SELENIUM AND HUMAN HEALTH

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Selenium (Se) is a naturally occurring, non-metallic trace element identified as an essential nutrient for human and animal health. It is unevenly distributed on the surface of the earth and consequently the concentration in different geo-ecosystems varies widely, forming seleniferous and seleno-deficient geo-ecosystems. This uneven distribution and low bioavailability of selenium likely to affect the health of both humans and animals through the food chain. Therefore the selenium in the geo-environment is of special importance, particularly to the developing countries of the tropical belt where there appears to be an apparent association with some diseases [1].

The intake of selenium varies widely, ranging from deficient to toxic levels. An intake of less than 11 µg/ g per day is considered deficient, while a dose in excess of 900 µg/ g per day is considered toxic to human health [2]. Protein energy malnutrition, haemolytic anaemia, cardiomyopathy, hypertension, ischemic heart disease, alcoholic cirrhosis, cystic fibrosis, infertility, cancer, arthritis, muscular dystrophy, multiple sclerosis and osteoarthropathy/ Kaschin-Beck disease (Fig. 1) are some diseases associated with low intake [3, 4] whereas garlic breath, hair and nail loss, skin and nervous system disorders, poor dental health and paralysis associate with toxic levels. Recommended average selenium intake is 60 µg per day for men and 53 µg per day for women [5].

Figure 1: Patients diagnosed with Kaschin-Beck Disease in China

Nutritional functions of selenium are attained by 25 selenoproteins and many of them are important to human health as most of them are important enzymes. Selenium plays an important part of the antioxidant enzyme, glutathione peroxidase (GSH-PX) that protects cells against the effects of free radicals that are produced during normal oxygen metabolism. Recent studies from United States (US Third National Health and Nutrition Examination Survey, Women's Health and Aging Study) and France (Epidemiology of Vascular Ageing Study) shows that high selenium status associate with low overall mortality as well.

Selenium also has the immunostimulant effect which helps the normal functioning of the immune system. It can enhance the proliferation of activated T cells, increase cytotoxic lymphocyte-mediated tumour cyto-toxicity and killer cell activity. A study from UK confirms that personals supplemented with selenium and injected with attenuated poliovirus can defend themselves against the virus more rapidly.

As human thyroid gland has the highest selenium concentration of all the other tissues, recently it has been suggested that selenium deficiency may be a driving factor in the onset of Iodine Deficiency Disorders (IDD). Selenium deficiency can inhibit the function of selenoenzyme, type 1 iodothyronine deiodinase (IDI) which governs the generation of active thyroid hormone tri-iodothyronine (T3), from inactive prohormone thyroxine (T4) and can adversely affect the thyroid hormone metabolism [6].

Occurrence and progression of some viral infections are closely linked with selenium deficiency and under deficient condition; harmless viruses also can be virulent. As example selenium is crucial nutrient for HIV infected individuals and selenium deficient patients are 20% more likely to die due to HIV than the others [7]. Some researchers have also proved that viruses may have the ability to get selenium from the host to produce viral selenoproteins and reduce the effect of host's immune response [8].

Selenium is also essential nutrient for brain function where its deficiency can cause for irreversible brain injury. Researchers have found that there is a strong relationship with serum selenium level and seizures, Parkinson's disease, coordination and cognitive decline. Epidemiological studies have revealed an inverse relation between selenium level and cancer mortality. Higher cancer risks are possible in areas where the dietary intake of selenium is low. Generally lung, colorectal, thyroid and prostate cancers are associated with selenium deficiency.

In Sri Lankan context, it has been identified that significant proportions of the Sri Lankan female population may be selenium deficient [9]. According to World Health Organization (WHO), low serum selenium levels have been recorded in people with CKDu in Sri Lanka [10]. Selenium deficiency may be a contributory factor in increasing the susceptibility of the kidneys to oxidative damage.

The effect of selenium on human health is complex and further research is required to identify the benefits and also the possible risk. In Sri Lanka except Fordyce et al., (2000) no detail studies have been considered selenium and its behavior in the geo-environment of Sri Lanka. Therefore, identification of the availability of selenium and dietary intake through the food chain in local environment is essential requirement for the benefit of both humans and animals. Currently a comprehensive research project is being carried out to investigate the selenium in the geo-environment of Sri Lanka in which Se levels in water, soil, rice and plants are investigating. The project is funded by the National Research Council.

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