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Modern •

Equine Vet

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Feeding the Insulin- Dysregulated Horse

Reducing Diarrhea in Foals

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Horses Are Thinking?

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Vet Stats



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ID PERSPECTIVE**

4 COVER STORY Feeding Strategies for the Insulin- Dysregulated Horse

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ID Perspective

This column, brought to you by Zoetis Equine, features insightful perspectives from leading minds

EDUCATING CLIENTS ON CORE AND RESPIRATORY DISEASE PREVENTION

Over the past two years, we've seen rising rates of mosquito-borne illnesses, including West Nile virus and eastern equine encephalomyelitis, affecting horses across the U.S. This has heightened levels of concern among horse owners and veterinarians alike and prompted clinics to develop additional safeguards in the hope of limiting or preventing these outbreaks.

As veterinarians, we're uniquely positioned to advocate for the public safety of the horses entrusted in our care. In this column, I address core and risk-based disease vaccination reminders and provide a paired vaccine recommendation. Our aim is to equip both vets and clients with the information needed to empower choices, promote partnership and provide greater peace of mind.



KEY INSIGHTS TO SHARE WITH CLIENTS

Annual spring wellness visits are the ideal time to educate horse owners on research-backed vaccine protocols. It can be helpful to remind clients that the core equine diseases—those that pose a risk of significant harm to horses—include Eastern equine encephalomyelitis (EEE), Western equine encephalomyelitis (WEE), tetanus, rabies and West Nile virus (WNV). Every horse is at risk for exposure to these five core diseases, but it's important to note that rabies remains the most serious threat. It's staggering to consider that only one in six horses is vaccinated when rabies is 100% fatal.¹

Of the risk-based diseases, respiratory illness remains the primary cause of death in horses, mostly due to equine influenza (flu) and equine herpesvirus (rhino).² I find it valuable to ground clients in the knowledge that flu is the most common risk-based disease and their horse can be exposed to it across the distance of half a football field.³ Given how difficult it is to stop the spread of certain infectious diseases, prevention needs to be our top priority through strong biosecurity protocols that include vaccination.

THE PERFECT PAIR

A two-part vaccine protocol that I recommend divides core equine disease coverage and respiratory disease protection into separate injections. This approach has been shown to provide up to 4.7 times better immune response against flu than combination vaccines.⁴ Zoetis refers to these vaccines as The Perfect Pair: Core EQ Innovator® and Fluvac Innovator® EHV-4/1.

The research behind this innovative pairing is extensive and reason enough to consider its unique formulation. Core EQ Innovator is the only vaccine to offer comprehensive coverage against the most prevalent and dangerous equine diseases in a single injection. Its counterpart, Fluvac Innovator EHV-4/1, delivers trusted flu and rhino (EHV-1 and EHV-4) protection. During annual wellness visits in the spring, I recommend vaccination against all five core equine

diseases along with a respiratory vaccine with flu and rhino coverage. Fall booster respiratory vaccines may also be recommended for horses at a higher risk.

REFERENCES

Core EQ Innovator® is indicated for the vaccination of healthy horses against rabies, tetanus, West Nile, and Eastern and Western equine encephalomyelitis.

1. Data on file, Animalytix, Inc., Equine EIV Vaccines data June 2023.
2. American Association of Equine Practitioners. Equine Influenza Guidelines. Accessed January 7, 2025.
3. American Association of Equine Practitioners. Vaccination Guidelines. <https://aaep.org/guidelines/vaccination-guidelines>. Accessed January 7, 2025.
4. Zoetis Inc. Data on file, Study Report No. 14OREQBIO-1, Zoetis Inc.



ABOUT THE AUTHOR

Kevin Hankins, DVM, MS, MBA, is the Managing Equine Veterinarian at Zoetis. Previously, he served as head of equine field service at Kansas State University Veterinary Medical Teaching Hospital and led hospital outreach and student practice management programs. Receiving a Master of Veterinary Science and Doctor of Veterinary Medicine from Kansas State, Dr. Hankins also holds a Master of Business Administration from Colorado State University.

HAVE A QUESTION? EMAIL THE EDITOR

For more information, visit The Perfect Pair website.



FEEDING STRATEGIES

for the Insulin-Dysregulated Horse

B y P a u l B a s i l i o

Endocrinopathic laminitis is the most common form of clinical laminitis, and horses with insulin dysregulation (ID) are at a significantly higher risk for developing the potentially debilitating disease. While medical treatment has its place in the management of some horses, the most effective way to manage and prevent episodes of endocrinopathic laminitis is through precise nutrition.

In a healthy horse, resting insulin levels are typically less than 20 IU. When horses with ID are fed

a grain meal that produces postprandial hyperinsulinemia, they start to approach the proposed laminitic insulin threshold of around 200 to 300 IU.

“In practice, the threshold is different for each horse,” said **Erica L. Macon**, MS, PAS, PhD, during a presentation at the 70th AAEP Annual Convention in Orlando. “We want to try to limit postprandial hyperinsulinemia because we don’t yet understand how often insulin needs to be elevated” to raise the risk for endocrinopathic laminitis.

