

<p>CHEMISTRY PANELS</p> <p>Bilirubin Panel Bilirubin , Total Bilirubin, Direct Bilirubin, Indirect</p> <p>Canine Chemistry Panel See "Small Animal Chemistry Panel"</p> <p>Electrolyte Panel Sodium (NA) Potassium (K) Chloride (CL)</p> <p>Electrolyte Panel, Urine Creatinine Chloride Sodium Potassium</p> <p>Equine Chemistry Panel See "Large Animal Chemistry Panel"</p> <p>Feline Chemistry Panel See "Small Animal Chemistry Panel"</p> <p>Iron Panel Serum Iron Total Iron Binding Capacity (TIBC) % Saturation</p> <p>Large Animal Chem Panel Sodium Potassium Chloride Bicarbonate Anion gap BUN Creatinine Calcium Phosphate Magnesium Total Protein Albumin Globulin A/G ratio Glucose CK SDH AST ALK PHOS GGT T. Bilirubin D. Bilirubin I. Bilirubin Iron TIBC % Saturation</p> <p>Mineral/Lytes Panel Sodium Anion Gap Potassium Calcium Chloride Phosphate Bicarbonate Magnesium</p> <p>Mineral Panel, Urine Magnesium Creatinine Phosphate Calcium</p> <p>Mineral/Lytes Panel, Urine Magnesium Potassium Phosphate Chloride Creatinine Sodium Calcium</p> <p>Metabolic Profile Test Panel BUN NEFA AST Albumin BHBA</p> <p>Non-Mammalian Chem Panel Sodium Phosphate Potassium Total Protein Chloride Glucose Uric Acid CK Calcium AST</p>	<p>Pre-Anesthesia Panel (Lrg An) Sodium Creatinine Potassium Calcium Chloride Glucose Bicarbonate SDH Anion Gap</p> <p>Pre-Anesthesia Panel (Sm An) Sodium Creatinine Potassium Calcium Chloride Glucose Bicarbonate ALT Anion Gap</p> <p>Ruminant Chem Panel See "Large Animal Chemistry Panel"</p> <p>Small Animal Chem Panel Sodium Potassium Chloride Bicarbonate Anion Gap Na:K BUN Creatinine Calcium Phosphate Total Protein Albumin Globulin A/G ratio Glucose ALT AST ALK PHOS GGT D. Bilirubin Cholesterol I. Bilirubin Amylase T. Bilirubin TIBC CK % Saturation Serum Iron Magnesium</p> <p>Total Protein Panel Total Protein Globulin Albumin A/G ratio</p> <p>Tot Protein Creatinine Ratio Total Protein Creatinine Protein:Creatinine Ratio</p> <p>Urinary Bile Acids Panel Creatinine Urine Bile Acids UBA: Creatinine Ratio</p> <hr/> <p>HEMATOLOGY PANELS</p> <p>Blood Smear Eval, Mammalian or Non-Mammalian White Blood Cell Examination Platelet Smear Examination Red Blood Cell Examination White Blood Cell Differential %</p> <p>Hemogram, Automated (Complete Bld Cnt Automated, or CBCA) White Blood Cell Count (WBC) Red Blood Cell Count (RBC) Hemoglobin (Hb) Hematocrit (Hct) Mean Corpuscular Volume (MCV) Mean Corpuscular Hemoglobin (MCH) Mean Corpuscular Hemoglobin Concentration (MCHC) Red Cell Distribution Width (RDW) Automated Platelet Count Mean Platelet Volume (MPV) White Blood Cell Differential, Automated</p>	<p>Hemogram, Non-Mammalian (Non-Mammalian Compl Bld Cnt, or CBC) White Blood Cell Count (WBC) Packed Cell Volume (PCV) Red Blood Cell Examination White Blood Cell Differential (Diff) White Blood Cell Examination Platelet Smear Examination Plasma Examination Total Protein by Refractometer (TP-Ref)</p> <p>Hemogram, Partial (Partial Blood Count, or PBC) White Blood Cell Count (WBC) Red Blood Cell Count (RBC) Hemoglobin (Hb) Hematocrit (Hct) Mean Corpuscular Volume (MCV) Mean Corpuscular Hemoglobin (MCH) Mean Corpuscular Hemoglobin Concentration (MCHC) Red Cell Distribution Width (RDW) Automated Platelet Count Mean Platelet Volume (MPV)</p> <p>Hemogram, Routine (Complete Blood Count, or CBC) White Blood Cell Count (WBC) Red Blood Cell Count (RBC) Hemoglobin (Hb) Hematocrit (Hct) Mean Corpuscular Volume (MCV) Mean Corpuscular Hemoglobin (MCH) Mean Corpuscular Hemoglobin Concentration (MCHC) Red Cell Distribution Width (RDW) Automated Platelet Count Mean Platelet Volume (MPV) Red Blood Cell Examination White Blood Cell Differential (Diff) Platelet Smear Examination White Blood Cell Examination Plasma Examination Total Protein by Refractometer (Tp-Ref)</p> <p>White Blood Cell (WBC) Panel, Automated White Blood Cell Count (WBC) White Blood Cell Differential, Automated</p> <p>White Blood Cell (WBC) Panel, Non-Mammalian White Blood Cell Count (WBC) White Blood Cell Differential (Diff)</p> <p>White Blood Cell (WBC) Panel White Blood Cell Count (WBC) White Blood Cell Differential (Diff) Platelet Smear Examination White Blood Cell Examination</p>
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Serum Bile Acids Results: Guidelines for Interpretation

