Trace element deficiencies in humans

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At least 10 trace elements are essential, and many act primarily by forming metalloenzymes.

Primary deficiencies arise from deficient diets and develop especially when requirements are increased or body stores are reduced (e.g., zinc or copper deficiency in preterm infants receiving breast milk or formula low in zinc[1] or copper[2]). Absorption may be impaired by high levels of dietary components such as phytate (e.g., iron and zinc) or by excessive intake of mineral supplements[3] (e.g., zinc in pregnant women receiving high levels of ferrous iron supplements and in infants fed iron-fortified formulas[4]). The effect of diet on copper, selenium and chromium bioavailability is not yet clear.

Conditioned deficiencies may develop in states of decreased absorption or excessive excretion or utilization. Zinc and copper deficiency may occur with malabsorption syndromes as well as chronic diarrhea, ileostomy, inflammatory bowel disease, alcoholic cirrhosis, hemolytic anemias and burns.[5]

Iatrogenic deficiencies may occur in people receiving prolonged unsupplemented total parenteral nutrition, in children with inborn errors of metabolism receiving semisynthetic diets and in patients treated with chelating drugs. Genetic defects in metabolism have also been described for copper (Menkes' kinky hair syndrome), iron (congenital atransferrinemia), zinc (acrodermatitis enteropathica) and molybdenum (xanthine and sulfite oxidase deficiencies).[6]

Uncertainties still exist about how best to assess trace element status. Measurement of concentrations in body fluids or tissues is most routine. Serum concentrations are most widely used to assess zinc and copper status, but they are not specific and sensitive enough to detect mild deficiency. However, serum selenium concentrations reflect the current selenium status and can be used to monitor patients receiving total parenteral nutrition. Most methods of measuring the serum chromium concentration are not sensitive enough to detect suboptimal levels.[6]

Recently developed static tests use easily accessible tissues (e.g., hair for zinc[7] and nails for selenium[8]), but blood tests of the activity of enzymes dependent on trace elements, such as glutathione peroxidase (selenium) and Cu,Zn-superoxide dismutase (copper), are generally more sensitive.[6]

Newer tests measure physiologic or behavioural functions that depend on a trace element, such as taste acuity and growth velocity (zinc), glucose tolerance (chromium) and cognitive function (iron). However, they are time-consuming, are not specific and must be used along with biochemical tests.

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