (a.m. and p.m.) daily. This results in changes in circulating insulin concentrations in ID horses.

Methods

The June 2024 study involved seven mixed-breed, mixed-sex horses group-housed on the same paddock growing Kentucky cool-season grass. All horses were classified as being ID.

The two phases of the study utilized the same horses and paddock with green, active-growth vegetation.

In Phase 1, the researchers collected blood and pasture samples and recorded daily environmental temperatures during the same morning hours (between 8 and 9 a.m.) for five days. The following week in Phase 2, they collected blood and pasture samples and recorded the environmental temperature at two time points (8 a.m. and 3 p.m.) on one day.

Blood samples were analyzed for insulin, and forage samples were immediately stored at -4 degrees F (-20 degrees C) prior to being shipped on ice to be analyzed by Equi-Analytical.

The researchers said all study horses remained clinically healthy and had no signs of laminitis throughout the trial.

Phase 1 Results

In Phase 1, Askins et al. found no correlation between daily environmental temperature and pasture NSC.

For example, the highest temperature was on Day 3 at 71 F (22 C), when NSC was 11.5% on a dry matter basis. The lowest temperature was on Days 1 and 2 at 66.2 F (19 C), when NSC was 15.4% (the highest recorded in this phase) and 12.5%, respectively. Day 4 had a temperature of 68 F (20 C) and 11.4% NSC. Day 5 had a temperature of 69.8 F (21 C) and 10.1% NSC.

As expected, the decreases in NSC dry matter were associated with changes in serum insulin concentrations—as NSC went down, so did horses' blood insulin levels.

Phase 2 Results

As expected, in Phase 2 both environmental temperatures and NSC increased from the morning to the afternoon. Serum concentrations also increased significantly from the morning to the afternoon samples.

The morning temperature was 75.2 F (24 C), when NSC was 9.5% on a dry matter basis, and insulin concentrations were 78.17 +/- 44.94 mIU/mL. The afternoon temperature was 89.6 F (32 C), when NSC was 13.4% and insulin concentrations were 101 +/- 50.97 mIU/mL.

Conclusions

The study confirmed that NSC changes can occur rapidly in pasture grasses. Importantly, the study showed that "NSC increases can occur between the morning to mid-afternoon in cool-season pastures even under warm/hot conditions."

These NSC increases were reflected in increased insulin concentrations, the research team noted. They also highlighted the tremendous individual variability in the ID horses' responses to the pasture and the changes in its NSC content.

Just because it is morning doesn't mean nonstructural carbohydrate levels will be low, the study authors pointed out. "Morning pasture NSC can change significantly from day to day," they noted. "Even in early summer, the morning NSC percentage in the grass may result in undesirable insulin concentrations in some grazing ID animals."

That means horse owners and managers must be careful assuming all morning grazing after the spring flush will be sufficiently low in nonstructural carbohydrates to be suitable for equids prone to laminitis.

The researchers also reminded horse owners and managers that because NSC can change rapidly, and horses' insulin responses to NSC vary, it is important to monitor individual insulin responses frequently. This is especially true in high-risk ID animals.

GETTY IMAGES

NSC changes can occur rapidly in pasture grasses, and morning pasture NSC can change significantly from day to day.

Horse Owner Survey on Knowledge of PPID

Key takeaway: About 43% of survey respondents had a self-proclaimed incomplete understanding of pituitary pars intermedia dysfunction (PPID, aka Cushing's disease). This means veterinarians have room for educating those owners on better care of affected horses.

Harris presented the results of a horse owner survey she and her colleagues (Nicolas Galinelli, PhD; Nicholas Bamford, PhD, DACVIM; and Simon Bailey, BVMS, PhD, DECVPT, from the University of Melbourne) conducted to gauge knowledge of PPID. Why? Because PPID "is an important and common condition in older horses and ponies and is linked to a range of other problems such as laminitis and loss of muscle mass."

A total of 1,143 survey responses from Europe (49%), Australia and New Zealand (32%), and North America (18%) met the inclusion criteria. Respondents were grouped based on their self-declared understanding of PPID. Forty-three percent classified themselves as having an "incomplete understanding," and 57% classified as having a "good understanding."

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Owners' understanding of PPID and their ability to make appropriate management decisions are crucial factors in maintaining affected horses' quality of life.

Objectives

The aims of this study were to assess:

- Owners' ability to recognize PPID.
- Their understanding of PPID.
- Factors influencing owners' decisions about management, veterinary involvement, and treatment of PPID.
- How they feed horses with and without PPID.
- Areas of further education and the channels through which owners are most likely to seek this information.

Owner understanding of PPID and "their ability to make appropriate management decisions are crucial factors in maintaining the quality of life of affected horses," the authors said. "Assessing owners' knowledge and understanding of PPID will provide information that will help veterinarians, researchers, and allied professionals to target and design owner education more efficiently."

