

Trace Elements in Human Nutrition

Trace elements are required by the body in small quantities for normal growth, development and physiology.

Iron

Is a constituent of haemoglobin, myoglobin and enzymes. Associated with ferritin, hemosiderin (spleen, liver, bone marrow) and transferrin (blood).

Sources are meat, eggs, vegetables, cereals.

Deficiency is observed at four stages in life 1) Between 6 months and 4 years iron content of milk is low, body grows rapidly and body reserves are insufficient 2) during early adolescence due to expanding RBC mass and need to deposit iron in myoglobin 3) menstrual iron loss 4) pregnancy, expanding blood volume of mother, demands of fetus and placenta, blood loss during childbirth.

Manifests as anemia, impaired psychomotor development, decreased physical activity and resistance to fatigue.

Excess is never encountered from food, rarely due to long term ingestion of home brews made in iron vessels. Acute intoxication in children is caused by ingestion of iron food supplement.

Idiopathic hemochromatosis - inborn error of metabolism – enhanced iron absorption.

Iodine

Is a component of thyroid hormones and is needed for proper functioning of thyroid gland, is needed in cell metabolism and to convert food to energy, it helps to metabolize excess fat, it may help prevent fibrocystic breast disease by regulating the effects of estrogen, is important in physical and mental development, improves mental alertness and cognitive function and also prevents multiple miscarriages.

Iodine **deficiency** symptoms are common in women, especially pregnant women or those over 50, and in older children. **Goitre**, is often the first sign of iodine deficiency. It results from over-stimulation of the gland as the body tries to produce thyroid hormones in the absence of iodine. The other symptom of chronic iodine deficiency is **hypothyroidism**, where the thyroid gland does not produce enough thyroid hormones. Some can be serious, such as **cretinism**, a type of mental and physical retardation in children.

Sources are seafish, seafood; eggs, milk and iodised salt (25mg/kg).

There is not enough iodine in food alone to cause **toxicity**, the most vulnerable group to toxicity are children. Eating too many foods high in iodine or from medication or supplementation can lead to hyperthyroidism which causes over-production of thyroid hormones accelerating the body's metabolism therefore resulting in palpitations, anxiety, irritability, sweating, and weight loss. Other symptoms are metallic taste in the mouth, a painful mouth or throat, thirst, shortness of breath, vomiting, diarrhea, abdominal pain, fever, shock or seizures, stupor, delirium. Doses in excess of 1g can cause burning in the mouth, weak heartbeat, and even coma.

Recommended daily intake for adults ranges between **150 and 200 µg** (differs by country and age).^[1]

Copper

Is a constituent of many enzymes, participating in iron binding in Hb (hematopoiesis), formation of pigmentation, immune function, constituent of cellular respiratory enzymes.

Sources are organ meat (liver), egg whites, seafood, nuts and seeds.

Deficiency is exceptional, described in malnourished children - anaemia, bone demineralisation, impaired immunity, hair and nail growth.

The primary organ for copper induced **toxicity** is the liver, also the central nervous system, immune system and interacts with other nutrients like iron transport and metabolism leading to anaemia.

Chromium

Tri-valent form enhances the action of insulin hence increased glucose tolerance, six-valent form is allergen and carcinogen.

Good sources: mushrooms, prunes, dark chocolate, nuts, whole grains

Deficiency is rare but if it occurs, the result is decreased glucose tolerance, hyperlipidemia, acceleration of atherosclerotic changes.

Excess chromium leads to headaches, mood disorders and is toxic to kidney.

Fluoride

Bone and teeth formation.

Sources are water, tea, fish if consumed with bone.

Deficiency leads to increased caries formation and poor bone mineralisation.

Excess leads to fluorosis -brown pigmentation of teeth

Selenium

Present at active site of glutathione peroxidase that catalyses the breakdown of hydroperoxides, thus preventing damage caused by free radicals. Positively influences immunity, probably anti carcinogenic.

Sources are seafood, kidney, liver, depending on the selenium content in soil also grains and seeds.

Deficiency - decreased lymphocytes and natural killer activity, decreased interferon formation, Keshan disease (cardiomyopathy), Kashin-Beck disease (osteoarthropathy). Selenosis with symptoms of gastrointestinal upsets, white blotchy nails, hair loss, fatigue, irritability, mild nerve damage and garlic breath odor.

Zinc

Is involved in more than 200 enzyme reactions, is a component of superoxide dismutase, prevents oxidative stress, positively influences tissue growth and healing, participates in insulin formation and spermatogenesis.

Sources are meat, liver, eggs, seafood.

Deficiency causes growth retardation, decreased immunity, loss of appetite, skin, nail, hair changes.

Excess: Does not occur from natural diet. Acute adverse effects of high intake of zinc include nausea, vomiting, loss of appetite, abdominal cramps, diarrhea, and headaches while intakes of 150-450 mg per day are associated with chronic effects such as altered iron function, reduced immune function, and reduced levels of high-density lipoproteins.

Links

Related articles

- Minerals in Human Nutrition
- Food Contaminants

Reference

1. Deutsche Gesellschaft für Ernährung, Österreichische Gesellschaft für Ernährung, Schweizerische Gesellschaft für Ernährungsforschung, Schweizerische Vereinigung für Ernährung. . *Referenzwerte für die Nährstoffzufuhr (DACH)*. 1. edition. Frankfurt am Main : Umschau/Braus, 2000. 216 pp. ISBN 3-8295-7114-3.

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