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Formulas

Information Needed

1. Horse's ideal bodyweight (BW)
2. Nonstructural Carbohydrates (NSC) % of Commercial Grain on a DryMatter (DM) basis
3. Feeding Rate for horse's ideal BW based on manufacturer's instructions
 - Examples: 1 lb. of concentrate/100 lbs. or 1100 – 1200 lbs. animal recommended feeding range 4 – 6 lbs. of concentrate

Steps

1. Convert horse's weight from pounds to kilograms.
 - $\frac{BW \text{ pounds}}{2.2} = BW \text{ (Kilograms)}$
2. Convert the total feeding rate (i.e., amount of feed horse would receive in a day) from pounds to kilograms, and then from kilograms to grams.
 - $\frac{\text{Feeding Rate Pounds}}{2.2} = \text{Feeding Rate (Kilograms)}$
 - $(\text{Feeding Rate Kg}) \times (1,000) = \text{Feeding Rate (Grams)}$
3. Ensure that NSC% is on a DM Basis. Pelleted concentrates are 95% DM. Textured concentrates are 90% DM.
 - $\frac{\text{As Fed \% NSC}}{\text{As Fed \% DM}} = \frac{(\% \text{ NSC on DM Basis})}{100\% \text{ DM}}$
4. Multiply the NSC DM basis $\left(\frac{\text{NSC\%}}{100} = \text{NSC DM Basis}\right)$ and the Feeding Rate (kilograms).
 - $(\% \text{ NSC DM}) \times (\text{Feeding Rate Grams}) = \text{Grams of NSC in Concentrate}$
5. Divide the grams of NSC in the concentrate (i.e., the full amount of NSC the horse will receive in a day from grain) by the animal's BW in kilograms. This will yield g NSC/kg BW and can be compared to recent research.
 - $\frac{\text{Grams of NSC in Concentrate}}{BW \text{ in Kilograms}} = \frac{g \text{ NSC}}{kg \text{ BW}}$

Formula to calculate NSC content of any equine feedstuff. Image courtesy of Dr. Erica L. Macon.

Current Research

Dr. Macon described a study in which she and her colleagues found that horses with ID had a reduced postprandial insulin response when fed a lower non-structural (NSC) feed (6% NSC), which led them to speculate that ID horses have a threshold for NSC from feeds.

During a follow-up study, they painstakingly developed diets with varying starch and sugar, also known as nonstructural carbohydrate (NSC), levels to identify that threshold. The feeds varied from 5.1% to 17.13% NSC (0.05 g/kg body weight [BW] to 0.19 g/kg BW), and they were fed at a rate of 1 g/kg of body weight.

The ID horses had higher insulin responses to all feedstuffs vs. healthy horses, as expected.

"We did learn a few things," said Dr. Macon, who is an assistant professor of equine science at Texas A&M University. "For example, ID horses have a lower threshold for starch when compared with sugar. That makes sense, since the horse actually doesn't produce a great amount of amylase."

This result also makes sense in the context of the horse's natural diet, which is mainly forage. The starch percentage of those diets is typically 1% to 2% at most.

The researchers also identified the threshold for total NSC at 0.1 g/kg BW—17 times lower than the threshold for healthy horses. "The caveat is that we used pure sources of sugar and starch, not something in a completely feed

matrix," she added. "The threshold might be slightly higher if it was included in a feed matrix."

She described another study in which ponies with ID were fed either soaked hay (10.9% NSC), dry hay (16.0% NSC), or haylage (18.5% NSC). Results showed that once the NSC concentration was above 10% to 11%, the ponies began to have marked insulin responses, according to a study in *The Veterinary Journal*.

Implementing Nutrition Strategies

Dr. Macon recommended veterinarians should calculate the NSC of a particular feed for ID horses or

ponies to determine just how much NSC the animal is getting with each feeding. If the NSC concentrations are above the 0.1 g/kg BW threshold, the feed can be split over multiple meals to avoid large fluctuations in postprandial insulin levels.

Nutrient content can vary from lot to lot of a specific feed. Owners can request lot-specific nutrient analyses from most manufacturers. In addition, Dr. Macon pointed out that not every low-NSC feed is actually low in NSC.

"You have to make sure that you go through and calculate the NSC regardless of what your client decides to feed their horse," she explained. "Make sure you're not going to exaggerate that postprandial response."

Even if a feed has a higher than advertised NSC concentration or exceeds the 0.1 g/kg BW threshold, there are still options, such as splitting a meal into thirds to spread out the insulin response.

"Low-NSC feeds are not all equal," she said. "They need to be calculated for each individual horse, and nutrition strategies should be implemented wherever possible."

Mechanical methods, such as slow-feeder buckets or grazing muzzles, can decrease feeding time and potentially blunt the postprandial insulin fluctuations.

"We need to have more research conducted in this area to see if that actually lowers insulin responses," Dr. Macon cautioned.

MeV

For more information:

Macon EL, Harris P, Bailey S, et al. Identifying possible thresholds for nonstructural carbohydrates in the insulin dysregulated horse. *Equine Vet J.* 2023;55(6):1069-1077. <https://pubmed.ncbi.nlm.nih.gov/36537847/>

Carslake HB, Argo CM, Pinchbeck GL, et al. Insulinaemic and glycaemic responses to three forages in ponies. *Vet J.* 2018;235:83-89. <https://pubmed.ncbi.nlm.nih.gov/29704944/>

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• Approved by FDA under NADA # 141-123

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• GASTROGARD (omeprazole) Paste for horses contains 37% w/w omeprazole and is available in an adjustable-dose syringe. Each syringe contains 2.28g of omeprazole. Syringes are calibrated according to body weight.

Indications

• For treatment and prevention of recurrence of gastric ulcers in horses and foals 4 weeks of age and older.

Dosage Regimen

• For treatment of gastric ulcers, GASTROGARD should be administered orally once-a-day for 4 weeks at the recommended dosage of 1.8 mg omeprazole/lb body weight (4 mg/kg). For the prevention of recurrence of gastric ulcers, continue treatment for at least an additional 4 weeks by administering GASTROGARD at the recommended daily maintenance dose of 0.9 mg/lb (2 mg/kg).

Directions For Use

• GASTROGARD for horses is recommended for use in horses and foals 4 weeks of age and older. The contents of one syringe will dose a 1250 lb (568 kg) horse at the rate of 1.8 mg omeprazole/lb body weight (4 mg/kg). For treatment of gastric ulcers, each syringe marking on the syringe plunger will deliver sufficient omeprazole to treat 250 lb (114 kg) body weight. For prevention of recurrence of gastric ulcers, each weight marking will deliver sufficient omeprazole to dose 500 lb (227 kg) body weight.