If a survey respondent was managing an animal with PPID, the study also investigated factors influencing their decisions about management, veterinary involvement, and treatment.

Methods

Harris et al. distributed an online survey worldwide. It included questions about factors that impact decisions related to the management of horses, the role of veterinarians, and factors influencing the management of horses with PPID.

Results

The researchers found that 52% of respondents had horses 15-20 years old, 47% had horses aged 20-25 years, and 40% had horses over 25 years old. The results included a variety of purebred and mixed-breed horses as well as ponies.

Respondents who declared an incomplete understanding of PPID rated long and curly hair as the most indicative clinical sign. The researchers noted that this is the most obvious sign of PPID.

Respondents who declared a good understanding of PPID rated laminitis as the most important clinical sign followed by susceptibility to infections. The researchers noted that while laminitis is not always associated with PPID, it is perhaps the most clinically serious condition that might occur in PPID animals.

Information sources for health and management differed between owners in the two groups. Both groups selected veterinarians as their main information source. However, the "incomplete understanding" group ranked nutritionists, trainers, and farriers as more important sources than the "good understanding" group, whose second-most selected category was scientific papers.

In the study's nutritional evaluation, Harris said factors considered for PPID horse diets included laminitis, the animal being obese or underweight, and dental problems. Despite laminitis being a key consideration for many, a high proportion of owners of PPID horses were feeding high-NSC diets.

Conclusions

"There is considerable scope for education of horse owners regarding PPID," noted the researchers. "Almost half of respondents declared an incomplete understanding of this condition.

"Being aware of what horse owners know about PPID will help to inform

future education strategies," they said, which should help optimize health outcomes for equids with PPID.

Use of Dexamethasone as a Model of Insulin Dysregulation

Key takeaway: While dexamethasone induces insulin resistance consistently over prolonged periods, its effect on insulin secretion seems temporary.

The corticosteroid dexamethasone is used to create experimental models of insulin resistance. However, its impact on insulin secretion is unclear. In a recent study, Francois-Rene Bertin, DVM, PhD; Andrew van Eps, BVSc, PhD, MACVSc, DACVIM; Demia de Tonnerre, BVSc, DACVIM-LAIM; Jeaneen Kulp; and Darko Stefanovski, MS, PhD, assessed dexamethasone-treated horses' response to an oral carbohydrate challenge, citing a need for an inducible/reversible model of ID.

Methods

Eight Standardbreds received 0.08 mg/kg of dexamethasone intramuscularly every 48 hours for 15 days. Oral glucose tests were conducted before treatment (Day 1) and on Days 8 and 15. The researchers measured glucose, insulin, total and active glucagonlike peptide-1 (gut hormones tGLP-1 and aGLP-1), and glucose-dependent insulinotropic polypeptide (GIP, another gut hormone) at baseline and intervals up to 240 minutes after the oral glucose tests.

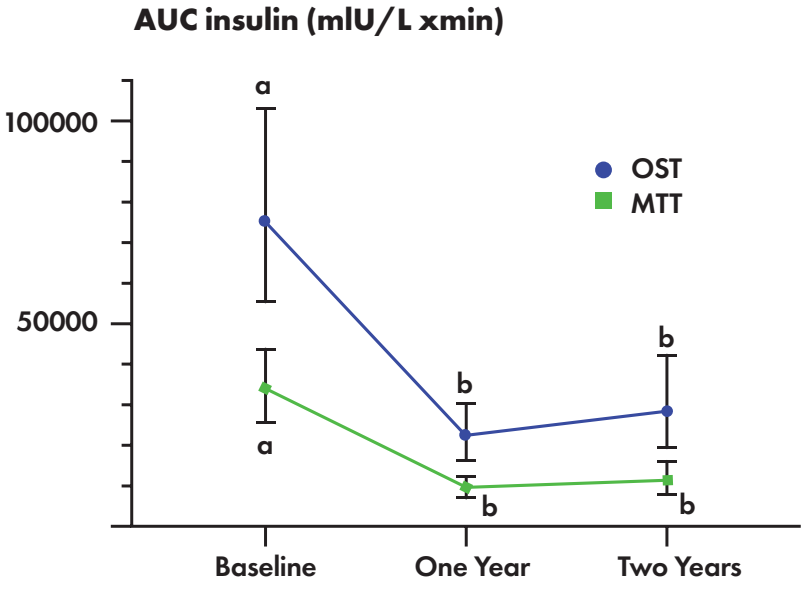
Results

After eight days of dexamethasone administration, the research team noted significant increases in areas under the curve (AUC) and maximum concentrations (Cmax) of glucose, insulin, tGLP-1, and GIP. However, these effects were blunted by Day 15. Glucose, insulin, and aGLP-1 AUC and Cmax were significantly lower than on Day 8. tGLP-1 and GIP AUC and Cmax did not differ from Day 1.

