

HORSE HEALTH

This horse health resource sheet is produced by the Western College of Veterinary Medicine's Equine Health Research Fund (EHRF).

With grassroots support from Western Canada's horse industry, the EHRF conducts vital horse health research, trains graduate students in specialized areas of horse health, provides a summer research program for veterinary students, and promotes awareness of horse health care and management among western Canadian horseowners.

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Monensin and Horses Don't Mix

For most cattle ranchers and poultry producers, *monensin* (also known by its trade name, *Rumensin*) is part of the daily routine on their farms. Monensin has been used for years as a growth-enhancing feed additive for beef and dairy cattle and poultry in Canada and the United States. It also helps to control a parasitic disease called *coccidiosis* that primarily affects poultry and cattle to a lesser scale. Cattle and poultry can ingest relatively high levels of monensin in their feed without any negative impact on their health. But for horses, it's a different story.

"Cattle can tolerate 20 milligrams (mg) per kilogram (kg), body weight, of monensin in their feed rations without any problems whereas the toxic dose in horses is about 2.0 mg of monensin per kg, body weight. That's about the same as a toxic dose of cyanide so it's pretty toxic stuff," explains veterinary toxicologist Dr. Barry Blakley. "Any time a horse gets exposed to monensin, it's a problem."

A familiar poison

Blakley, whose toxicology laboratory in Prairie Diagnostic Services at the Western College of Veterinary Medicine (WCVN) serves all four western provinces, usually receives calls about monensin poisonings in horses at least once or twice a month.

"Obviously some veterinarians don't call: they just go ahead and treat the case as they see fit. So there are probably a lot more cases of monensin poisoning that we just don't hear about."

Monensin is an *ionophore* — a chemical that affects the transport of ions in the various cell membranes. This ability makes monensin capable of controlling the parasite *coccidia* in chickens and other animals, but it also makes it deadly for horses. While it does affect many systems, its main impact is on the animal's muscles — especially the heart.

In a healthy horse, natural ion fluxes of sodium and potassium allow for the contractility of the heart. Monensin disrupts those ion fluxes, causing the horse's heart to work improperly and leading to eventual cardiovascular collapse.

Why is monensin so toxic to horses in comparison to other livestock? Scientists still don't know the exact reason, but the feed industry has been aware of monensin's devastating effect on horses since it was first introduced as a feed additive in the mid-1970s.

While it's illegal to mix monensin in any horse rations, Blakley says accidental poisonings occur when there's a mixing error at a feed mill. "In these cases, we usually ask, 'What feed did you mix right before producing horse feed?' If the plant made cattle or poultry ration just before switching to horse feed, we immediately know what must have happened."

Overall, only a small percentage of monensin poisoning cases are caused by contaminated horse feed. The more common scenario is a horse accidentally eating cattle feed containing the additive. For example, Blakley says monensin poisonings have occurred most commonly at beef cattle feedlots where working horses may be exposed to spilled cattle feed by accident.

Symptoms: straight to the heart

The symptoms of toxicity vary with the amount of monensin ingested by a horse. Trace amounts may cause a horse to go off his regular feed, show signs of colic and appear unwell for a few days. Larger amounts will cause a horse to show more serious symptoms within a few hours including colic, stiffness, sweating, a lack of co-ordination and the inability to stand.

As Blakley points out, these symptoms are non-specific — making it difficult for veterinarians and horse owners to confirm the problem. Ultimately, examining a horse's cardiovascular system provides the most important clinical evidence: an affected horse's heart rate may double or triple, and its breathing will be laboured even though it's standing still.

Monensin and Horses *(continued)*

“In horses, the most important and obvious result of monensin poisoning is damage to heart muscle. Sometimes animals die very quickly with acute, congestive heart failure. In other cases, horses may die of heart failure in a few days or even weeks later.”

To confirm a diagnosis of monensin poisoning, Blakley says veterinarians and toxicologists rely on blood and urine samples that provide two key pieces of information. First, an affected horse’s blood will contain dramatically elevated muscle enzyme levels. Second, a horse suffering from monensin toxicity will have high levels of the muscle protein myoglobin in its urine. Both are indicators of muscle damage.

