

CHART OF KEY MINERAL BENEFITS AND DEFICIENCIES

Macro Minerals	Function	Deficiency Signs	Mineral Relationships
CALCIUM (Ca)	Bone & teeth formation, blood clotting, smooth muscle contraction	Milk fever, lazy calving, retained afterbirth, slow growth, bone fractures, lower milk yield, rickets, hypocalcaemia	Phosphorous, Magnesium, Fluorine, Sulphur, vitamin D
PHOSPHOROUS (P)	Bone & body structure, fertility, growth, milk yield, appetite control, energy metabolism & many key body functions. Makes up 29% of total minerals in the body	Reduced milk yield and milk protein, rickets, poor growth, irregular oestrus, silent heats, delayed/low conception, depraved appetite etc	Calcium, Sodium, Magnesium, Iron, Zinc, Molybdenum, Aluminium, vitamin D
SODIUM (Na)	Nutrient transfer, waste removal, major body electrolyte, involved in appetite (palatability), muscle & heart contraction, rumen & blood pH	Depraved eating behaviour, urine licking, lower milk production, reduced male fertility	Potassium, Chloride, Sulphates
CHLORIDE (Cl)	Regulate osmotic pressure & acid base balance, manufacture of hydrochloric acid	Loss of appetite, weakness, craving for salt, blood alkalosis	Sodium, Potassium
POTASSIUM (K)	Osmotic pressure, acid-base balance, nerve transmission	Loss of hair glossiness, decreased feed intake	Sodium, Chloride, Magnesium
MAGNESIUM (Mg)	Enzyme activator, bone & muscle, muscle contraction	Grass tetany, lazy calving, retained afterbirth, retarded growth, muscle incoordination, salivation, convulsions	Calcium, Phosphorous, Potassium, Nitrogen, Iron
SULPHUR (S)	Sulphur-containing amino acids, detoxifier, B vitamins synthesiser, cellulose digestion, acid-base balance	Reduced microbial growth, poor appetite. Avoid excess Sulphur	Selenium, Copper, Molybdenum, Nitrogen, Rumen ph
Trace Minerals	Function	Deficiency Signs	Mineral Relationships
COBALT (Co)	Synthesis of vitamin B12 by the rumen microbes	Poor appetite, anaemia, rough hair coat	vitamin B12
COPPER (Cu)	Enzyme activation, blood synthesis, nervous system, hormonal system, development and maintenance of vascular & skeletal systems	Reduced milk production & growth rates, slower return to heats post calving, silent heats, reduced conceptions, delayed puberty in heifers, poorer health and lower immunity, loss of hair colour, scouring, lameness & stiffness. Deficiency also impairs immune response leading to poor response to vaccinations and parasitic treatments	Sulphur, Molybdenum, Iron, zinc, Note: A high proportion of ingested Copper is lost via faeces if not in highly available form
IODINE (I)	Synthesis of thyroxine (hormone)	Enlarged thyroid gland (goitre appearance) weak, dead or hairless new born calves, retained placenta, reduced growth rate, poor reproductive performance with increased early embryonic deaths, abortions, lower milk butterfat	Manganese, Calcium, Cobalt, excess Potash and Nitrogen
IRON (Fe)	Part of blood haemoglobin, oxygen & electron transporter, enzyme systems, immune system function	Anaemia, retarded growth in foetus & youngstock. Excess generally more problematic than deficiency	Naturally magnetic excess iron affects uptake of Phosphorus, Calcium, Copper and vitamin A and can induce Cobalt, Copper, Manganese, Selenium & Zinc deficiency
MANGANESE (Mn)	Growth, bone formation, brain & nervous system function, enzyme activation & insulin activity	Impaired growth, poor reproduction, shortening & bowing of joints	Calcium, Zinc, Iron, Phosphorous and Cobalt

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SELENIUM (Se)	Anti-oxidant, enzyme formation (Glutathione peroxidase), protects cell membranes, stimulates production of antibody producing cells, immune function	Reproductive disorders, mastitis, reduced disease resistance, white muscle disease, retained placenta	vitamin E, Calcium, Sulphur, vitamin B6, ascorbic acid
ZINC (Zn)	Enzyme activation, repair of damaged tissue, essential role in immune system, synthesis & metabolism of proteins & carbohydrates, test keratin formation, transfer of carbon dioxide in red blood cells	Reduced growth rate poor skin condition. Elevation in somatic cell count, mastitis & slow healing of wounds. Hoof disfunction & stiff joints. Impaired sexual function in males & reduced conception rates in females	Iron, Copper, Manganese, Calcium, Phosphorus
Vitamins	Characterisation	Biological Function	Deficiency symptoms
VITAMIN A	Growth vitamin, epithelial-protective vitamin, anti-infective vitamin	Formation and protection of skin and mucous membranes: formation of visual purple and regulation of growth; essential for the immune system	Pathological changes in skin and mucous membranes; impaired fertility; depressed growth; mastitis; weak calves
VITAMIN D	Anti-rickets vitamin	Essential in calcium and phosphorous metabolism. Promotes growth and mineralisation of the bones	Disturbances of calcium and phosphorous metabolism. Softening & deformation of bones; milk fever; hypocalcaemia
VITAMIN E	Anti sterility vitamin, fertility vitamin	Powerful anti oxidant action. Involved in most aspects of reproduction. Regulation of muscle metabolism, increases immunity; better wound healing	White muscle disease, high cell counts, muscular dystrophy, mastitis, reproduction issues
VITAMIN K	Blood clotting vitamin	Important in blood clotting	Increase in blood clotting time; haemorrhaging from burst blood vessels
VITAMIN B1 Thiamine	Anti-neuritic vitamin; anti beriberi vitamin	Regulates carbohydrate metabolism; important for normal function of nerve tissue and heart muscle	Depressed growth; poor feed efficiency & scouring
VITAMIN B2 Riboflavin		Co-enzyme in protein & fat metabolism	Retarded growth; poor feed efficiency
PANTOTHENIC ACID	Anti dermatitis factor	Involved in protein, carbohydrate & fat metabolism	Changes in skin hair & mucous membranes; gastro intestinal disorders
VITAMIN B4 Choline		Choline is a component of lecithin & thus essential for fat metabolism	Disturbed fat metabolism with fatty liver; malformation of joints & bones; retarded growth
NICOTINIC ACID		Nicotinic acid & nicotinamide are involved in numerous metabolic reactions. They are essential for the normal function of skin & digestive organs	Skin changes & gastro intestinal disorders; retarded growth
VITAMIN B12	Anti-anaemia vitamin	Essential for normal blood formation, growth & protein metabolism	Poor weight gain; retarded growth, reduced feed efficiency. Synthesis in ruminants reliant on availability of cobalt
FOLIC ACID	Anti-anaemia factor	Active in protein & nucleic acid (DNA) metabolism; involved in formation of red blood cells	Abnormal blood picture
VITAMIN H BIOTIN	Skin vitamin	Involved in whole series of metabolic functions	Cracked hooves & soles, disturbed hair growth, skin inflammation