Conclusions

Dexamethasone markedly increased insulin secretion after an oral carbohydrate challenge. This showed how exogenous glucocorticoids like dexamethasone can cause or exacerbate ID, even in healthy horses. However, the effect was transient and partially reversed by Day 15. While dexamethasone induces insulin resistance consistently over prolonged periods, its effect on insulin secretion seems temporary. Therefore, the dexamethasone model of ID is an unstable model for testing medication.

(*Note: This work was funded by a Grayson Jockey Club Research Foundation grant. No horse developed clinical laminitis.*)



Study horses' postprandial insulin responses decreased with canagliflozin treatment and remained low for two years.

Long-Term Canagliflozin Therapy in ID Horses

Key takeaway: Preliminary results indicate canagliflozin is a promising drug for the long-term treatment of ID horses.

An ongoing study on the effect of canagliflozin on ID horses concluded its second year. Elin Svonni, DVM, PhD student with the Department of Clinical Sciences at Swedish University of Agricultural Sciences, presented the preliminary report. Her research colleagues are Sanna Lindåse, DVM, PhD, and Johan Bröjer, DVM, MSc, PhD, DACVIM (LAIM), DECEIM, of the same institution.

Methods

The study involved 16 horses diagnosed with ID. They underwent an oral sugar test and a meal tolerance test at baseline (BL). Those tests were repeated after one year and two years of treatment with once-daily canagliflozin (0.4 mg/kg).

Objectives

Velagliflozin and canagliflozin are sodium-glucose co-transport 2 (SGLT2) inhibitors that have been studied in horses. These SGLT2 drugs reduce glucose reabsorption in the kidneys, promote glucosuria (glucose excreted in urine), and consequently decrease blood glucose and insulin concentrations.

The researchers acknowledged that short-term treatment with SGLT2

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inhibitors has been shown to decrease the postprandial (after a meal) insulin response in ID horses. The aim of this study was to investigate the effects on postprandial insulin responses, serum triglyceride (TG, a type of fat in the blood), and concentrations of the enzyme glutamate dehydrogenase in ID horses treated with canagliflozin for up to two years.

Results

Svonni reported that the postprandial insulin responses decreased with canagliflozin treatment and remained low for two years (see graph on page 24).

For the oral sugar test, she said, "the average insulin responses were 29.3% and 37.6% of the baseline response at one and two years, respectively. The corresponding data for the meal tolerance test were 28.2% and 33.7%.

"There was no difference in glutamate dehydrogenase concentrations at any time point compared to BL," she added. "Some individuals developed elevated serum triglyceride concentrations during canagliflozin treatment but showed no clinical signs of hyperlipemia (high levels of fat in the blood)."

Conclusions

These results indicate horses treated with canagliflozin "have sustained decreases in postprandial insulin responses over two years without severe side effects related to hypertriglyceridemia. Thus, canagliflozin is a promising drug for long-term treatment of ID horses."

(*Note: The Swedish-Norwegian Foundation for Equine Research funded this study.*)

Pergolide's Effects on Horses' Thyroid Function

Key takeaway: Pergolide is unlikely to cause low thyroid hormone concentrations in PPID horses.

Pergolide mesylate is labeled for the treatment of PPID in horses. While PPID is not associated with a primary thyroid disorder, it is part of the nonthyroid illness syndrome, said Bertin, who co-authored a study on the topic with Martyna Jargielo, DVM, and Janice Kritchevsky, VMD, MS, DACVIM, all of Purdue.

Objectives

Bertin said pergolide is "over 90% protein-bound. As such, it could cause a decrease in thyroid hormone concentrations by displacing them off circulating proteins." The Purdue study's aim was to determine the effect of pergolide administration on horses' thyroid function.

Methods

The study involved six lightbreed horses. Each received 1 mg of pergolide mesylate orally once a day for five days. Total thyroxine (tT4, a hormone produced by the thyroid gland) was measured daily from Days 0 to 11 (before, during, and after pergolide treatment).

The researchers conducted thyrotropin-releasing hormone (TRH) stimulation tests on Days 0 and 6. "Total triiodothyronine, tT4, and free thyroxine were measured at baseline, 2 hours, and 4 hours after TRH administration," said Bertin.

Results

Bertin said they detected no effect of pergolide administration on tT4 during or after treatment. TRH administration resulted in a significant increase in all thyroid hormones. However, it did not have a significant effect on thyroid function.

Conclusions

"Pergolide has no detected effect on thyroid hormone concentrations or thyroid gland function in horses," Bertin concluded, noting that protein-bound agents do not necessarily affect blood T4 concentrations. Low thyroid hormone concentrations in PPID horses are unlikely to be caused by pergolide, he added. EM

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