• To deliver GASTROGARD at the treatment dose rate of 1.8 mg omeprazole/lb body weight (4 mg/kg), set the syringe plunger to the appropriate weight marking according to the horse's weight in pounds.

• To deliver GASTROGARD at the dose rate of 0.9 mg/lb (2 mg/kg) to prevent recurrence of ulcers, set the syringe plunger to the weight marking corresponding to half of the horse's weight in pounds.

• If, after dosing, the syringe is not completely empty, it may be reused on following days until emptied. Replace the cap after each use.

Warning

• Do not use in horses intended for human consumption. Keep this and all drugs out of the reach of children. In case of ingestion, contact a physician. Physicians may contact a poison control center for advice concerning accidental ingestion.

• The safety of GASTROGARD has not been determined in pregnant or lactating mares.

Adverse Reactions

• In efficacy trials, when the drug was administered at 1.8 mg omeprazole/lb (4 mg/kg) body weight daily for 28 days and 0.9 mg omeprazole/lb (2 mg/kg) body weight daily for 30 additional days, no adverse reactions were observed.

• To report suspected adverse drug events, for technical assistance, or to obtain a copy of the Safety Data Sheet (SDS), contact Boehringer Ingelheim Animal Health USA Inc. at 1-888-637-4251. For additional information about adverse drug experience reporting for animal drugs, contact FDA at 1-888-FDA-VETS, or online at www.fda.gov/reportanimalae.

Efficacy

• **Dose Confirmation:** GASTROGARD, administered to provide omeprazole at 1.8 mg/lb (4 mg/kg) daily for 28 days, effectively healed or reduced the severity of gastric ulcers in 92% of omeprazole-treated horses. In comparison, 32% of controls exhibited healed or less severe ulcers. Horses enrolled in this study were healthy animals confirmed to have gastric ulcers by gastroscopy. Subsequent daily administration of GASTROGARD to provide omeprazole at 0.9 mg/lb (2 mg/kg) for 30 days prevented recurrence of gastric ulcers in 84% of treated horses, whereas ulcers recurred or became more severe in horses removed from omeprazole treatment.

• **Clinical Field Trials:** GASTROGARD administered at 1.8 mg/lb (4 mg/kg) daily for 28 days healed or reduced the severity of gastric ulcers in 99% of omeprazole-treated horses. In comparison, 32.4% of control horses had healed ulcers or ulcers which were reduced in severity. These trials included horses of various breeds and under different management conditions, and included horses in race or show training, pleasure horses, and foals as young as one month. Horses enrolled in the efficacy trials were healthy animals confirmed to have gastric ulcers by gastroscopy. In these field trials, horses readily accepted GASTROGARD. There were no drug related adverse reactions. In the clinical trials, GASTROGARD was used concomitantly with other therapies, which included: anthelmintics, antibiotics, non-steroidal and steroidal anti-inflammatory agents, diuretics, tranquilizers and vaccines.

Management Considerations:

Safety

• GASTROGARD was well tolerated in the following controlled efficacy and safety studies.

• In field trials involving 139 horses, including foals as young as one month of age, no adverse reactions attributable to omeprazole treatment were noted.

• In a placebo controlled adult horse safety study, horses received 20 mg/kg/day omeprazole (5x the recommended dose) for 90 days. No treatment related adverse effects were observed.

• In a placebo controlled tolerance study, adult horses were treated with GASTROGARD at a dosage of 40 mg/kg/day (10x the recommended dose) for 21 days. No treatment related adverse effects were observed.

• A placebo controlled foal safety study evaluated the safety of omeprazole at doses of 4, 12 or 20 mg/kg (1, 3 or 5x) once daily for 91 days. Foals ranged in age from 66 to 110 days at study initiation. Gamma glutamyltransferase (GGT) levels were significantly elevated in horses treated at exaggerated doses of 20 mg/kg (5x the recommended dose).

Reproductive Safety

• In a male reproductive safety study, 10 stallions received GASTROGARD at 12 mg/kg/day (3x the recommended dose) for 70 days. No treatment related adverse effects on semen quality or breeding behavior were observed. A safety study in breeding mares has not been conducted.

For More Information

• Please call 1-888-637-4251.

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Rev. 07-2020

Reference: Product Insert 147528-002

Revised 05/2019



Nucleotide Supplementation May Reduce Diarrhea in Foals

Supplementing a newborn foal's diet with nucleotides reduced the number of days they experienced diarrhea and increased volatile fatty acids, but researchers saw no clear differences in the fecal microbial communities between the foals who received supplementation and those who did not.

Diarrhea is a common experience for young foals. Researchers from Italy wanted to know whether nucleotide supplementation in the form of an oral paste would make a difference because these

arrhea incidence, systemic immunity, intestinal microbiota and volatile fatty acid production in 30 newborn Standardbreds from 3 different premises.

One group received the paste, while the other group received a placebo. They collected fecal and blood samples on days 1 and 35 after birth.

The group that received supplement showed a lower relative frequency in the number of days the animals had diarrhea (6.12% vs 13.33%; $P < 0.001$), greater weight gain compared with the control

group (50.3 ± 5.65 kg vs 44.0 ± 8.65 kg; $P < 0.05$), as well as higher levels of total volatile fatty acids than the group that was not supplemented.

"This outcome may explain an earlier establishment of a gut microbiota in the foals of the [nucleotide supplementation] group that was closer to that typical of an adult horse, characterized by predominant fibrolytic populations. Volatile fatty acid production (especially butyric acid) has also been shown to correlate with the intestinal well-being of the horse, supporting the use of dietary nucleotide supplements for improved health and well-being in newborn foals," the researchers wrote.

However, they found no statistical differences in im-

munity shown by measuring the cytokines (TNF- α , IFN- γ , IL-6, IL-12) or in fecal calprotectin levels between the 2 groups.

