

## Functions of Manganese

ENZYME OR REACTION	NORMAL FUNCTION	DEFICIENCY/EXCESS
Superoxide Dismutase	Free radical detoxification	Free radical damage
Isocitrate Dehydrogenase	Citric Cycle reaction	Block of energy metabolism
Glucokinase	Glycolysis reaction	Block of energy metabolism
Arginase.	Urea formation	Block of Nitrogen Excretion
Production of Mucopolysaccharides	Growth,maintenance of bone connective tissue, cartilage	Musculo-skeletal disease and weakness.
Osteoblast and Osteoclast activity	Bone mineralisation	Osteoporosis and osteopenia
Melanin Production	Skin pigmentation	? Vitiligo
Dopamine production	Neurotransmission	Nerve and brain function
Fatty Acid synthesis	Nerve tissue and cell membrane production	Degenerative,allergic diseases
Fatty Acid synthesis	Immune system modulation.	Allergies, autoimmune disease
Fatty Acid synthesis	Steroid hormone synthesis	Endocrine Problems
Thyroxin synthesis	Thyroid gland activity	Hypothyroidism
Milk production	Lactation	Lactation Problems, prolactinemia