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Foal and Adult Horse Blood Samples: What's the Difference?

Blood and serum testing can provide a wealth of information about a horse's current health status. Is he battling an infection or an immune-mediated disease? Does he have metabolic issues? Liver or kidney damage?

These red blood cell, white blood cell, platelet, and other levels become less clear, however, when dealing with a neonatal foal, whose body is still adapting to life outside the uterus. Therefore, it's important that veterinarians become familiar with what's normal and what's not normal on a foal's blood sample test results.

"Most labs only report reference ranges for adult horses, which can lead to foal samples being incorrectly flagged as abnormal," said Michelle Barton, DVM, PhD, Dipl. ACVIM, director of clinical academic affairs and the Fuller E. Callaway endowed professor of large animal medicine at the University of Georgia College of Veterinary Medicine's Department of Large Animal Medicine.

She described these differences between foals and adult horses at the 2015 American Association of Equine Practitioner's Convention, held Dec. 5-9 in Las Vegas, covering everything from red and white blood cells to kidney and liver values.

Red blood cells Immediately after birth, a foal's red blood cell count is about the same or slightly higher than an adult's, thanks to the last little bit of blood the dam's placenta transfers, said Barton. Within 48 hours, as the foal begins consuming colostrum, or first milk, the count drops and continues to decrease gradually over the next few months due to milk's low iron content as well as reduced signaling to the bone marrow to replace old red blood cells.

"Therefore, foals look anemic compared to adults," Barton said. "This physiological anemia we see in the neonatal period is not harmful. If values get below 20% (compared to normal adult values of 35-50%), however, investigate it." These values refer to the percentage of red blood cells compared to plasma, also known as the horse's packed cell volume.

Barton also noted that some breeds have different red blood cell indices. The degree of anemia in draft foals is not as dramatic as in light breeds, whereas Arabians' is more pronounced, she said. Donkey foal values are similar to those of light breed foals.

White blood cells These are involved in the body's immune defenses and include neutrophils and lymphocytes. Neutrophil counts in neonates tend to be similar to or higher than those in adult horses. Lymphocyte counts, on the other hand, are typically the same or lower.

"The cortisol (also known as the stress hormone) surge right before birth leads to a higher neutrophil-to-lymphocyte ratio," Barton explained. The lack of a cortisol surge in premature deliveries explains why otherwise healthy premature foals might have very low neutrophil counts the first few days of life.

Coagulation It's important to use age-controlled references when looking at platelet levels, said Barton, as coagulopathy—a reduced ability to clot—is common in critically ill foals. Here's why. During the first few days of life, neonates' platelet counts will be the same as or higher than adults'; their prothrombin and activated partial thromboplastin times (how long it takes for blood to clot) will be the same or longer; and fibrinogen (a protein vital to clotting) concentrations will be the same or lower. Antithrombin (another clotting protein) activity is significantly lower in the first month of life—almost half that of adults, Barton added.

Serum protein Unlike human mothers, dams do not pass infection-fighting antibodies to the fetus in utero, so foals are born with very low immunoglobulin (an antibody type) levels that make their total serum protein concentrations lower than adults'. After foals have nursed properly and absorbed the antibodies from the mares' colostrum, their total protein concentration increases to the low end of normal adult concentrations.

Electrolytes Neonatal electrolyte levels are fairly stable and similar to those of adult horses. The only exception, said Barton, are increased phosphorus values during the first year of life, due to osteoblastic (bone-forming) activity as the foal grows.

Renal (kidney) values During the first 48 hours of life, a neonate's serum creatinine levels will often be higher than normal adult levels. This is because the foal's body is accustomed to the placenta removing this waste product while in utero and must adjust to the kidneys now clearing it, said Barton. Further, neonates typically produce little urine in the first 12 hours after birth, which also delays creatinine clearance. These values do not indicate renal dysfunction as long as they decrease steadily to the normal value by the second to third day of life, she said.

Hepatic (liver) values Neonates' bilirubin (a waste product from clearing dead red blood cells) concentrations are significantly higher than adults' for the first few weeks of life, making foals appear jaundiced, said Barton. While elevated bilirubin levels typically indicate excessive red blood cell destruction or liver disease, in newborns they aren't as concerning as long as the red blood cell count and liver values are within what is expected for a foal. "Bilirubin concentrations in donkey foals tend not to be as high as horse foals and often are within adult donkey reference range," she added.

Liver enzyme concentrations are often greater in neonates than in adult horses, and serum bile acids concentration (an indicator of liver function) might also be greater than adult values in the first few weeks of life. Collectively, Barton said, these values can throw veterinarians off and lead to an inaccurate liver disease diagnosis.

Metabolic values Milk contains fat and lactose, or "milk sugar," that the body breaks down into the sugars glucose and galactose. This is why a neonate's glucose levels are typically the same or two to three times higher than an adult's for the first month. Triglyceride (a type of fat) concentrations are also higher than adult levels for the first several months.

In closing, said Barton, "There are some very unique differences in clinical pathologic parameters between neonates and mature horses. We really need to use age-related lab references; failure to do so can result in erroneous interpretations."