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There was no difference in the fecal microbial communities between supplemented foals and those that did not receive supplements.



Shutterstock/Eric Iselle

"semi-essential nutrients" affect rapidly proliferating tissues. Cells have a limited capacity to synthesize these compounds, the researchers wrote. They looked at di-

For more information:

Penazzi L, Pagliara E, Nervo T, et al. Dietary supplementation of new-born foals with free nucleotides positively affects neonatal diarrhoea management. *Ir Vet J*. 2025;78(1):7. doi: 10.1186/s13620-025-00294-3.

<https://irishvetjournal.biomedcentral.com/articles/10.1186/s13620-025-00294-3>

Earlier Detection of EIV

By Adam Marcus

A new study shows equine influenza virus (EIV) can be detected in the air around infected horses, even before the animals appear sick.

“I believe that regular air sampling and testing of air samples will enable early detection of infectious diseases” in horses, said **Manabu Nemoto**, DVM, PhD, of the Equine Research Institute at the Japan Racing Association, in Tochigi, who led the study. “This technology is not widely used in the Japanese equine industry, so I hope that air sampling will be useful as a new technology for infectious disease control in the future,” added Dr. Nemoto, who also is an expert at the World Organisation for Animal Health Reference Laboratory for Equine Influenza.

For the study, Dr. Nemoto and his colleagues infected 2 horses—housed in separate stalls—with EIV, then collected air samples for the next 13 days using the AerosolSense Sampler (Thermo Fisher Scientific). The machine can detect a range of animal and human viruses, including influenza, SARS-Cov-2, the cause of COVID-19, and respiratory syncytial virus. The test also can be paired with polymerase chain reaction (PCR) testing to identify genetic material in samples.

According to Dr. Nemoto’s group, EIV RNA turned up in 26 of 28 aerosol samples between day 1 and day 13 of the study, demonstrating the infected horses shed detectable amounts of virus even when they did not exhibit clinical signs of infection.

The researchers also used a less sophisticated rapid test, which can return a result in 30 minutes through real-time PCR, to look for EIV. Again, the virus was readily apparent, showing up in 23 of 28 tests across the study period.

“These findings confirm that horses infected with EIV shed the virus into the air,” the researchers reported. “Air sampling is safe for humans and horses and avoids the potential for injury when nasopharyngeal swabs need to be collected from untrained or aggressive horses.”

Dr. Nemoto acknowledged the presence of viral DNA in an air sample does not necessarily mean an animal is sick. “It depends on the stages of infection. Viruses detected in the early stages of infection are



Being able to sample and test air samples could result in earlier detection of equine infectious diseases.

linked to clinical signs, whereas viruses in the late stages of infection are not,” he said. “The air sampler can detect inactivated viruses that are not associated with clinical signs, especially in the late stages of infection.”

Dr. Nemoto said the air sampler also can detect viral genes from environmental surfaces in the stalls, rather from aerosols shed directly by the horses. “This means that, for accurate evaluation, environmental surfaces in the stalls must be cleaned and disinfected before using the air sampler,” he said.

MeV

For more information:

Nemoto M, Kawanishi N, Kambayashi Y. Detection of equine influenza virus gene in the air around infected horses. *Vet Microbiol.* 2025;302:110388 <https://doi.org/10.1016/j.vetmic.2025.110388>

<https://www.sciencedirect.com/science/article/abs/pii/S0378113525000239>



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¹ Data on file.

² Adequan® i.m. Package Insert, Rev 1/19.

³ Burba DJ, Collier MA, DeBault LE, Hanson-Painton O, Thompson HC, Holder CL: In vivo kinetic study on uptake and distribution of intramuscular tritium-labeled polysulfated glycosaminoglycan in equine body fluid compartments and articular cartilage in an osteochondral defect model. *J Equine Vet Sci* 1993; 13: 696-703.

⁴ Kim DY, Taylor HW, Moore RM, Paulsen DB, Cho DY. Articular chondrocyte apoptosis in equine osteoarthritis. *The Veterinary Journal* 2003; 166: 52-57.

⁵ McIlwraith CW, Frisbie DD, Kawcak CE, van Weeren PR. Joint Disease in the Horse. St. Louis, MO: Elsevier, 2016; 33-48.

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Repeat EHV-1 Immunization MAY PREVENT INFECTION

Equine herpesvirus 1 (EHV-1) is a highly contagious, highly prevalent virus that causes disease worldwide. Although the virus causes mostly mild disease, severe disease is possible, and ongoing outbreaks have the potential to have a high economic impact.

New research presented by **Bettina Wagner, DVM,**

Dr med Habil, a professor of immunology at Cornell University, shows that repeated intramuscular (IM) administration of an EHV-1 vaccine can induce EHV-1-specific mucosal antibodies to effectively prevent infection and disease, as well as reduce nasal shedding and cell-associated viremia.

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1. Zycosan[®] Freedom of Information Summary NADA 141-559

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Background

EHV-1 enters the horse through the upper respiratory tract, where it spreads to regional lymph nodes. From there, it establishes leukocyte-associated viremia in the peripheral blood.

“It can stop there and only cause fever and respiratory signs,” Dr. Wagner said during a presentation at the 2024 ACVIM Forum in Minneapolis. “But in some cases, the virus can spread to the vascular endothelial cells, where it can then go to the pregnant uterus or to the CNS to establish more severe forms of EHV-1.”

Control of the leukocyte-associated viremia is therefore seen as 1 of the key parameters for protecting horses against the virus. In the past, this has been established mainly by peripheral T-cell immunity, but recent research has shown that local mucosal immunity in the upper respiratory tract can provide protective immunity against severe outcomes.

Dr. Wagner said that mucosal antibodies (mucAbs) can neutralize EHV-1 and prevent repli-

Controlling the leukocyte-associated viremia in horses with EHV-1 is a key parameter for protecting horses.

cation in the upper respiratory tract. When horses are protected, they only show low or no viral replication in the upper respiratory tract, and they show low or no cell-associated viremia, which prevents severe outcomes. In addition, recent research has shown that an intranasal modified-live vaccine resulted in no mucosal antibodies.

