



# Diagnosics 101 - The Equine Blood Chemistry



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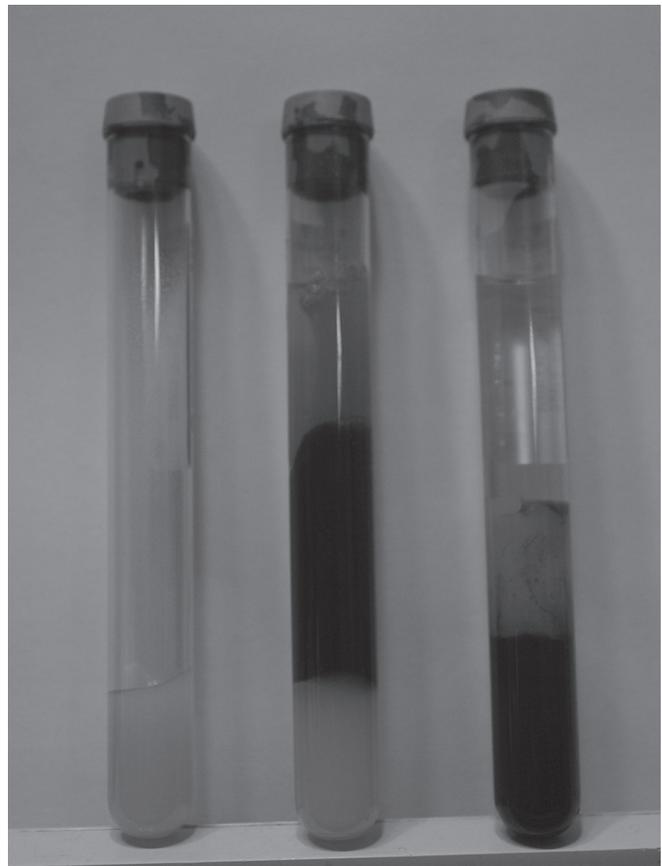
Blood tests are an important part of the process by which veterinarians can assess the health and well being of their equine patients. In the first part of this series, we took a look at the CBC (Complete Blood Count), identifying what cell types make up the CBC and what those values mean to all of us as we care for our horses. In this article, we will look at the second most common component of “routine blood work”, the equine blood chemistry panel.

The chemistry panel (also termed a “profile”) requires drawing the blood into a specific tube (serum separator tube) that contains a gel in the bottom, which will separate the cells from the fluid. The blood needs to fully clot in the tube (45-60 minutes to clot), after which the tube is centrifuged (spun) so that the cells move to the bottom of the tube and are separated from the fluid by the gel layer. The resulting liquid is called “serum,” a yellow colored fluid that contains electrolytes, enzymes, proteins, carbohydrates, and waste products of the body’s metabolism.

In a healthy horse, the body works to maintain itself in a steady, stable state called “homeostasis,” in which all components of the blood are maintained in a relatively narrow range that we consider “normal.” A number of these blood components change in specific and predictable ways when a horse is sick or injured that give us clues as to the source of the problem and help us to gauge a horse’s treatment response and recovery.

When we interpret a horse’s blood chemistry, we must think about all the factors that might influence our results. The collection and handling of the blood, as well as the time lapse between the sampling and the processing, can affect the result of some of the commonly measured serum values. The lab at which the blood is analyzed will have its own set of “normal ranges,” dependent on the equipment used, the type of test run, and the distribution of horse breeds whose blood is sent to that lab (the relevant patient population), as well as many other

factors. A horse’s age, sex and breed also can have an impact on what “normal” might be. Because of the very nature of what we are measuring, some of the individual tests can have a wider degree of variability from horse to horse as well as across different breeds of horses, which can make them much more difficult to interpret. Other values are minimally affected by these factors. cont...



