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Determination of Potential Toxic Heavy Metals and Quality in Soil in a Chronic Kidney Disease of Unknown Etiology (CKDu) Hotspot, Sri Lanka

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Abstract

CKDu (Chronic Kidney Disease of unknown etiology) concentrated mainly in North Central province in Sri Lanka and recently it appeared in Uva province as well. Soil can be taken as a main environmental source for occurrence of this kidney malfunctioning, as it is a material which is frequently used by the people in those areas and soil has a direct co-relation between food and water sources. Therefore, the present study attempts to investigate the potential toxic levels and the quality of soil in Rideemaliyadda South Grama Niladari Division (CKDu hotspot), Badulla district, Uva province, Sri Lanka. Triplicated 30 soil samples were collected according to random satisfied sampling including 13 home gardens, 9 cultivated areas, 5 forested areas and 3 tank sediment samples separately. The sample numbers from each stratum was estimated by ArcMap 10.2.2 software based on land use patterns. The soil samples were analysed for heavy metals using the Inductive Coupled Plasma- Mass Spectrometry (ICP-MS) followed by microwave digestion. The average concentration of selected heavy metals including Lead, Cadmium, Chromium, Zinc, Copper and Nickel in soil (in mg/kg) 8.850 ± 3.870 , 0.01 ± 0.05 , 43.62 ± 33.88 , 52.35 ± 60.48 , 15.74 ± 9.66 and 12.96 ± 7.02 respectively. The average Zn content in soil was exceeding the permissible levels given by WHO. The average pH of the soil samples were 6.798 ± 0.840 which indicates a slightly acidic condition and it has not exceeding the permissible soil pH given by WHO. The average electrical conductivity of the soil samples were $145.30 \pm 282.80 \mu\text{S cm}^{-1}$ which was lower than the permissible soil conductivity level. Hence, the soil in the sampling area was more or less contaminated with heavy metals, human long-term exposure to one or more of these metal toxicants is nearly unavoidable and they tend to be concentrated within human body under the dehydrated conditions. It may be one of the causative factors for the prevalence of CKDu in dry zone areas in Rideemaliyadda south GND.

Keywords: CKDu, Soil, Random satisfied sampling, Toxic heavy metals, Long-term exposure