The Study

Dr. Wagner and her colleagues designed a longitudinal vaccination study to test 2 hypotheses: IM EHV-1 vaccination will result in both systemic and mucAbs, and frequent vaccination will not increase antibodies beyond certain concentrations.

A total of 14 adult Icelandic research horses (10 mares and 5 geldings) with prior EVH-1 exposure were enrolled. They were divided into 2 groups, depending on whether they had been experimentally infected or whether they had been vaccinated. On average, each horse had their last exposure between 1 and 2 years before the study.

Zycosan®

(pentosan polysulfate sodium injection)

250 mg/mL

For intramuscular use in horses only.

Brief Summary (For Full Prescribing Information, see package insert)

CAUTION: Federal law restricts this drug to use by or on the order of a licensed veterinarian.

DESCRIPTION: Zycosan contains pentosan polysulfate sodium, a semi-synthetic polysulfated xylan.

It is a pale yellow to brownish yellow, clear, sterile solution.

INDICATION: For the control of clinical signs associated with osteoarthritis in horses.

CONTRAINDICATIONS: Horses with hypersensitivity to pentosan polysulfate sodium or any of the inactive ingredients in Zycosan should not receive Zycosan. Do not use Zycosan concurrently with other anticoagulant drugs. Do not use in horses with clotting disorders or within 24 hours of surgical procedures (see Warnings and Precautions).

WARNINGS AND PRECAUTIONS:

User Safety Warnings: Not for use in humans. Keep out of reach of children. Pentosan polysulfate sodium is a weak anticoagulant. Caution should be used when administering Zycosan if you are taking an anticoagulant. **In case of accidental self-injection, seek immediate medical attention. If product comes into contact with skin, rinse skin thoroughly with water and seek medical attention if needed.** To obtain a Safety Data Sheet (SDS), contact Dechra at (866) 933-2472.

Animal Safety Warnings and Precautions:

Zycosan has been shown to prolong coagulation parameters up to 24 hours after injection, therefore caution should be used when administering this drug before or after strenuous activities (see Target Animal Safety). Due to the anticoagulant effects, this drug may exacerbate Exercise Induced Pulmonary Hemorrhage (EIPH).

The concurrent use of NSAIDs with Zycosan has not been evaluated. Due to the anticoagulant effects of Zycosan and known anticoagulant effects of some NSAIDs, caution should be used if NSAIDs are concurrently administered. Horses concurrently treated with Zycosan and NSAIDs should be monitored for hemorrhage or other clinical signs of abnormal bleeding (e.g., petechiae, ecchymosis, or epistaxis). The safety of long-term repeat use of Zycosan has not been evaluated. Pigmentary changes in the retina (pigmentary maculopathy) have been reported in human patients following long-term oral use of pentosan polysulfate sodium. It is not known if a similar finding occurs in horses. The safe use of Zycosan has not been evaluated in breeding, pregnant, or lactating horses.

Other Warnings:

Do not use in horses intended for human consumption.

ADVERSE REACTIONS:

Injection site reactions were the most frequently reported adverse reactions in the field study. Injection site reactions were associated with clinicopathology changes in some cases. Other adverse reactions reported in more than one horse were prolongation of coagulation parameters (activated partial thromboplastin time (aPTT) and prothrombin time (PT)), lethargy, behavior changes, and colic.

To report suspected adverse events, for technical assistance or to obtain a copy of the Safety Data Sheet (SDS), contact Dechra at (866) 933-2472. For additional information about adverse drug experience reporting for animal drugs, contact FDA at 1-888-FDA-VETS or online at <http://www.fda.gov/reportanimalae>.

STORAGE CONDITIONS: Store at room temperature 68–77°F (20–25°C), with excursions to 59–86°F (15–30°C).

MANUFACTURED FOR:

Dechra Veterinary Products
7015 College Boulevard, Suite 525
Overland Park, KS 66211 USA

Approved by FDA under NADA # 141-559

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Each horse received a dose of the EHV-1 vaccine (Calvenza, Boehringer Ingelheim Animal Health) at days 0 and 22, and at 2, 3, 6, and 8 months. Baseline blood samples showed that each horse had an existing protective antibody response. Nasal swab and serum samples were obtained at different times and tested for EHV-1-specific antibodies as part of the EHV-1 risk evaluation assay from Cornell. They also focused on immunoglobulin G (IgG) 4/7, which has been shown to neutralize EHV-1.

EHV-1 antibodies increased in all horses after the second vaccination at 22 days, after which they hit a plateau.

“In horses with pre-existing immunity, you can only do so much,” Dr. Wagner said.

For mucAbs, however, the results were a bit different. All horses had existing mucosal immunity, and mucAbs increased after each vaccination, with the exception of 1. Significant antibody increases were seen at 6, 9 and 10 months compared with baseline, which confirmed that IM vaccination provokes mucAbs at the upper respiratory tract.

“If you vaccinate a horse intramuscularly, that provokes an activation of the B-cell memory response at the regional lymph nodes,” Dr. Wagner explained. “They have memory cells that are activated, and within 3 to 5 days we see antibody-secreting cells

in the peripheral blood.”

Those are called plasmablasts, and they typically travel to the bone marrow, where they reside as plasma cells.

“One hypothesis is that a large number of antibodies circulate in the periphery and go on to the respiratory mucosa via some mechanism that we don’t know about,” she said. “The second hypothesis is that those plasmablasts not only reside in the bone marrow but that they can also reside in the respiratory mucosa and provide the local antibodies that we see in our study.”

Dr. Wagner noted that the dosing schedule used in the study is not recommended by the manufacturer.