Dogs and Cats

Fasting bile acids concentration greater than 13 $\mu\text{mol/L}$ can be the result of hepatobiliary disease. Bile acids concentrations exceeding the reference interval can occur in clinically healthy animals because of inadequate fasting, spontaneous gall bladder contraction, and other variables. The probability of hepatobiliary disease is high if fasting bile acids concentration is $> 30 \mu\text{mol/L}$.

2 hour post-prandial bile acids concentration greater than 30 $\mu\text{mol/L}$ in dogs and greater than 25 $\mu\text{mol/L}$ in cats is suggestive of hepatobiliary disease. Most animals with congenital or acquired portosystemic shunting have markedly increased post-prandial bile acids concentration.

Prolonged fasting or intestinal malabsorption can lower bile acids concentration and could decrease the sensitivity of the test as an indicator of hepatobiliary disease. Occasional animals have post-prandial values lower than the fasting values, which has been attributed to delayed gastric emptying or slower GI transit.

Horses

Bile acids concentration greater than 11 $\mu\text{mol/L}$ can be the result of hepatobiliary disease. Slightly increased concentration (up to approximately 20 $\mu\text{mol/L}$) can result from decreased feed intake for a period of several days or longer. Most horses with hepatobiliary disease have markedly increased bile acids concentration.

Cows

Bile acids concentrations are extremely variable in health and therefore have not been found to be useful in diagnosis of hepatobiliary disease. For optimum diagnostic value, bile acids results should be interpreted with regard to clinical findings and other laboratory results.

Sample Index Results

You will find three test results following the results for both fasting and post-prandial bile acids results. These tests are titled LIPEMIA, HEMOLYSIS, and ICTERUS. These are actually indexes of sample quality and are assessed by the analyzer by passing light at different wavelengths through the sample. The number reported under LIPEMIA measures the turbidity of the sample in terms of concentrations of lipid in an emulsion of fat. The number reported under HEMOLYSIS is a semi-quantitative measurement of the concentration of free hemoglobin in mg/dL . The number reported under ICTERUS is an estimation of the bilirubin concentration in mg/dL rounded to the nearest whole number. These indexes are more objective and consistent than visual assessment of a sample. The approximate correlation of lipemia and hemolysis index results with a sample's appearance to the eye is as follows:

- LIPEMIA = 30 – 60 appears slightly lipemic
- LIPEMIA = 60 – 120 appears moderately lipemic
- LIPEMIA > 120 appears markedly lipemic
- HEMOLYSIS = 20 – 100 appears slightly hemolyzed
- HEMOLYSIS = 100 – 200 appears moderately hemolyzed
- HEMOLYSIS > 200 appears markedly hemolyzed

Both lipemia and hemolysis can interfere with measurement of bile acids. Samples that are lipemic are cleared by ultracentrifugation before bile acids are measured. A LIPEMIA index of < 50 indicates that the bile acid result was not affected by lipemia.

Urinary Bile Acid Measurement in Dogs and Cats

Measurement of urinary bile acids (as a bile acid to creatinine ratio) is recommended for screening dogs and cats for hepatic insufficiency/injury and portosystemic shunts (acquired or congenital).

Small amounts of bile acids are found in the urine from healthy animals, however if serum bile acids are increased, the excess bile acids are excreted by the kidneys, resulting in high urinary bile acid concentrations. High urinary bile acid concentrations indicate the need for further hepatic testing, e.g., aspirates/biopsy, ultrasonographic and/or radiographic imaging.

Measurement of urinary bile acid is advantageous over serum bile acid testing (particularly random samples) as patients do not need to be fasted and sample collection is simple.

