Coppers as an Essential Element for Human Body (Systematic Review)

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ABSTRACT

Introduction:
Absorption, transfer, storage and disposal of copper is highly controlled. Copper is absorbed through the small intestine and it enters the cells through the process of diffusion and the exiting is done side-by-side through active transmissions, but it may also be done through diffusion. There is a constant competition between copper ions and other 2-volume cathodes. Copper is more likely to attach to metallothionein than zinc ions and other ions in intestinal absorption cells. The amounts of copper absorbed by metallothionein levels is determined in mucosal cells.

Methods:
Searches were conducted by two independent researchers in international (PubMed, Web of science, Scopus and Google scholar) and national (SID, Magiran) databases for related studies from the inception of the databases to September 2017 (without time limitation) in English and Persian languages.

Discussion:
Copper is just one of the enzymes the deficiency of which causes malfunction in the process of enzymes. Copper, in the form of ceruloplasmin, has a crucial role in oxidizing iron before it is connected to plasma. RDA copper is 900 micrograms per day for adult women and men. Teens need 890 micrograms. Infusions in infants are 200 to 220 micrograms per day and between 340 and 440 micrograms in children. Preterm infants are born with little copper reserves and may need nutrient copper in their first months of life. Serum copper and ceruloplasmin levels are useful biomarkers to assess copper status in human body. More sensitive variables (such as copper enzymes in blood cells) are required for copper conditions. Copper deficiency is characterized by anemia, neutropenia, and skeletal disorders, especially non-mineralogical. Other changes that may develop include bone hemorrhage, depigmentation of the skin and hair and the formation of imperfect elastin.

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Introduction:
Absorption, transfer, storage and disposal of copper is highly controlled. Copper is absorbed through the small intestine and it enters the cells through the process of diffusion and the exiting is done side-by-side through active transmissions, but it may also be done through diffusion (1). There is a constant competition between copper ions and other 2-volume cathodes (2). Copper is more likely to attach to metallothionein than zinc ions and other ions in intestinal absorption cells. The amounts of copper absorbed by metallothionein levels is determined in mucosal cells (3). The net absorption of copper varies from 25% to 60%. Sufficient absorption helps maintain copper intake, thus reducing the absorption rate by increasing consumption (4). The consumption of fiber and phytate leads to partial absorption of copper. There is no free copper in the body. Approximately 90% of serum copper is in conjunction with ceruloplasmin. Ceruloplasmin is a functional enzyme involved in the formation of erythrocytes in the bone marrow (5). The remaining 10% is linked to albumin, transferrin and other proteins, free amino acids and possibly histidine. Serum copper levels and serum immunosuppressive levels of ceruloplasmin are higher in women than in men. Concentration of serum copper is highest in neonates and this rate decreases gradually during the first year of life (6).

Copper is bound to albumin and albumin plays a crucial role in restoring the temporary copper source. In the liver, copper is bound to metallothionein (7).

Interaction with other nutrients negates the common misconception according to which excessive use of beneficial vitamin and mineral supplements is beneficial (8). Zinc, in the amount of 150 mg per day, leads to copper deficiency by absorbing metallothionein in the absorption of intestinal cells. Also, taking high levels of ascorbic acid (1500mg / day) reduces the blood density, which may reduce the role of ceruloplasmin in the formation of erythrocytes (9).

Methods:
1.1. Search strategy:
Searches were conducted by two independent researchers in international (PubMed, Web of Science, Scopus and Google scholar) and national (SID, Magiran) databases for related studies from the inception of the databases to September 2017 (without time limitation) in English and Persian languages. To ensure literature saturation, the reference lists of included studies or relevant reviews identified through the search were scanned. The specific search strategies were created by a Health Sciences Librarian with expertise in systematic review search using the MESH terms and free terms according to the PRESS standard.

