

## White Tailed, Black Tailed, and Mule Deer Metal & Mineral Data (where known)

Metals and minerals measured by ICP/MS. This mineral data is based on Puls, [Mineral Levels in Animal Health](#), 1994 and 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	Cervid Normal Range	Units	Deficient	High	Toxic
Cobalt	Serum	-	ng/mL	-	-	-
Copper	Serum	0.60 - 1.30	µg/mL	< 0.50	-	-
Iron	Serum	152 - 277	µg/dL	-	-	-
Manganese	Serum	-	ng/mL	-	-	-
Molybdenum	Serum	-	ng/mL	-	-	-
Selenium	Serum	60 - 150	ng/mL	< 60	-	-
Selenium	Blood	100 - 180	ng/mL	< 50	-	-
Zinc	Serum	0.50 – 1.00	µg/mL	-	-	-
Arsenic	Blood	-	ng/mL	-	-	-
Cadmium	Blood	-	ng/mL	-	-	-
Lead	Blood	-	ng/mL	-	-	-
Thallium	Blood	-	ng/mL	-	-	-

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

Analyte	Cervid Normal Range	Units	Deficient	High	Toxic
Cobalt	< 0.4	ug/g dwt	-	-	-
Copper	60 - 560	ug/g dwt	< 20	-	-
Iron	480 - 1200	ug/g dwt	-	-	-
Manganese	12.0 – 25.6	ug/g dwt	-	-	-
Molybdenum	-	ug/g dwt	-	-	-
Selenium	0.80 – 4.40	ug/g dwt	-	-	-
Zinc	120 - 440	ug/g dwt	-	-	-
Arsenic	-	ug/g dwt	-	-	-
Cadmium	-	ug/g dwt	-	-	-
Lead	-	ug/g dwt	-	-	-
Thallium	-	ug/g dwt	-	-	-
Dry wt. fraction	25 - 34	%			

***For information only, the following data are known for sheep and goats:***

**Caprine Metal & Mineral Data (where known)**

**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	-	> 1.20
Iron	Serum	50 - 100	µg/dL	-	-	-
Manganese	Serum	-	ng/mL	-	-	-
Molybdenum	Serum	-	ng/mL	-	-	-
Selenium	Serum	80 - 200	ng/mL	< 50	-	-
Zinc	Serum	0.65 – 2.70	µg/mL	< 0.65	-	-
Arsenic	Blood	-	ng/mL	-	-	-
Cadmium	Blood	-	ng/mL	-	-	-
Lead	Blood	-	ng/mL	-	-	-
Thallium	Blood	-	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	%			

### Ovine Metal & Mineral Data (where known)

#### Blood and Serum/Plasma

Analyte	Sample	Ovine Normal Range (adults and growing lambs)	Ovine Normal Range (neonates)	Units	Deficient	High	Toxic
Cobalt	Serum	0.18 – 2.0	0.18 – 2.0	ng/mL	-	-	-
Copper	Serum	0.75 – 1.7	0.75 – 1.7	µg/mL	< 0.40	-	> 2.00
Iron	Serum	90 – 270	90 – 270	µg/dL	< 60	-	-
Manganese	Serum	1.0 – 6.0	1.0 – 6.0	ng/mL	-	-	-
Molybdenum	Serum	1.0 – 50	1.0 – 50	ng/mL	-	-	-
Selenium	Serum	60 – 200	50 – 100	ng/mL	< 30	-	-
Selenium	Blood	120 - 350	120 - 350	ng/mL	< 50	-	-
Zinc	Serum	0.55 – 1.2	0.55 – 1.2	µg/mL	< 0.45	-	> 30.0
Arsenic	Blood	0.01 - 0.08	0.01 - 0.08	ng/mL	-	-	> 5.0
Cadmium	Blood	< 0.20	< 0.20	ng/mL	-	-	-
Lead	Blood	< 0.25	< 0.25	ng/mL	-	> 0.7	> 1.0
Thallium	Blood	-	-	ng/mL	-	-	-