

	Functions	Symptoms (Bird and Mammal)
Vitamin A:	Growth, alimentary tract and respiratory mucosa	Ruffled feathers, inflamed eyes, bulging and watery eyes, muscle incoordination, roughened coat, cloudiness of the cornea, nasal discharge,
Vitamin B1:	Carbohydrate metabolism, nerve or neuro-muscular impulse transmission	Anorexia, weakness, diarrhea, lethargy, seizures and other neurological disorders, weight loss, leg weakness, ruffled feathers, impaired digestion
Vitamin B2:	Functions within 2 other co-enzymes	Curled toe paralysis, anorexia, loss of weight, weakness, reduced growth, rough coat, diarrhea, leg paralysis,
Vitamin B6:	Protein metabolism	anorexia, retarded growth, muscular incoordination, convulsions and neurological disorders, abnormal excitability
Vitamin B12:	Carbohydrate metabolism	Anorexia, loss of weight, neurological and locomotion disorders,
Biotin:	coenzyme	Broken flight feathers, paralysis of hind quarters, fur discoloration, hair loss, degenerative changes in the hair follicles, thickened and scaly skin, conjunctivitis, eye infections, dermatitis
Choline:	Nerve functioning,	Extreme weakness, labored breathing with 6-8 days, enlarged hocks, slipped tendons, reduced growth of leg bones, awkward gait, growth retardations, muscular weakness
Folic Acid:	Transfers single carbon units in molecular transformations	Lack of growth and emaciation, low WBC (anemia), depigmentation of feathers, poor feathering, profuse salivation
Niacin:	Functions in 2 coenzymes	Reduced growth, enlarged hocks, poor feathering, anorexia, drooling, dermatitis, tongue discoloration
Pantothenic Acid:	Necessary for fat, carbohydrate, and amino acid metabolism	Anorexia, skin lesions, crusty scabs around beak and eyes, emaciation, weakness, reduced growth, leg disorders, poor feathering,
Vitamin D:	Calcium absorption and metabolism	Rickets, nervous disorders, enlarged joints, wobbly gait, low appetite, stiff legs See Metabolic Bone Disease
Vitamin E:	Antioxidant, muscle	Nutritional muscular dystrophy, sudden death

	integrity	(weakened heart)
Vitamin K:	Necessary for blood clotting	Hemorrhaging
Calcium:	Skeletal growth	Paralysis, retarded growth See Metabolic Bone Disease
Chromium:	Synergism with insulin to promote glucose uptake and metabolism	Reduced rate of growth, hyperglycemia
Cobalt:	Synthesis of Vitamin B12	Anemia, wasting away, loss of appetite
Copper:	Necessary for hemoglobin and melanin formation, blood proteins, enzyme systems	Anemai, diarrhea, loss of appetite, nervous disorders, loss of hair color, reduced hair growth, bone deformities,
Iron:	Formation of hemoglobin	Anemia, listlessness, weight loss
Manganese:	Bone formation, energy metabolism, electrolyte balance	Nervous disorders, loss of equilibrium, bone malformations, slipped tendon
Phosphorus:	Energy metabolism, skeletal growth	Lack of appetite
Potassium:	Acid-base balance in intracellular fluid. Activates enzymes, heart, muscle tone	Overall muscle weakness, loss of appetite, cardiac weakness and failure
Selenium:	Interacts with Vitamin E to maintain tissue integrity	Nutritional muscular dystrophy, labored breathing, diarrhea,
Sodium:	Acid-base balance, water retention	Lack of appetite
Zinc:	Essential for synthesis of DNA, RNA and proteins	Enlarged hocks of birds, poor feathering, retarded growth, rough hair coat and hair loss, weight loss, loss of appetite, impaired wound healing, shortening of long bones, dry foot pads

References: *Nutritional Diseases of Mammals*, J. Wallach **and** G. Hoff; *Keeping Livestock Healthy*