After the MEDLINE strategy was finalized, it was adapted to search in other databases. Accordingly, PROSPERO was searched for ongoing or recently related completed systematic reviews. The key words used in the search strategy were “copper”, “Micro nutrient ” which were combined with Boolean operators including AND, OR, and NOT.

Transmission in blood:
Function:
Copper is just one of the enzymes the deficiency of which causes malfunction in the process of enzymes. Copper, in the form of ceruloplasmin, has a crucial role in oxidizing iron before it is connected to plasma (10). Lysil oxidase is a copper enzyme and is essential for lysine-related cross-linking in collagen and elastin (high protein reactivity proteins) (11). Copper is, also, effective in producing mitochondrial energy through being involved in electron transport. As part of copper enzymes such as SOD, copper protects the body against free oxidants and free radicals and promotes the synthesis of melanins and catecholamines. Other roles of copper enzymes are understood quite clearly up to now (12).

Receiving a diet reference:
RDA copper is 900 micrograms per day for adult women and men. Teens need 890 micrograms (13). Infusions in infants are 200 to 220 micrograms per day and between 340 and 440 micrograms in children. Preterm infants are born with little copper reserves and may need nutrient copper in their first months of life (14).

Food resources and reception:
Copper has been widely distributed in foods, including animal products (other than milk). Most diets include 0.6 to 2 mg of copper per day. Copper-
rich foods include mollusks (oysters), organ meats (liver, kidney), muscle meat, sugar, brains, cereal grains, dried beans and dried fruits (15).

In sum, fruits and vegetables have a small amount of copper. Cow's milk is a poor source of copper and its copper content is 0.015 to 0.18 mg / L, while breast milk copper is well absorbed and varies from 0.15 to 1.05 mg / L (16).

Infants fed with cow's milk are exposed to copper deficiency due to low copper content (17).

### Deficiency:

Serum copper and ceruloplasmin levels are useful biomarkers to assess copper status in human body (18). More sensitive variables (such as copper enzymes in blood cells) are required for copper conditions. Copper deficiency is characterized by anemia, neutropenia, and skeletal disorders, especially non-mineralogical (19). Other changes that may develop include bone hemorrhage, depigmentation of the skin and hair and the formation of imperfect elastin (20). Erythropoietic failure may lead to death, along with brain and cerebrovascular analysis. Volotope Neutropenia is the best initial indicator for detecting copper deficiency in children (20). The classical copper deficiency has been reported in children with inadequate nutrition and diarrhea, and infants fed with diluted cattle dairy (21). Other deficiencies have also been reported. Since a huge bulk of the copper restored in human body normally passes through the last months of pregnancy, preterm infants appear to have copper deficiencies, unless they are supplemented. Since diets contain little copper in developing countries, pregnancy outcomes should be monitored in these countries (22).

Since copper is stored in the liver, the depletion progresses slowly with the depletion of its reserves. There has been no report of copper deficiency with a varying diet. Low levels of copper, ceruloplasmin and superoxide disodium (SOD) are symptoms of copper deficiency, but these indices are not sensitive to the marginal position of copper (23). Copper supplementation may improve bone changes, osteoporosis, metaphysy bulge and calcification of soft tissues in infants who have long had complete intravenous feeding. The only sign of copper deficiency in adults is neutropenia and microcycy anemia. Since copper is stored in the liver during life, copper deficiency is quite rare in adults (24).

### Poisoning:

Poisoning due to food intake is impossible. Excessive supplementation or copper salts used in agriculture can lead to cirrhosis of the liver and the formation of abnormal red blood cells (25). Concentrations of ceruloplasmin increase during pregnancy and oral contraceptive use. Concentration of copper in pregnant women is approximately 2 times higher than non-pregnant women (26). Serum and bile duct concentrations of copper can increase in acute and chronic infections, liver disease, and plaque. The physiological significance of this increase is unknown. Any chronic liver disease that disrupts bile ducts leads to copper retention. Early biliary cirrhosis with mechanical blockage of the bile duct plays a role in the progressive increase in copper content in the liver. (27)

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