

## Caprine Metal & Mineral Data (where known)

Metals and minerals measured by ICP/MS. Note that our mineral reference ranges have been updated. This mineral data is based on Puls, Mineral Levels in Animal Health, 1994 and updated data gathered by Dr. Tom Herdt, Nutritionist at the Michigan State University Veterinary Diagnostic Laboratory. We are in the process of gathering population data for multiple species to adjust the adequate ranges.

### Blood and Serum/Plasma

Analyte	Sample	Caprine Normal Range	Units	Deficient	High	Toxic
Cobalt	Serum	-	ng/mL	-	-	-
Copper	Serum	0.80 - 1.20	µg/mL	< 0.40	0.90 – 1.80	1.20 – 7.50
Iron	Serum	50 - 100	ug/dl	-	-	-
Manganese <sup>1</sup>	Serum	See below	ng/mL	-	-	-
Molybdenum <sup>2</sup>	Serum	See below	ng/mL	-	-	-
Selenium	Blood	150 – 350	ng/mL	< 100	-	-
Selenium	Serum	80 - 200	ng/mL	< 50	-	-
Zinc	Serum	0.65 – 2.70	µg/mL	< 0.65	-	-
Arsenic	Blood	-	µg/mL	-	-	-
Cadmium	Blood	< 0.02	µg/mL	-	-	> 0.90
Lead	Blood	< 0.20	µg/mL	-	0.50 – 0.90	> 0.90
Thallium	Blood	-	µg/mL	-	-	-

<sup>1</sup>Normal serum Manganese: Bovine: 0.9 – 6.0 ng/mL; Ovine: 1.0 – 6.0 ng/mL

<sup>2</sup>Normal serum Molybdenum: Bovine: 2.0 – 35 ng/mL; Ovine: 1.0 – 50 ng/mL

### Liver (*Dry weight basis*) – Determined gravimetrically

Analyte	Caprine Normal Range	Units	Deficient	High	Toxic
Cobalt	-	ug/g dwt	-	-	-
Copper	100 - 600	ug/g dwt	< 40	-	> 920
Iron	200 - 520	ug/g dwt	< 120	-	-
Manganese	8.0 - 24.0	ug/g dwt	< 4.0	-	-
Molybdenum	> 1.24	ug/g dwt	-	-	-
Selenium	1.00 – 4.80	ug/g dwt	< 0.40	-	-
Zinc	100 - 480	ug/g dwt	< 80	-	-
Arsenic	-	ug/g dwt	-	-	-
Cadmium	-	ug/g dwt	-	-	-
Lead	< 4.0	ug/g dwt	-	12 - 20	> 40
Thallium	-	ug/g dwt	-	-	-
Dry wt. fraction	25 - 34	%			

**Liver Biopsy (As received basis) – wet weight**

Analyte	Caprine Normal Range	Units	Deficient	High	Toxic
Cobalt	-	ug/g wwt	-	-	-
Copper	25 - 150	ug/g wwt	< 10	-	> 230
Iron	50 - 130	ug/g wwt	< 40	-	-
Manganese	2.0 - 6.0	ug/g wwt	< 1.0	-	-
Molybdenum	> 0.31	ug/g wwt	-	-	-
Selenium	0.25 - 1.20	ug/g wwt	< 0.10	-	-
Zinc	25 - 120	ug/g wwt	< 20	-	-
Arsenic	-	ug/g wwt	-	-	-
Cadmium	-	ug/g wwt	-	-	-
Lead	< 1.0	ug/g wwt	-	3.0 - 5.0	> 10.0
Thallium	-	ug/g wwt	-	-	-

**Kidney cortex (Dry weight basis) – Determined gravimetrically**

Analyte	Caprine Normal Range	Units	Deficient	High	Toxic
Cobalt	-	ug/g dwt	-	-	-
Copper	12.0 - 16.0	ug/g dwt	-	-	-
Iron	200 - 500	ug/g dwt	-	-	-
Manganese	4.0 - 12.0	ug/g dwt	< 2.4	-	-
Molybdenum	> 0.88	ug/g dwt	-	-	-
Selenium	2.40 - 6.00	ug/g dwt	< 0.40	-	-
Zinc	60 - 120	ug/g dwt	-	-	-
Arsenic	-	ug/g dwt	-	-	-
Cadmium	-	ug/g dwt	-	-	-
Lead	< 4.0	ug/g dwt	-	12 - 20	> 40
Thallium	-	ug/g dwt	-	-	-
Dry wt. fraction	28 - 38	%			

**Caprine Feed (Total Diet) – Compare feed results to feed label claims**

Analyte	Caprine Safe Range	Units	Deficient	High	Toxic
Cobalt	-	ug/g	-	-	-
Copper	10 - 23	ug/g	< 5	-	-
Iron	30 - 100	ug/g	-	-	-
Manganese	40 – 90	ug/g	< 20	-	-
Molybdenum	0.10	ug/g	-	-	> 300
Selenium	0.30	ug/g	< 0.10	-	-
Zinc	40 – 100	ug/g	< 15	-	> 1000
Arsenic	< 0.050	ug/g	< 0.035	-	-
Cadmium	-	ug/g	< 0.05	-	-
Lead	< 3.0	ug/g	-	-	> 100
Thallium	-	ug/g	-	-	-