“It is likely that [intramuscular] vaccines that induce EHV-1-specific mucosal antibodies effectively prevent infection and disease, and also reduce nasal shedding and cell-associated viremia,” she said. “Of course, individual vaccine formulations may differ in their ability to induce mucosal antibodies, and especially IgG 4/7.”

MeV

Dr. Wagner is the director of Serology/Immunology at the Animal Health Diagnostic Center at Cornell University. This study was funded by the Harry M. Zweig Memorial Fund for Equine Research.

A Softer Approach to Jump Racing Could Save Lives

A recent study found that racing horses on softer ground may decrease fatalities among horses that jump race.

About 35% of races held in Great Britain are jump races, according to the researchers. The risk for fatalities occurring is higher during jump racing than it is racing on a flat surface. From 2000 to 2009, the estimated fatality rate for steeplechase starts was 6.2 deaths per 1,000 starts; and for hurdles, it was 4.6 deaths per 1,000 starts. By comparison, the risk for flat racing in Britain between 2000 and 2013 was 0.8 deaths per 1,000 starts.

For jump racers, fatalities were more common after a catastrophic musculoskeletal injury.

In this retrospective cohort study, the researchers wanted to update the risk for fatalities, as well as describe factors that could increase that risk.

They analyzed jump racing starts in Great Britain from January 2010 until April 2023, collating all available information for each horse, the race, racecourse,

trainer and jockey, as well as the medical details of all recorded fatalities in a central database. They defined a death as any sudden death after starting or euthanasia that resulted 48 hours after racing. They analyzed steeplechase and hurdle starts separately.

The overall fatality rate was 5.9 per 1,000 steeplechase starts and 4.5 per 1,000 hurdle starts. In both types of racing they found that horses that stumbled and fell as well as older horses had higher risks for death (falls: steeplechase: OR 28.7, 95% CI 23.0–35.8; hurdle: OR 41.4, 95% CI 32.9–52.0) (age: steeplechase: OR 1.1 per extra year, 95% CI 1.1–1.2; hurdle: OR 1.2 per extra year, 95% CI 1.1–1.2). They also found that steeplechase starts during the summer and by horses that were not trained in Great Britain experienced higher odds of fatalities. In hurdling, horses racing for the first time had higher odds of fatality.

“In both race types, softer going decreased the odds of fatality,” they wrote.

MeV

For more information:

Allen SE, Taylor S, Given J, et al. Risk factors for fatality in jump racing Thoroughbreds in Great Britain (2010–2023). 2024 Dec 12. *Equine Vet J*. <https://beva.onlinelibrary.wiley.com/doi/10.1111/evj.14450>

Do You Know What That Horse Thinks?

By Adam Marcus

Getting inside a horse's mind is the key to better veterinary care, said **Antonia J.Z. Henderson**, PhD, a research and equine psychologist in Fort Langley, B.C., Canada. *Modern Equine Vet* spoke with Dr. Henderson about the state of science in equine cognition and how veterinarians can apply the latest principles in their practice.

MEV: How can equine veterinarians incorporate positive reinforcement techniques into their routine medical procedures to improve compliance and reduce stress for their patients?

Dr. Henderson: Most veterinarian procedures could run more smoothly and safely if all equine clients had some positive reinforcement (PR) training—where responses that are desired, such as remaining calm, standing still or placing a foot on a block for a radiograph, are immediately rewarded, making them more likely to occur in the future. However, these responses need to be trained over time through shaping—rewarding closer and closer approximations of the target behavior—such as standing still for 1 second, then 2 seconds, then 3, and so on—and thus, don't always lend themselves to practitioner visits, which are (hopefully) infrequent and often under time constraints.

What equine veterinarians can do is demonstrate how calm behavior might be trained with PR and then encourage their clients to practice in between visits. There is a wealth of information on equine PR training. Shawna Karrasch is an engaging and accessible resource—with podcasts, videos, articles and courses—and her knowledge is grounded in sound psychological science.

Horses, like humans and dogs, and even goldfish, also learn by association, or classical conditioning.



so it behooves equine practitioners to make sure that their arrival is associated with good things. Play Santa Claus by plying on the treats from arrival and throughout procedures, and equine clients will soon learn that veterinarians rock. Owners are often concerned that horses become nippy and aggressive when fed treats by hand, but this is only true if they are rewarded for doing so. Practitioners can ensure the first lesson is that treats only happen when the horse moves their head away from—even if that requires a small push rather than toward Santa.

MEV: What are the most common misconceptions horse owners have about equine cognition, and how can veterinarians help educate them for better welfare and training outcomes?

Dr. Henderson: The misconceptions that work out badly for horses is our tendency to either underestimate or overestimate their cognitive abilities.

We underestimate them when we measure our horse's cognitive intelligence by how closely it matches our own. Horses, as a prey species, have developed cognitive abilities crucial to their survival that are much less relevant to us, and often dismissed as stupidity (e.g., neophobia—or fear of new spaces and situations, a hair-trigger flight response and greater sensitivity to olfactory and auditory cues well outside of our range. It turns out that horses often do know something we don't know!)

We overestimate their cognitive abilities when we believe that our horses know what we want, should want the same things and are being spiteful when they don't comply. We fail to consider that horses do not comply for numerous and varied physiological and psychological reasons that have nothing to do with malevolence; they are physically or psychologically incapable of performing the behavior, they are in pain, depressed or lonely, they don't understand the question because the rider's aids are conflicting and inconsistent, they are distracted by other stressors in the environment, and so on. It is on our watch to see the world from a horse's perspective, to dig deeper, and to try to figure out what they are trying to tell us.

MEV: How does environmental enrichment affect a horse's cognitive abilities and overall welfare, and what practical steps can owners take to enhance their horse's living conditions? For example, recent studies seem to show that horses given even 1 or 2 hours a day to socialize are better behaved and even appear to be more "optimistic."