Abbreviation	What it Means:	What Does it Tell Us?
Chem Panel	Chemistry Panel	Also called a Chemistry Profile. A panel of tests done on serum that assesses organ function (kidney, liver, muscle, etc.) and general body metabolism.
Na	Sodium (electrolyte)	Sodium plays a role in water regulation in the body. Main source - the diet. Low sodium occurs with loss of sodium containing fluid (diarrhea or excessive sweating), some types of colic, ruptured bladder in a foal. High sodium is uncommon, seen with water deprivation.
K	Potassium (electrolyte)	Elevated potassium values can be due to kidney disease, metabolic disease, and muscle damage. High levels can be deadly. Low potassium is associated with a decreased dietary intake, loss from the GI tract (ex. diarrhea), or changes in kidney function.
CL	Chloride (electrolyte)	Chloride often changes as sodium changes, at the same time and in the same direction. Low CL can result from upper blockage that causes reflux (loss of fluid from the stomach).
Ca	Calcium (mineral)	Essential mineral for many systems in the body (skeleton, enzymes, muscle, blood and body regulation). High levels can be due to kidney failure, cancer, toxic levels of vitamin D, and poor nutrition. Low levels can be seen with conditions like lactation, acute kidney failure, and low albumin.
Phos	Phosphorus (mineral)	Phosphorus is found primarily in the bone and teeth, closely assoc. with Ca. The kidney removes excess phosphorus. Changes in phosphorus levels can be caused by changes in dietary intake, a decrease in the ability of the kidneys to excrete it, or through hormonal imbalances that affect the level of calcium.
BUN	Blood Urea Nitrogen (from protein breakdown)	Elevated levels are seen with conditions such as kidney failure, dehydration, heart disease, and bladder rupture. Low levels might suggest excessive water intake, liver issues, or low levels of protein obtained from the diet.
Cr	Creatinine (product of muscle metabolism)	More specific test for kidney function. Kidneys are responsible for clearing creatinine from the body. Level is not affected by the diet or by liver function. Elevated levels can be due to kidney issues or severe, prolonged exercise (Cr originates in muscle but is not an indicator of muscle damage). A higher than normal creatinine may be seen with newborn foals and may be normal or indicate a birth or placenta related problem.
ALP	Alkaline Phosphatase (enzyme)	An enzyme found in a variety of tissues (liver, intestine, bone, placenta, kidneys and white blood cells). Increased levels indicate increased production. Elevated most commonly with liver and bone disease.
AST	Aspartate Amino-transferase (enzyme)	An enzyme found in a variety of tissues (muscle, heart, red blood cells, kidneys and liver). Elevations can be seen with either muscle or liver damage. Highest levels of AST will be seen at approx. 24 hours after muscle injury.



Abbreviation	What It Means:	What Does it Tell Us?
GGT	Gamma-Glutamyl Transferase (enzyme)	Found in the highest levels in the liver and kidney. Increased GGT is seen most often with liver disease.
CK	Creatinine Kinase (enzyme)	Muscle enzyme that is elevated with muscle damage. Highest level will be seen 4-6 hours after injury. This enzyme will peak before AST.
LDH	Lactate Dehydrogenase (enzyme)	Found in large amounts in many different organs and tissues. Is released from cells during organ/tissue damage. 5 different types of LDH exist. Increases of LDH are seen with liver, skeletal muscle, heart muscle, and kidney damage/disease.
TBIL	Total Bilirubin (orange pigment)	Pigment produced by the breakdown of hemoglobin, usually taken up by the liver. Used to measure liver function. It is responsible for the yellow color known as "jaundice." Can be increased with liver disease and when a horse is not eating, and in diseases in which red blood cells are being destroyed (hemolysis).
TP	Total Protein (protein)	A measure of all of the proteins in the blood (globulins and albumin). Elevated with dehydration and increased production of globulins (for ex. with chronic disease or cancer). Decreased levels are due to kidney or GI disease, liver failure or starvation.
ALB	Albumin (protein)	A type of blood protein formed in the liver, important in maintaining the ratio of water and solids in the blood (osmotic pressure). Increased albumin is seen with dehydration. A decrease can indicate liver disease, kidney or intestinal disease, some viral infections and decreased protein intake or absorption.
GLOB	Globulin (protein)	Includes antibodies and proteins involved in blood clotting and inflammation. Important component of the immune system to fight infection.
A/G Ratio	Albumin to Globulin Ratio	Compares the ratio of Albumin to Globulin. Can be useful to differentiate between dehydration (both will be elevated) and disease (in which these two proteins can change independent of each other).
tCO <sub>2</sub>	Total Bicarbonate	Helps to assess the changes that occur with respect to the acid-base balance of the body. The blood needs to maintain itself at a pH around 7.4 (7.0 is neutral) -tCO <sub>2</sub> acts as a "buffer system." An increase in tCO <sub>2</sub> indicates a higher than desired pH (metabolic alkalosis), a decrease indicates a lower than desired pH (metabolic acidosis).
Glu	Glucose (carbohydrate)	A sugar easily measured in blood. Elevated with a recent feeding, excitement, transportation, stress/pain (for ex. colic), metabolic disease (Cushing's syndrome). Low levels are seen most often in foals that are sick/injured such that feed intake (mare's milk) is decreased and energy stores are quickly used up.
Fibrinogen	Type of plasma protein	Inflammatory "marker" released by the body in response to injury and inflammation. Produced in the liver and important in clotting. Increased levels indicate acute or ongoing inflammation. Decreased levels indicate decreased production by the liver or increased utilization of fibrinogen by the body during a disease process. May be found in higher levels in young foals and during pregnancy.

