



## Mineral/Vitamin Deficiencies and Toxicities

**CALCIUM (Ca):**      *Deficiency-* Osteopenia, a “condition characterized by poor mineralization of the osteoid tissue and the probability of enlarged joints and crooked long bones.” Survey and diet analysis on 19 Ohio and Kentucky horse farms confirmed. Mature horses can experience weakening of bone and lameness. (NRC, p. 72)

*Toxicity-* Osteochondrosis and Hypercalcion (Amounts of 5X the recommended Ca have been fed without detrimental effects as long as there is adequate Phosphorus to support it). (NRC, p. 72)

**PHOSPHORUS (P):**      *Deficiency-* Rickets in growing horses, and osteomalacic changes in mature horses. (NRC, p. 77).

*Toxicity-* Reduced rate of Ca absorption which leads to chronic Calcium deficiency. \*Nutritional Secondary Hyperparathyroidism (NSH), characterized by shifting lameness and enlargement of upper and lower jaw and facial crest. (NRC, p. 77).

**MAGNESIUM (Mg):**      *Deficiency-* Nervousness, Muscle Tremors, Ataxia. Potential for Hypernea and Death. (NRC, p. 79).

*Toxicity-* Has not been studied

**POTASSIUM (K):**      *Deficiency-* Loss of appetite, therefore weight loss and unthrifty appearance. (NRC, p. 82)

*Toxicity-* Has not been studied

**SODIUM (Na):**      *Deficiency-* Decreased skin turgor, a tendency for horses to lick objects such as sweat contaminated tool handles, a slowed rate of eating, decreased water intake, and eventually a cessation of eating. In acute

sodium deficiency, muscle contractions and chewing were uncoordinated and horses had an unsteady gate. (NRC, p. 85).

*Toxicity-* As long as sufficient water is supplied the horse will excrete excess sodium in urine. (NRC, p. 85).

**COPPER (Cu):**

*Deficiency-* Declining liver copper values, osteochondritis, epiphysis and limb deformities. (NRC, p. 89).

*Toxicity-* Unknown for Horses

**IODINE (I):**

*Deficiency-* Hypothyroidism, resulting in thyroid gland hypertrophy or goiter. Stillborn foals or weak foals and abnormal estrous cycles in mares. In 1935 Redenwold and Simms reported losing about 50% of foals born to mares receiving iodine-deficient feedstuffs. (NRC, p.91).

*Toxicity-* Goiter in newborn foals, abortions and foal mortalities. An iodine toxicity usually results only when iodine is over-supplemented or when animals are receiving feeds containing unusually high amounts of iodine such as some types of seaweeds. (NRC, p. 91).

**IRON (Fe):**

*Deficiency-* Microcytic, hypochromic anemia. Listlessness. (NRC, p. 93).

*Toxicity-* Depressed serum and liver zinc. Foal deaths. (NRC, p. 93).

**MANGANESE (Mn):**

*Deficiency-* No research in horses. In other species: Abnormal cartilage development, crooked limbs, and other limb abnormalities. (NRC, p. 94).

*Toxicity-* Interference with phosphorus absorption. (NRC, p. 94).

**SELENIUM (Se):**

*Deficiency-* Weakness, impaired locomotion, difficulty suckling and swallowing, respiratory distress and impaired cardiac function. (NRC, p. 95).

*Toxicity-* Blind staggers (blindness, head pressing, perspiration, abdominal pain, colic, diarrhea, increased heart and respiration rates, and lethargy. (NRC, p. 95).

**Zinc (Zn):**

*Deficiency-* In foals: In appetite, reduced growth rate, parakeratosis, alopecia, reduced serum and tissue zinc concentrations and decreased alkaline phosphate. (NRC, p. 97).

*Toxicity*- Enlarged epiphyses, stiffness of gait, and lameness. Secondary copper deficiency. (NRC, p. 97).

**Chromium (Cr):** *Deficiency*- No research in horses. Symptoms associated with adult-onset diabetes and cardiovascular disease in humans. (NRC, p. 98).  
*Toxicity*- Not studied in horses.

**Vitamin A:** *Deficiency*- Night blindness, impaired growth and hematopoiesis. Respiratory infection in weanlings. (NRC, p. 110-111).

*Toxicity*- Bone fragility, hyperostosis, exfoliated epithelium and teratogenesis. Developmental orthopedic disease (DOD) in growing horses. (NRC, p. 111).

**Vitamin D:** *Deficiency*- Rickets and bone growth developmental problems. (NRC, p. 113).

*Toxicity*- Calcification of soft tissue, death. (NRC, p. 113).

**Vitamin E:** *Deficiency*- Equine motor neuron disease (trembling, almost constant shifting of weight in rear legs, prolonged recumbency and muscle wasting.) (NRC, p. 115).

*Toxicity*- Does not appear to be toxic to horses. In other species: coagulopathy and impaired bone mineralization. (NRC, p. 115).

**Vitamin K:** *Deficiency*- All species: Impairment of blood coagulation. Humans: Diseases affecting bone and vascular health. (NRC, p. 117).

*Toxicity*- Renal colic, hematuria, azotemia and electrolyte abnormalities consistent with acute renal failure. (NRC, p. 117).

**Thiamin:** *Deficiency*- Anorexia, bradycardie, muscle fasciculations, and ataxia. (NRC, p. 118).

*Toxicity*- Not studied in horses

**Riboflavin:**

*Deficiency*- In other species: rough hair coat; atrophy of epidermis, hair follicles and sebaceous glands; dermatitis; vascularization of the cornea; catarrhal conjunctivitis; photophobia; and excess lacrimation. (NRC, p. 119).

*Toxicity*- Not studied in horses

**Niacin:**

*Deficiency*- In other species: severe metabolic disorders that manifest as lesions of the skin and digestive system. Not studied in horses. (NRC, p. 120).

*Toxicity*- Not concluded in horses. In humans: Vasodilation, itching, sensations of heat, nausea, vomiting, headaches and occasional skin lesions. (NRC, p. 120).

**Biotin:**

*Deficiency*- In livestock: severe dermatitis. (NRC, p. 120).

*Toxicity*- Not studied in horses. Poultry and Swine: Can tolerate at least 4-10X their dietary requirement. (NRC, p. 121).

**Folate:**

*Deficiency*- Not studied in horses. Other species: Megaloblastic anemia and leukopenia. In pregnant women: Increased risk of preterm delivery, infant low birth weight, fetal growth retardation, and neural tube defects. (NRC, p. 122).

*Toxicity*- Not found in horses. High doses in rats resulted in epileptic convulsion and renal hypertrophy. (NRC, p. 122).

**Vitamin C:**

*Deficiency*- Scurvy, resulting from impaired collagen synthesis. In horses with decreased blood ascorbic acid concentrations; post-operative and post-traumatic wound infections, epistaxis, strangles, acute rhinopneumonia, and performance insufficiency. (NRC, p. 123).

*Toxicity*- In humans and lab animals: allergic responses, oxaluria, uricosuria, and interference with mixed function oxidase systems. (NRC, p. 123).

## References

*Nutrient Requirements of Horses*. 6th ed. Washington, D.C.: National Academies Press, 2007.

## Side Notes

\*Condition does not occur often in U.S. but Hintz (1997), “cautioned that horse owners still need to be made aware of this potential problem, particularly if horses are fed large amounts of grain-based feedstuffs.” “Can still occur in situations when horses are fed grains not supplemented with Calcium or that contains substantial amounts of oxalates.” (NRC, p. 77).