Dr. Henderson: The ubiquitous industry norm of individual housing, with no tactile contact with conspe-

cifics, has an enormous deleterious impact on equine welfare, which then necessarily compromises psychological state, cognition, learning ability, performance and almost every other aspect of the horse-to-human interface. Horses living in an enriched environment (which is actually not "enriched" but merely natural, i.e., allowing horses to live with other horses with free access to movement and forage) have been found to be calmer, less fearful, less reactive to novel objects, less touchy, are more responsive and interactive with humans, are more optimistic, have greater curiosity and are more adaptable, accurate and speedier in learning tasks than horses living in traditional stabling.

Also, the purported advantages of individual housing, that it keeps horses safe and less "herd-bound" (as if horses are not supposed to be bound to their herd), are not born out in the research. Contrary to popular wisdom, individually housed horses sustain more injuries in their lower limbs, show higher incidence of lameness and sustain greater incidents of tendon, joint and health problems than do group-housed horses. Furthermore, group-housed horses are less likely to suffer separation anxiety when temporarily removed from their friends and are better able to handle the short-term confinement and isolation of horse shows.

Although there is ample research indicating the wealth of positive benefits and virtually no downside to herd living (even for high-performance top breeding stallions! Yes, I said stallions!), if owners, trainers and managers are still reluctant to turn horses out together, horses will still benefit from the opportunity for tactile contact between compatible neighbors. For example, where traditional stalls were modified to create "social stalls" to enabling stallions (yes, stallions) to interact and groom one another, Zollinger and colleagues (2023) found that horses sustained only minor and insignificant injuries and reaped enormous welfare benefits.

Also, the practice of feeding forage that is high in quality and necessarily low in quantity leaves horses vulnerable to EGUS [equine gastric ulcer syndrome] and exacerbates their compromised isolated life. The claim that horses will become obese if fed ad libitum has been based more on traditional horse "wisdom" than science. A study of 56 high-performance horses in training still maintained an optimal body condition score when fed a free forage diet. For horses that are less active, there are many high-fiber, low-sugar forages that require longer chewing time and are less likely to contribute to obesity. Horses who have lived with rationed forage will initially consume a large quantity of hay when given the opportunity. However, most horses will self-regulate once they learn that food is always available, particularly if the forage is stalkier and less delicious.

We need to foster a sea change in how we house and manage horses—sport horses in particular—as the ubiquitous industry norm of individual housing with limited foraging and movement opportunities is a system that works very well for humans and not at all for horses. Romane Phelipon et al. (2024) demonstrated that elite equine high-performance athletes, when provided with free access to forage, social interaction with conspecifics and turn-out time (coined by Lauren Fraser as the three Fs of Friends, Forage and Freedom), can live enhanced, enriched, safe and healthy lives, still win Olympic medals, and score higher on all welfare indicators when compared with singly housed sport horses. A plethora of research supports the notion that solitary confinement is as egregious for horses as it is for people, and we have recently come to believe that for people it is a punishment too appalling to be borne. The good news is that relatively modest environmental and management changes and letting go of some traditional beliefs about what keeps horses safe and happy can make a monumental difference to horses' physiological and psychological well-being.

MEV: Are there specific handling techniques or interventions veterinarians can use to help horses with past traumatic experiences overcome learned helplessness or fear behaviors?

Dr. Henderson: Unlike most of the behaviors we train horses to perform that require numerous repetitions to learn, fear responses can be learned in a single trial, and once learned can never be eliminated. Fear responses can emerge randomly and unpredictably in what learning theorists call spontaneous recovery. For this reason, it is wise to avoid eliciting fear responses at all costs; veterinarians might sometimes need to abandon a procedure before fear responses escalate until a later visit where more homework with the owner can ensure a seamless intervention.

Bringing owners on board to work with horses in between visits is critical to rewriting the horse's story about scary events. Fear responses can be suppressed by building new neural networks through a new reinforcement history. Take for example the horse who is dangerously needle shy. This may have arisen from a trauma or more probably because the horse learned that evasive behaviors got rid of the syringe and more dramatic evasions got rid of it even more efficiently. Owners could work with their horse with a clicker (to mark exactly the behavior they want—in this case calmness) to first simply approach the horse and touch the shoulder; when the horse is non-reactive, remove the hand, click and reward. Next, the owner could take a slight pinch of skin

and when the horse is relaxed, release, click and reward. In each step the owner builds the criteria (a slightly harder pinch, a longer pinch, a pinch and touch with a needleless syringe, pressure with the syringe, poking with the syringe, and so on) and always clicking and immediately rewarding when the horse is relaxed. If things look like they might go south, simply back up the sequence to where the horse was calm and build again. The horse is rewarded through positive reinforcement (with the click and reward) and through negative reinforcement (or pressure and release, because the horse learns that they can make the unpleasant syringe go away by standing quietly). When the vet comes, they can go through the same sequence and safely inject the horse because the horse has learned that the discomfort of an injection is short lived and worth the return on investment of a tasty treat jackpot. Equine practitioner Gemma Pearson has created several short videos entitled "Don't break your vet" that illustrate how owners and veterinarians can turn dangerous behaviors around. Miracles can happen in less than 6 minutes with good timing and good treats.

Learned helplessness occurs when animals, including us, face unpredictable and uncontrollable stressors, and learn that no behavior or strategy can impact their dire consequences; they disengage and simply give up trying. Since horses are evolutionarily hard-wired to be stoic (it doesn't pay to show your infirmities when you could be the next predator's dinner) their suffering is often not obvious even to conscientious owners. Learned helplessness can occur through bad management (e.g., horses living in social isolation finally withdraw and disengage from humans, other horses, and their surrounding environment), bad training (e.g. where a rider imposes conflicting aids such that no response alleviates pressure) or both. Since the passive attitude and flat affect characteristic of learned was often what is desirable in many equine disciplines (think bomb-proof school horse, the "quiet" show hunter or the peanut-rolling Western pleasure horse) this state may not only be overlooked but actively pursued. Learned helplessness can be ameliorated (although not always and not immediately) when conditions improve and a horse rediscovers that events are predictable and their behavioral choices offer them a modicum of control over outcomes.

