Geochemical availability of dietary Se possible etiological determinant of viral infectious diseases (VIDs)

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Se Biogeochemistry May Determine Outbreak of Pandemic Flu and other VIDs

Regions of low geologic Se bioavailability [1] overlain with etiological origins of diseases indicates pandemic influenzas (1918 "Spanish" flu, 1957 Asian flu, 1968 Hong Kong flu, Avian H5N1 flu) and SARS originated in east central China "Guangdong" and Hubei Provinces; whereas, HIV and Ebola hemorrhagic fever originated in west central Sub-Saharan Africa, respectively [2]. These diseases are viral and infectious. Sparse data from literature indicate nutritional Se in these regions can fall substantially below dietary 37 mcg Se/d required to achieve metabolic 1μMol Se/L blood for full expression of immunocompetence [3].

Discussion of Results

Micronutrient Se contributes to immunocompetence. Se-deficient individuals are susceptible to enterovirus, and benign viral forms mutate to virulence under Se-deficient host conditions [4]. Individuals <1μMol Se/L blood are susceptible to poliovirus, have decreased immune response to poliovirus vaccination, and poliovirus mutates under those host conditions; Se supplementation of the low Se status population raises immune response and decreases viral mutations [5]. Subsequent research confirms viral virulence and infectivity occurs under Se-deficient host conditions.

Determinations of geochemical bioavailability of Se to food crops in these geographic regions are needed to help abate probable nutrient Se-deficiencies – and potential subsequent VIDs.

[1] Oldfield (2002) *Se-Te Assoc* , 70p. [2] Harthill (2008) *GSA annual mtg*, [3] Xia *et al*. (2005) *Am J Clin Nutr* **81**, 829-834. [4] Beck *et al*. (1994) *J Med Virol* **43**, 166-170. [5] Broome *et al.* (2004) *Am J Clin Nutr* **80**, 154-166.

Colloids in karstic percolation waters: Implications for the interpretation of trace element variations in speleothems

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Much of the current understanding relating to colloidal organic matter (COM) in speleothem-forming groundwaters has been obtained from detailed studies of the optical and chemical properties of speleothems. In particular, marked increases in trace elements known to coordinate with oxygen-containing groups of organic ligands (Y, Pb, Cu, Zn, P, Br) have recently been shown to coincide with UV-fluorescent laminae in a stalagmite from Grotta d'Ernesto, NE Italian Alps. Variations in the abundances of trace elements associated with COM in speleothems over time may be linked to the magnitude of infiltration events in the soil-aquifer system, but there have been no specific studies of element binding to organic or other finer colloids in speleothem-forming groundwaters. Percolation water samples from three contrasting locations have been size-separated utilising membrane filtration (1 μm, 0.1 μm) and ultrafiltration (1 kD) and analysed for total organic carbon (TOC), UV-fluorescence and trace elements (ICP-MS). One study location (Pooles Cavern) offers high pH (>10) conditions resulting in charge-stabilisation of finer colloids. At both high and lower pH drip sites, including Ernesto, enhanced autumnal infiltration coincides with higher TOC concentrations and elevated concentrations of trace metals. Also, observed depletions in trace metal concentrations between size-separated drip water samples reflect the same relationship found in soil leachates from the same site. Hence episodes of high abundances of colloid-associated trace elements measured in speleothems correspond to palaeo-precipitation events.