

MANGANESE - TRACE ELEMENT

Introduction

Atomic mass 55. A ubiquitous element with 11 oxidation states. The major ores are predominantly manganese oxides. Manganese's major use is in steel production. It is also used in the production of non-ferrous alloys, dry cell batteries, fertilisers, dyes, catalysts, wood preservatives, glass and ceramics. Organic manganese containing compounds are used as an anti-knock petrol additives and fungicides.

Exposure

Workplace exposure to manganese fume and dusts may occur during mining and processing of ore. Exposure of the general population to manganese from air, water and food sources is very low.

Absorption

Inhaled manganese is well absorbed, especially the very fine particles associated with fume. Intestinal uptake of manganese is poor, only three percent of an oral dose is absorbed.

Distribution

Absorbed manganese is transported in the blood bound to transferrin and alpha-2-macroglobulin. Manganese bound to transferrin appears to be widely distributed around the body while the balance of the absorbed manganese passes through the liver and is excreted to the bile. The liver therefore has a relatively high manganese content. Other manganese rich tissues include the pancreas and kidney. Some areas of the brain are manganese rich.

Excretion

Homeostasis is achieved through excretion of surplus manganese to the bile. There is extensive enterohepatic circulation of manganese. Very little manganese is excreted in the urine and it is uncertain whether individual levels change in response to exposure to the metal.

Pathology

Symptoms of manganese intoxication appear after one to two years exposure and then progress rapidly. A psychosis characterised by nervousness, irritability and hallucinations appear initially. These progresses to include motor dysfunction that mimics Parkinsonism. Individual susceptibility appears to play a large part in the commencement and progression of the intoxication. Manganese deficiency has been demonstrated in veterinary practice where the symptoms identified in animals were growth impairment, skeletal deformity and neuromuscular abnormalities. One case has been reported in humans where low cholesterol, weight loss, dermatitis and nausea were noted.

Monitoring

The individual concentrations of manganese in blood, plasma, tissue and urine will vary with total body burden and exposure status. PaLMS Trace Element Service recommends that when manganese exposure is to be assessed, blood, plasma and urine levels should be determined. For nutritional supplementation assessment the determination of blood manganese at one to three month intervals is recommended.



Treatment

There is no definitive therapy for intoxication although there have been reports that treatment with L-dopa improves symptoms. Suspected deficiency or long-term reduced intake should be treated cautiously with supplementation.

Analysis

Graphite furnace atomic absorption is traditionally offered. PaLMS Trace Element Service employs inductively coupled plasma mass spectrometry for improved turn around time and result quality. Samples are expected to have low levels of manganese and so are prone to environmental contamination. Collection equipment and tubes commonly cause the contamination. Please contact the PaLMS Trace Element Service for detailed collection advice.

For further information please contact Ross Wenzel, PaLMS Trace Elements on (02) 9926 7682 or email rwenzel@nscchhs.nsw.health.gov.au.