

Appendix: The User Guide to Clinical Chemistry and Hematology

Below you will find tables of data that provide the ‘normal’ range for horses used at large animal clinics at the University of Pennsylvania and at the University of Guelph. The term ‘normal’ in the context used here clinically normal, i.e. in the range that is seen in ‘normal’ horses presented to the clinic over a period of years. In some cases the normal range is large, and therefore cannot be used in a meaningful way when evaluating how your horse may be doing during a ride, transport, or recovery. Just because a value for your horse in the normal range, does not mean that it is a good value for your horse or that it is even normal for your horse. Please keep this in mind when comparing your results with these ‘normal’ ranges.

Below these tables you will find definitions for the terms and abbreviations, as well as a brief explanation for some of the more common deviations from normal.

Clinical Chemistry Normal Values for Horses

	U Pennsylvania	U Guelph
ALB g/dL	2.5 - 4.2	3.0 – 3.7
AST U/L	205 - 555	259-595
BUN mg/dL	8 -27	
Ca mg/dL	10.7 - 13.4	2.75-3.25 mM
CK U / L	90 - 565	108 - 430
Cl mmol/L	94 - 102	95 - 104
CO₂ mmol/L	24 - 31	25 - 36
CREA mg/dL	0.6 -1.8	0.8 – 1.3
GGT U/L	12 - 45	7 - 54
GLU mg/dL	72 -114	3.7 – 6.7 mM
Na mmol/L	132 -141	136 - 144
TBIL mg/dL	0.1 - 1.9	21 - 57
TP g/dL	4.6 - 6.9	5.7 – 7.5

Hematology Normal Values for Horses

	U Pennsylvania	U Guelph
WBC /cubic mm	5,500- 12,500	
Segmented Neutrophil /cubic mm	2700 - 6700 or 30 - 65%	2800 - 7700
Lymphocyte/ cubic mm	1500-5500 or 25-70%	1300 - 4700
Monocyte /cubic mm	0 - 800 or 0.5 -7%	100 - 800
Eosinophil / cubic mm	0- 925 or 0 -11%	0 - 700
Basophil / cubic mm	0-170 or 0-3%	0 - 100
Platelets	100,000-600,000 /cubic mm	83 - 270 X 10 ⁹ /L
RBC /cubic mm	6.5 -12.5 million	6.9 - 10.7 million
MCV fl	34-58	36 – 45
Hemoglobin g/dL	11 -19	11.2 – 16.9
PCV%	32 - 52	28 - 44
MCH pg		14 – 19
MCHC g/L		369 – 426
RDW%		18 – 21
ACL Fibrinogen mg/ dL	150 - 375	120 – 230

ALB = albumin, one of the two major plasma proteins (with globulin)

BUN = blood urea nitrogen

Ca = calcium

CK = creatine kinase, an enzyme of muscle that can be found in blood with muscle damage

Cl = chloride, the main anion found in plasma

CO₂ = carbond dioxide; referring to the total (all forms) of CO₂ in blood

CREA = creatinine, a muscle peptide that can be found in blood with muscle damage

GGT = γ -glutamyl transpeptidase; an enzyme (protein) normally found in liver cells

GLB = globulin, one of the two major plasma proteins (with albumin)

GLU = glucose, the main carbohydrate in blood

Hb = Hemoglobin, the concentration of hemoglobin in whole blood

HCT = hematocrit, same as PCV - packed cell volume

MCH = mean corpuscular hemoglobin

MCHC = mean corpuscular hemoglobin concentration

MCV = mean corpuscular volume

MPV = mean platelet volume

Na = sodium, the main cation of plasma

PCT = plateletcrit, the percent of platelets in blood

PCV = packed cell volume

PDW = platelet distribution width

PLT = Platelets; number of cells in 1 cubic mm (1 cc); a type of white blood cell involved in clotting

RBC = red blood cells; number of cells in 1 cubic mm (1 cc)

RDE = red blood cell distribution width

TBIL = total bilirubin; bilirubin is the main liver breakdown product of hemoglobin; it is an indicator of red blood cell breakdown

TP = total protein (total plasma protein), which is albumin and globulin combined

WBC = White blood cells; these cells normally comprise about 1% of all of the blood cells. They are involved in immune function and help to defend against infectious disease and foreign materials. The different types of white cells (neutrophils, lymphocytes, monocytes, eosinophils, basophils and platelets) perform different functions.

Guide to Interpretation of Clinical Results:

Calcium	
Increased values can be due to:	Decreased values can be due to:
Hyperalbuminemia (elevated albumin); dehydration	Hypoalbuminemia
Malabsorption	
Excessive vitamin D or Ca	Massive myopathy

Sodium – Na⁺
Increased values
Dehydration
Hemolysis – ruptured red cells (except dogs)
Sodium excess (fluid therapy)
Adrenocortical hyperfunction
Excessive water loss- sweating
Osmotic diuresis
Salt poisoning

Chloride – Cl⁻	
Increased values	Decreased values
All causes of increased sodium	Prolonged sweating
Metabolic acidosis	‘metabolic’ alkalosis
Respiratory alkalosis	Too much water intake
Decreased excretion	
Excessive salt intake	
Water deprivation	
Adrenocortical hyperfunction	

Total protein	Globulin
Increased values	Increased values
Dehydration, shock	Dehydration, shock
Increased production	Hepatopathy
	Rheumatoid arthritis

Albumin	A:G ratio
Increased values	Increased values: Hyperalbuminemia, with normal or low globulins
Dehydration	
Shock	Decreased values: Hyperglobulinemia, with normal or low albumin

Urea (best interpreted in combination with creatinine)
Increased values
Pre-renal azotemia
- dehydration, shock
- high protein intake (slight effect)
- drugs - steroids, aminoglycosides
Post-renal azotemia

Creatinine
Increased values
Decreased renal perfusion
- dehydration, shock
Renal azotemia (as for urea)
Post-renal azotemia (as for urea)

Bilirubin, total
Increased values
Hemolysis, blood loss into body cavity
Hepatic disease

Aspartate aminotransferase (AST, formerly SGOT)
Increased values
Skeletal muscle damage
Hepatic necrosis
Hepatitis, hypoxia
Myocardial necrosis
Hemolysis (artifact)

Glucose	
Decreased values	
Decreased glucose production	
Utilization rate great than production / g.i. absorption	
Hyperinsulinism (insulinoma)	

γ-glutamyl transpeptidase (GGT)
Increased values
Hepatic disease
Cholestasis
Hepatic fibrosis

Creatine kinase (CK)
Increased values
Necrosis of skeletal muscle
- intramuscular injections
- downer animals
- recent severe exercise
Myocardial necrosis
Hemolysis (artifact)