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The Selenium - Silent Retreat

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Short Communication

Accumulated evidence over decades has established the essentiality of selenium in human nutrition. Selenium is a trace element and has shown its mettle in wide range of biological functions ranging from reproduction to growth, thyroid metabolism and protection of cell membrane and DNA from oxidative damage.

Selenium (Se) is naturally present in Earth's crust and selenium content in foods is greatly influence by the selenium content of the soil in which the food is cultivated. Hence the geographical location, seasonal hanges, protein content and food processing determines the Se content in food. Brazil nut is richest source but not commonly eaten. It is sufficiently available in meat, fish, lamb, pork, sea foods, cheese etc. Others good sources are mushroom, onion, broccoli, lentils, green pea, berries, dates and raisins. In nature selenium exists in two forms, i.e. organic (selenomethionine (SeMet) and selenocysteine (SeCys) and inorganic (selenate and selenite). Both forms can be ingested through dietary sources or dietary supplements but utilized in the body in varying capacity. Se-supplements are also available but should be taken judiciously. Selenium is absorbed actively through intestinal mucosa of duodenum and SeMet is better absorbed from foods rich in methionine. Vitamin A, C, E enhances the absorption while heavy metals, sulphur, mercury and deficiency of vitamin B2, B6, vitamin E and methionine reduce it.

Selenium plays its role in the body by incorporating into proteins to make selenoproteins or selenoenzymes which are of paramount importance in several biological functions. Some important selenium dependent enzymes are glutathione peroxidase and iodothyronine deiodinases.

Being a selenoprotein enzyme, Glutathione peroxidase (GPx) is crucial in health and disease. It protects the body from oxidative stress. It catalyses the hydrogen peroxides (H_2O_2) and lipid peroxides into their corresponding compounds thus detoxify the body. GPx also protects the cell membrane integrity and the DNA.

Iodothyronine deiodinase is another crucial selenium dependent enzyme which is critical in thyroid metabolism. It is essential for the conversion of thyroxin, or tetraiodothyronine (T4), into its active form, triiodothyronine (T3). Though iodine has been audaciously advocated for thyroid functioning but without selenium iodine is not so effective. Thus, selenium supplementation has shown drastic improvements in cases of Hashimotto thyroiditis, an autoimmune disease and Grave's disease (a condition of hyperthyroidism). Selenium also provides protection from excess of iodine exposure [1-3].

Selenocysteine is found in plasma protein as Selenoprotein P and play role in transportation and retention of selenium in the body. Selenoprotein P is mainly secreted by liver and is also found in hormone producing organs particularly involved in reproduction and metabolic activities.

Low dietary intake of selenium usually does not show instant deficiency symptoms. Gradually it affects the conversion of T4 into T3 and results in elevated T4 and depleted T3, which is associated with hypothyroidism. Selenium deficiency exacerbates the deficiency of iodine. Deficiency of both increases the risk of Myxedematous cretinism that is characterized by mental growth retardation, in young population of certain geographical regions.

Selenium deficiency is endemic in certain parts of China, Tibet, Siberia and New Zealand where selenium content in the soil is extremely low. Phenylketonuria and maple syrup urine disease in some children from New Zealand; Kashin-Beck disease (musculoskeletal disorder) from Siberia and Asia; Keshan disease (cardiomyopathy) are observed there.

Low plasma level of selenium is often found in persons kept on parenteral or enteral feeding for long duration; dialysis, gestation, lactation; patients with vascular diseases, heavy metal poisoning; alcohol abuse and vegetarians. It also triggers viral replication in case of influenza and HIV because it tends to inhibit the production of antibodies thus lowers the immunity. During prolonged oxidative stress, hydrogen peroxide

(H_2O_2) gets accumulated in thyroid cells and impairs thyroid metabolism. Selenium deficiency impairs the functioning of glutathione peroxidase leading to excessive production of dangerous hydroxyl radical and eventually results in onset of serious diseases such as cardiovascular disease, Crohn's disease, ulcerative colitis, rheumatoid arthritis, etc.

Selenium toxicity is also observed in persons on high protein intake mainly from animal foods. The symptoms are garlicky odour in breath, nausea, skin rashes, metallic taste in mouth irritability, loss of sensation in arms and legs. In extreme case kidney may also be affected.

Thus one needs to be careful of selenium intake both in case of deficient and excessive amounts. World Health Organization (WHO) recommends intake of selenium @55µg/ day in healthy individual, however, under stressful conditions the requirement is increased. Further Selenium doses above to 400µg /day may exert toxic actions.

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