MEV: What are the ethical implications of modern training and management practices considering what we now understand about equine cognition and emotional states?

Dr. Henderson: Much of the focus questioning equestrian sport's social license to operate has zeroed in on

the competition arena (bits, noseband pressures, head positions, whip use, etc.) because this is what the public sees. Certainly, enormous changes need to occur here to ensure that the horse always comes first. The horse, unlike other athletes on the podium, is not a voluntary participant. But we need to go further. We need to bring learning science into horse training. Although there are great coaches who train horses fairly, effectively and compassionately without a shred of learning science knowledge, bringing learning theory fundamentals into requirements for all trainer certifications would go a long way towards improving equine welfare. Without learning science, we are much more likely to view horses' both undesirable and desirable behaviors as something intrinsic to the horse's personality, character and willingness (or lack thereof) to please their owner and so can feel justified in punishing them when they do not comply. With learning science, we understand that horses, like people, do what works and cease doing what doesn't work. Although learning theorists make the science a great deal more complicated, the basic message of operant conditioning really is that simple.

Equally critically, we need to address how we house and manage sport horses. Our practices have become so normalized and our horses' anguish so invisible that owners and industry professionals often do not see, or cannot allow themselves to see, their

horses' suffering. In one study, caretakers reported that 5% of the horses in their care exhibited stereotypes such as cribbing, weaving, stall-walking, etc., but on-site researchers recorded 37% of horses with stereotypical behavior.

Not only do our current practices have a negative impact on a horse's cognitive abilities and their training progress but it deprives them of what researchers have termed an ethological need. (i.e., the animal is highly motivated to perform the behavior, the behavior is self-rewarding, preventing the behavior results in a rebound—performed for longer duration and more intensely after prevention, and suppressing the behavior results in chronic stress). Researchers have identified that social contact and mutual grooming, play, free movement and free access to roughage constitute fundamental basic or ethological needs in horses; when not met, it results in severe negative welfare consequences.

Training and management practices have come to be not because they are the best practices but because they are the most common practices. We have a wealth of equine and equitation science informing us of what horses need to not only survive but to thrive. Equine veterinarians, who have the respect of their clients and are thus well positioned to nudge the welfare needle, can be a valuable bridge to bringing this science back to the stable.

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Additional Resources

Looking for more information about this topic, check out these studies:

Briefer Freymond S, Briefer EF, Von Niederhäusern R, et al. Pattern of social interactions after group integration: a possibility to keep stallions in group. *PLoS One*. 2013;8(1):e54688. <https://doi.org/10.1371/journal.pone.0054688>

Flamand A, Zellenka C, Mos J, et al. Neigh-bours: Why every young horse needs good friends. A pilot study during the breaking-in period. *Appl Anim Behav Sci*. 2024;272. <https://doi.org/10.1016/j.applanim.2024.106190>

Giupana R, Diugan EA, Spinu M, et al. The effect of management practices on the welfare score of breeding horses. *J Biotechnol*. 2017;256 (Supplement), S51. <https://doi.org/10.1016/j.jbiotec.2017.06.970>

Krueger K, Esch L, Farmer K, et al. (2021). Basic needs in horses. A literature review. *Animals*. 2021;11(6). <https://www.mdpi.com/2076-2615/11/6/1798>

Lansade L, Valençon M, Foury A, et al. (2014). Behavioral and transcriptomic fingerprints of an enriched environment in horses (*equus caballus*). *PLoS ONE*. 2014;9(12):1-19. <https://doi.org/10.1371/journal.pone.0114384>

Phelipon R, Hennes N, Ruet A, et al. Forage, freedom of movement, and social interactions remain essential fundamentals for the welfare of high-level sport horses. *Front Vet Sci*. 2024;11:1504116. <https://www.frontiersin.org/journals/veterinary-science/articles/10.3389/fvets.2024.1504116/full>

Popescu S, Lazar EA, Borda C, et al. Welfare quality of breeding horses under different housing conditions. *Animals*. 2019;3(3):81. <https://www.mdpi.com/2076-2615/9/3/81>

Sanmartín Sánchez L, Blanco-Penedo I, Perea Muñoz JM. Welfare assessment at a Spanish army equine breeding centre. *Italian J Anim Sci*. 2020;19(1), 137–146. <https://www.tandfonline.com/doi/full/10.1080/1828051X.2019.1706433>

Zollinger, A., Wyss, C., Bardou, D., & Bachmann, I. (2023). Social box: A new housing system increases social interactions among stallions. *Animals*. 2023;13:8. <https://www.mdpi.com/2076-2615/13/8/1408>

VET Stats

Owners Experience Barriers to Exercise

UK researchers did a study to explore 804 owners' thoughts about their horse's weight and the importance of exercise for their animals.

About the respondents:

98%
FEMALE

83.3%
LEISURE
OWNERS

89.3%
>10 YEARS
INVOLVEMENT WITH
HORSES

4.5%
FIRST-TIME
OWNERS

61.2% report horses gained weight easily

39.1% report horses were overweight or obese, but only **12.6%** had been diagnosed as such

BARRIERS REPORTED (PEOPLE COULD CHOOSE UP TO 3):

90%

barriers limit their opportunities to exercise their horse.

Access to areas to exercise: **35.3%**

Had people to ride with: **12.4%**

Time: **54%**

Weather: **68.4%**

Horse's age: **16.4%**

Horse's health/soundness: **19.8%**

Horse's behavior: **8.1%**

Rider health: **11.6%**

Rider confidence or skill: **6.6%**

Desire to ride the horse: **21.3%**

FOR MORE VET STATS, CHECK OUT OUR WEBSITE AT
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