

New World Camelid (Llama, Alpaca & Guanaco) 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	Llama et al. Normal Range	Units	Deficient	High	Toxic
Cobalt	Serum	-	ng/mL	-	-	-
Copper	Serum	0.40 – 1.00	µg/mL	< 0.4	-	> 2.00
Iron	Serum	70 - 220	µg/dL	-	-	-
Manganese	Blood	-	ng/mL	-	-	-
Manganese	Serum	-	ng/mL	-	-	-
Molybdenum	Serum	-	ng/mL	-	-	-
Selenium	Blood	200 - 400	ng/mL	-	-	-
Selenium	Serum	120 - 200	ng/mL	-	-	-
Zinc	Serum	0.33 - 1.57	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	Llama et al. Normal Range	Units	Deficient	High	Toxic
Cobalt	-	ug/g dwt	-	-	-
Copper	100 - 400	ug/g dwt	-	-	> 1000
Iron	280 - 800	ug/g dwt	-	-	-
Manganese	2.0 - 4.0	ug/g dwt	-	-	-
Molybdenum	-	ug/g dwt	-	-	-
Selenium	1.00 – 3.28	ug/g dwt	-	-	-
Zinc	80 - 360	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:

Ovine Metal & Mineral Data (where known)

Blood and Serum/Plasma

Analyte	Sample	Ovine Normal Range	Units	Deficient	High	Toxic
Cobalt	Serum	-	ng/mL	-	-	-
Copper	Serum	0.70 - 2.00	µg/mL	< 0.40	-	> 3.00
Iron	Serum	166 - 222	µg/dL	< 160	-	-
Manganese	Blood	20 - 25	ng/mL	< 14	30 - 40	-
Manganese	Serum	8 - 30	ng/mL	-	-	-
Molybdenum	Serum	10 - 70	ng/mL	-	-	> 2300
Selenium	Blood	120 - 300	ng/mL	< 50	-	> 350
Selenium	Serum	80 - 300	ng/mL	< 30	-	-
Zinc	Serum	0.80 - 1.20	µg/mL	< 0.45	-	> 30.0
Arsenic	Blood	0.01 - 0.08	µg/mL	-	-	> 5.0
Cadmium	Blood	< 0.20	µg/mL	-	-	-
Lead	Blood	< 0.25	µg/mL	-	> 0.70	> 1.0
Thallium	Blood	-	µg/mL	-	-	-

Liver (Dry weight basis) – Determined gravimetrically

Analyte	Llama et al. Normal Range	Units	Deficient	High	Toxic
Cobalt	0.08 - 0.35	ug/g dwt	< 0.02	-	> 20.00
Copper	200 - 600	ug/g dwt	< 16	-	> 1000
Iron	250 - 1000	ug/g dwt	< 100	-	> 35,600
Manganese	3.5 - 20	ug/g dwt	-	-	-
Molybdenum	0.9 - 7.5	ug/g dwt	-	-	> 30.0
Selenium	0.8 - 3.0	ug/g dwt	< 0.4	-	> 60.0
Zinc	80 - 300	ug/g dwt	< 60	-	> 1600
Arsenic	< 0.2	ug/g dwt	-	> 4.0	> 10.0
Cadmium	< 1.4	ug/g dwt	-	6 - 36	> 50.0
Lead	< 0.8	ug/g dwt	-	> 5.0	> 10.0
Thallium	< 0.05	ug/g dwt	-	-	> 0.16
Dry wt. fraction	25 - 34	%			