Samples should ideally be collected from animals without any evidence of renal disease (acute or chronic renal failure, cystitis, etc). Please note that collection of urine obtained within 4-8 hours of eating is optimal for urinary bile acid measurement.

Studies performed by Dr. Center at Cornell University reveal the following:

Dogs

Urinary bile acids appear to be more specific (100% specificity) than serum bile acids (pre and/or post-prandial, 67% specificity) for detection of liver disease, although are less sensitive (urinary bile acids, 61% versus serum bile acids, 78% sensitivity). This data suggests that an abnormal (high) urinary bile acid result is compatible with liver insufficiency, cholestasis or portosystemic shunting. However, since the numbers of dogs with non-hepatic disease in this study were small (n=9), if clinical signs do not correspond to test results, further diagnostic testing is recommended. Results within the provided reference interval do not exclude the presence of underlying liver insufficiency or shunting. If clinical signs in the patient are compatible with these liver disorders despite “normal” urinary bile acid values, pre- and post-prandial bile acid concentrations should be obtained.

Cats

Urinary bile acids appear equally specific to serum bile acids (pre and/or post-prandial, 88% specificity) for detection of liver disease and are similarly sensitive (urinary bile acids, 85% versus serum bile acids, 87% sensitivity). This data suggests that an abnormal (high) urinary bile acid result typically occurs with liver insufficiency, cholestasis or portosystemic shunting, but may be seen with non-hepatic disorders. Results within the provided reference interval do not exclude the presence of underlying liver insufficiency or shunting. If clinical signs in the patient are compatible with these liver disorders despite “normal” urinary bile acid values, additional testing, including determination of post-prandial bile acid concentrations (since fasting may be contraindicated in a sick feline patient), is recommended.

Cholinesterase Results: Guidelines for Interpretation

Measurement of cholinesterase activity in serum or plasma is an inexpensive and quick screening test that is indicated for animals with a history of possible exposure to organophosphate or carbamate compounds and/or show clinical signs compatible with exposure.

Serum/plasma cholinesterase activity below the reference interval is consistent with exposure to cholinesterase-inhibiting compounds, including organophosphate and carbamate insecticides. If history and clinical signs are suggestive of organophosphate or carbamate poisoning, then testing of tissue, gastric contents, urine, or blood for these insecticides may be warranted.

Cholinesterase activity within the reference interval does not rule out exposure to organophosphate or carbamate insecticides since the range of activity within a species is so broad that an individual animal may have significant reduction of its pre-exposure activity and still be within the reference interval. Cholinesterase activity above the reference interval has no known significance. Hemolysis can increase cholinesterase activity in serum/plasma samples by release of cholinesterase from red blood cells.

Non-Esterified Fatty Acid (NEFAs) in Pre-Partum Dairy Cows: Guidelines for interpretation

Dry Cows – NEFAs

This is a test for negative energy balance in prepartum cows.

Interpretation of NEFA values

The following interpretation is most applicable under the following conditions:

1. Twelve samples per herd are provided.
2. Samples are collected from cows within **2 to 14 days precalving**.
3. Samples should ideally be collected **just before** feeding.

NEFA values **> 0.4 mEq/L in 15%** (i.e., 2/12 cows) of sampled cows is suggestive of negative energy balance in the herd. We recommend that the energy intake in the prefresh cows be increased. For example, increase the energy density, feed bunk space and/or feeding frequency.

Artifacts: NEFA values may increase with the following:

1. Clinically ill cows that are off feed.
2. Excitement, exercise or stress during blood sample collection.
3. Hemolysis of the sample – samples should be non-hemolyzed.
4. Samples not kept cool.

Values obtained with these circumstances may not accurately represent energy balance.

If you would like additional information/help with test interpretation only, please call the Clinical Pathology Laboratory at (607) 253-3255. If you would like additional information on test interpretation and herd management, please contact Dr. Nydam by e-mail: dvn2@cornell.edu.

Please note: these guidelines are based on recommendations in the literature and those from the Universities of Michigan, Wisconsin and Guelph. We are in the process of establishing our own guidelines and the interpretations listed above may change.

β -Hydroxybutyrate (BHBA) Testing in Post-Partum Dairy Cows: Guidelines for Interpretation

LACTATING COWS

BHBA is important for:

1. Detection of subclinical ketosis in postpartum dairy cows. Herd, and not individual cow, testing is advised for this purpose. We also offer a fuller metabolic profile if requested in these cows. This will include: BHBA, NEFAs, albumin, blood urea nitrogen (BUN) and aspartate aminotransferase (AST).
2. Diagnosis of clinical ketosis in postpartum dairy cows. Individual cow testing is usually performed for this purpose.