In a more prolonged situation where the horse doesn’t die in the first few hours, echocardiography (ultrasound examination of the heart) may provide direct evidence of cardiac dysfunction. Death of cardiac muscle, congestion of the lungs and swelling of the liver may also be apparent in a post mortem examination. Since monensin causes membrane damage, Blakley says there may be no obvious lesions or signs that make a simple or obvious diagnosis for pathologists.

What’s also challenging about monensin is that it’s a molecule that breaks down very quickly, making it very difficult to detect — especially in cases where the affected horse lives for several days. As well, very few toxicology laboratories have established the methods for monensin detection. Tissue samples in Western Canada are often submitted to one of several government laboratories for analysis.

Blakley says a quicker alternative is to test the affected horse’s feed — something that’s done by the Canadian Food Inspection Agency (CFIA) as part of its mandate to monitor feed-related problems in the country.

Damaged for life

Although there’s no antidote for monensin poisoning, Blakley says some practitioners have used selenium and vitamin E to stabilize muscle membranes in acute cases. This approach has limited success, mainly because the muscle membranes are already damaged by the time there’s a confirmed diagnosis.

“It may minimize the damage, but it doesn’t eliminate it.”

And that’s the heartbreaking part about cases of monensin toxicity. Even if a horse does recover, the damage to muscles — including the heart — is permanent and may have consequences later in life. Surviving horses may, at some later date, develop signs of congestive heart failure if they are ridden, used in some type of performance sport or stressed in some other way.

“Recovered horses may look okay and appear to be in good health. The big concern is that an affected horse could become ill while someone is riding or driving it,” says Blakley.

Another concern is the sale of monensin-affected horses: owners must be upfront and disclose that a horse has suffered monensin poisoning so that the new owners are forewarned of potential long term effects on the heart.

In Western Canada, Blakley has been an expert witness in several cases where new horse owners have taken former

owners to court because they believe a purchased horse suffered from the effects of monensin poisoning. Months or even years after a potential poisoning, Blakley says it’s very difficult to prove that a horse has ingested the drug.

“If a horse dies and a post-mortem examination is conducted, the pathologist may find evidence of heart muscle damage — but that’s about it. The fact that the drug disappears from the tissues very quickly makes it very challenging to prove that they have been exposed to monensin. All you know is that you’ve got a horse with a heart problem.”

What Blakley hopes is that increased public awareness of monensin and its deadly effects on horses will make owners more vigilant about keeping livestock feed separate and to not assume that what’s good for cattle and poultry must be good for horses.

“Some farms keep horses with cattle and having the animals eat the same feed isn’t unusual. If you’re going to do that, make sure there’s no monensin in the feed.”

ADDING MORE FACTS ABOUT MONENSIN

- Monensin is an ionophorous antibiotic produced by the fungus *Streptomyces cinnamomensis*. An ionophore is an organic compound that affects the transport of ions across cell membranes.

- In the poultry industry, monensin is used to prevent a parasitic infection called coccidiosis and is sold under the trade name Coban 60.

- Monensin is also known as Rumensin, a growth promotant in cattle and poultry that’s added to premix, pelleted or bulk feeds, and mineral blocks. It improves feed efficiency, the rate of gain in cattle and reduces the incidence of feedlot bloat and acidosis.

- Horses are particularly susceptible to monensin toxicity: the median lethal dose is only 2.0 to 3.0 mg/kg. Reports of monensin poisoning in horses have appeared since 1975. One example occurred in 1986 when several hundred horses in Michigan were exposed to varying levels of monensin after an Ontario feed mill made a feed substitution error.

- It’s believed that in horses, the drug inhibits sodium and potassium ion transport across cell membranes. This leads to mitochondrial failure (the parts of the cells that are responsible for energy production) and other physiologic issues.

- While horses appear to be the most sensitive to monensin, the drug is also toxic to other animals when given at higher doses than recommended, when mixed with incompatible drugs, or when feed rations are accidentally given to animals for which they’re not intended.

- The median lethal dose of monensin varies for different species: 12 mg/kg for sheep; 16 mg/kg for pigs; 20 mg/kg for dogs and 200 mg/kg for chickens. Cattle fed five to 10 times the recommended doses of monensin can also be poisoned. The median lethal dose in cattle is 22 mg/kg — more than 20 times the recommended daily dose. **H**