Chart may be clipped from magazine and laminated for reader's personal use.

***The Equine Blood Chemistry, cont.***

*“You look like me..... you smell like me..... but you are not exactly like me.”*

The units used to measure the components of the chemistry panel are weight per volume of blood (grams, milligrams and micrograms per milliliter, deciliter or liter) for the solids like albumin and globulin, level of activity per volume of blood (Units/liter) for the enzymes like ALP and CK, and milliequivalents/liter (mEq/L) of blood for electrolytes like sodium and potassium.

A basic chemistry panel contains values that are looked at individually or in groups to gain valuable information as to how a horse is doing at a particular point in time. The electrolytes often measured are sodium, potassium and chloride, which are vital to the normal function of all cells. To assess the liver, the chemistry panel will include such values as ALP, AST, GGT and bilirubin. For the evaluation of kidney function, the levels of BUN and creatinine are the most useful. To detect muscle damage and inflammation, measurements of CK, AST and LDH will provide a good picture of how the horse is doing.

On the previous pages, you will once again find a table that contains many of the common values found on a chemistry panel for the horse. I hope that this table, used in combination with the CBC table from the previous article, will provide you with a quick and easy-to-use reference as you tackle your own horse's blood results. There is no doubt that a working knowledge of this aspect of your horse's medical record will enable you to be more confident as you team up with your veterinarian to care for your horse, whether as part of routine, preventative care or during a more serious sickness or injury.

**“KNOWLEDGE IS POWER”**

**Accomplishments****Seelchen's Super Season  
By David Feibush**

FHANA member Seelchen Feibush is an amateur USDF (United States Dressage Federation) Bronze and Silver medalist with many USDF, FHANA and IFSHA titles to her credit, but her 2012 competition year was an unprecedented success. She and her star mare, Sietske van 'e Seadwei, had a year that was truly remarkable. By finishing 1st level with a median of 72.931, they beat more than 1,900 other amateur 1st level competitors of all breeds to win the USDF Amateur 1st Level Championship. They also were the 1st level Vintage Cup National Champion. It is very rare indeed for a Friesian to win a USDF National Championship. At the USDF 2nd level they were the 7th ranked Amateur horse and rider and finished 3rd in Vintage Cup. Seelchen and the mare also won the USDF FHANA All-Breeds Open, Amateur and Vintage Cup Championships at both 1st and 2nd levels. They also won the Southern California 1st Level Elite Regional Adult Amateur Competition and many California Dressage Society Chapter Series Championships at 1st and 2nd level. In IFSHA competition they won the 1st and 2nd level Dressage National Championships and also won the IFSHA Sport Horse Mare in Hand National Championship, Dressage Hack Amateur World Championship and the National and World Amateur English Show Hack Championships. Seelchen also campaigned her 4th level gelding Jesse van de Seedyk Star Sport and finished as the 18th ranked 4th level Amateur in the USDF. They also won the Open, Amateur and Vintage Cup USDF FHANA All-Breeds National Championships and the IFSHA 4th Level Dressage Championship. This year Seelchen and her Dressage Friesians won 21 USDF, FHANA and IFSHA National Championships as well as many prestigious perpetual trophies and numerous other local awards. She and her horses are currently home in Orange California enjoying a well-deserved break and preparing to begin competing at 3rd level and Prix St. Georges in 2013. For more info on all of her horses check out her website at [FriesianDressage.com](http://FriesianDressage.com).