Interpretation of BHBA values

Herd testing for subclinical ketosis

The following interpretation is most applicable under the following conditions:

1. Twelve samples per herd are provided.
2. Samples are collected from cows within **5-50 days after calving**.
3. Samples are collected after feeding (e.g., 3-4 hours).

Interpretation:

Values **> 14 mg/dL in 15%** (i.e., 2/12 cows) of sampled cows are suggestive of subclinical ketosis.

Individual cow testing for clinical ketosis

Interpretation:

A BHBA value of **> 26 mg/dL**, accompanied by supportive clinical signs and laboratory results, is compatible with clinical ketosis.

If you would like additional information/help with test interpretation only, please call the Clinical Pathology Laboratory at (607) 253-3255. If you would like additional information on test interpretation and herd management, please contact Dr. Nydam by email: dvn2@cornell.edu.

Please note, these guidelines are based on recommendations in the literature and those from the Universities of Michigan, Wisconsin and Guelph. We are in the process of establishing our own guidelines and the interpretations listed above may change.

Metabolic Profiles in Post-Partum Dairy Cows: Guidelines for Interpretation

LACTATING COWS

The following interpretations are most applicable under the following conditions:

1. Twelve samples per herd are provided.
2. Samples are collected from cows within **5-50 days after calving**.
3. Time of sample collection should be optimized for BHBA, collect samples after feeding (e.g., 3-4 hours). However, NEFAs will decrease after feeding.

BHBA

Values **> 14 mg/dL in 15%** (i.e., 2/12 cows) of sampled cows suggests subclinical ketosis. In individual cows, BHBA values **> 26 mg/dL** are compatible with clinical ketosis, if accompanied by other supportive clinical and laboratory findings.

NEFAs

Values **> 0.7 mEq/L in 15%** (i.e., 2/12 cows) of sampled cows suggests subclinical ketosis.

Artifacts: NEFA values may increase with the following:

1. Clinically ill cows that are off feed.
2. Excitement, exercise or stress during blood sample collection
3. Hemolysis of the sample – samples should be non-hemolyzed.
4. Samples not kept cool.

AST

Values **> 162 U/L** could indicate liver damage from ketosis, particularly if NEFAs are increased.

Note: Values may be high due to hemolysis or muscle injury, e.g., IM injections, down cows.

BUN

This is an indicator of rumen ammonia concentration.

Values **> 19 mg/dL** suggests excessive dietary protein concentration, which has been associated with reduced fertility.

Values **< 10 mg/dL** suggests inadequate protein in the diet.

Albumin

Values are an indicator of protein-calorie malnutrition as levels vary directly with protein intake. Values will decrease normally in cows after calving.

Values **> 3.0 g/dL** are a good goal for cows in early lactation.

Values **< 2.5 g/dL** suggests protein deficiency, if concurrent inflammation is ruled out.

Note: Low values can be seen in cows with diseases causing albumin loss (e.g., intestinal diseases) or decreased albumin production (e.g., chronic liver disease, inflammation).

If you would like additional information/help with test interpretation only, please call the Clinical Pathology Laboratory at 607-253-3255. If you would like additional information on test interpretation and herd management, please contact Dr. Nydam by email: dvn2@cornell.edu.

Please note, these guidelines are based on recommendations in the literature and those from the Universities of Michigan, Wisconsin and Guelph. We are in the process of establishing our own guidelines and the interpretations listed above may change.

Special Sample Collection Instructions for Ionized Calcium Testing

Test Name: Calcium, Ionized or Ionized Calcium
Test Fee: \$13.75
Test Days: M-Sa
Lag: 1-2 days
Samples: 1 mL separated serum
Container: non-anticoagulant tube (plain red top)
Coolant: refrigerate

Please note that for ionized calcium testing, blood samples should be collected into non-anticoagulant (plain red top) tubes. The sample should then be centrifuged and the serum removed anaerobically (using an evacuated needle and syringe through the tube cap) and placed into a second non-anticoagulant tube (once again, inserting the needle through the cap of the tube). The tubes should not be uncapped under any circumstances. Keep the serum cool at all times.

Analysis should be performed within 48 hours after collection for optimal results. Alternatively the serum can be frozen, shipped on dry ice, and analyzed within seven days. Our reference intervals were established for heparinized whole blood samples analyzed, like blood gas, immediately after collection. These intervals are not necessarily valid for serum. Studies suggest that, compared to whole blood, serum values are slightly lower in dogs (mean of 0.01 mmol/L) and cows (mean of 0.03 mmol/L) and slightly higher in horses (mean of 0.09 mmol/L). Ionized calcium values will be affected by exposure of the sample to air and by changes in pH in the sample.