

LAB NOTES



TRACE METALS

Trace Metals are important elements, both from nutritional and toxicological points of view. We obtain minerals such as calcium, magnesium, manganese and iron in our diet as well as small amounts of essential metals such as copper, selenium, and zinc which are required for the maintenance of growth and normal health. Deficiencies (due to extraordinary needs/losses or lack of supplementation) can occur when there are inadequate amounts provided to meet the metabolic need. Patients on total parenteral nutrition (TPN) are at risk for vitamin, metal, and mineral deficiencies associated with inadequate provisions of these nutrients in the fluid. Clinical toxicity also occurs if over ingestion of some elements takes place. Malabsorption due to intestinal disease, disease of the liver, and kidney can cause derangements of trace elements, affecting absorption, tissue distribution and excretion. When such disorders are combined with nutritional depletion and/or use of drugs such as diuretics, then secondary or acquired deficiencies can result.

The loss of lean body mass, especially skeletal muscle, which occurs during the catabolic phase of the response to trauma or infection, and produces a negative nitrogen balance, also results in a negative balance of some inorganic elements (potassium, magnesium, phosphorus, sulphur, copper, zinc, and selenium). Nutritional support during convalescence and patient weight regain must ensure appropriate replacement of these essential inorganic elements as well as major nutrients, to allow growth and wound healing.

Trace Metal assays should be used in conjunction with clinical symptoms in monitoring TPN patients. Through understanding of signs/symptoms of deficiency and toxicity are essential for patient care. It's important to keep in mind with TPN fluids—deficiency of chromium and manganese are uncommon; zinc and selenium often require supplementation.

Most Frequently Tested Trace Metals (Primary Function and Clinical Significance)

Copper - Required for hemoglobin synthesis, and maintains iron utilization as a cofactor for ceruloplasmin. Deficiency signs include anemia (hypochromic microcytic), thrombocytopenia, neutropenia, malabsorption symptoms, and kinky hair. Increases are seen in patients with Addison's disease, hypopituitarism, infection, lymphomas, and liver disease. Toxicity signs include diarrhea, vomiting, metallic taste, hemolysis, jaundice, renal failure, and vascular collapse. Testing requires a blood sample drawn in a dark blue (Sodium Heparin) tube, available in HHLA's Trace Metal kit.

Zinc - Plays a role in protein synthesis, many enzymes are zinc dependent, and it's important in immune function.

Deficiency signs include alopecia, diarrhea, loss of appetite, skin lesions, taste change, poor wound healing. Decreased levels in serum are seen with hepatic cirrhosis, sickle cell anemia, chronic renal failure, carcinoma of the lung, myocardial infarction, and oral contraceptive usage. Testing requires blood sample drawn in a dark blue tube, available in HHLA's Trace Metal kit.

Selenium - Plays a role in the metabolism of enzymes, protects the cell from lipid oxidation, and functions with vitamin E. Deficiency signs include muscle pain, weakness, whitened nail beds, cardiomyopathy. Decreased levels are seen in gastrointestinal cancer and protein calorie malnutrition. Toxicity signs include dermatitis, loss of hair and nails, headaches, nausea, fatigue, garlic odor on breath. Testing requires a blood sample drawn in a dark blue tube.

Manganese - Involved in enzyme activation. Deficiency signs include weight loss, dermatitis, nausea, vomiting, change in hair color, slow hair growth. Toxicity signs may include dementia-like symptoms, neurologic sequela. Testing requires a blood sample drawn in a dark blue tube - and you must specify if you want the whole blood, RBC or serum tested. According to lab resources, optimum specimen for nutritional manganese measurement is either whole blood or RBC.

Chromium - acts as a cofactor with insulin and is important in maintaining protein, carbohydrate and lipid metabolism. It's also important in maintaining glucose tolerance and peripheral nerve function. Deficiency signs include glucose intolerance, peripheral neuropathy, weight loss, glucosuria. Toxicity signs include mutagenesis, decreased glomerular filtration rate. Beware chromium is often found as a contaminate of amino acid preparation (in TPN nutrient fluid). Accurate measurement is difficult because of the low amounts present in the body. Testing requires a blood sample drawn in a dark blue tube.

HHLA offers Trace Metal kits that contain the appropriate tubes for your specimen collection for Trace Metal testing. We also have designed a Trace Metal Notification Program that provides administrative assistance in the form of an automatic reminder that eliminates the difficulty in scheduling routine periodic Trace Metal testing. Getting started is easy. Just call the Account Management department at 866-752-2638 and ask to sign up for the Trace Metal program.



The Lab-in-a-Box®

- 1) "Research interests: Role of trace metals in nutrition and disease" Fred Y. Leung Updated 03-04-98, www.biochem.uwo.ca/fac/leung/oldleung.html
- 2) "Trace elements in Clinical Nutrition" T.G.Baumgartner, Nutrition in Clinical Practice 8:251-263,1993
- 3) "Trace Elements and Micronutrient Unit" an Introduction (3) 1pg. NHS Scotland-2001 www.griteu.demon.co.uk/bakgrund2.htm
- 4) "Micronutrient Status During Long Term Total Parenteral Nutrition Therapy" Reid A. Nishikawa, PharmD, BCNSP, FCSHP, pg.5-Trace Elements.
- 5) "Tests for Monitoring and Evaluating Nutritional Status and Diagnosis of Select Conditions" Saunders Manual of Clinical Laboratory Science- Craig A. Lehmann copyright 1998-pg 283.
- 6) "Assessing Vitamin and Mineral Status In Home Parenteral Nutrition Patients" Melinda Parker, MS, RD, CNSD, page2-2001.
- 7) "Tremor and Seizure Associated with Chronic Manganese Intoxication" Brain Development, H. Komaki, S.Maisawa, K.Sugai et al. 21:122-124, 1999.