Exploring of the root causes of Chronic Kidney Disease of uncertain etiology (CKDu) via analysis of toxic metal contents in environmetal constituents; water, soil, and food

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Abstract

Chronic kidney disease (CKD) is a global public health concern attracting international attention due to the rapid spread. However, CKD of unknown etiology is also prevalent and creates rapid progress in certain regions of the world, particularly in Africa, Central America, and Asia. An intimate relationship between the quality of the water, soil, and food and the underlying geology has been recorded repeatedly in different geographical regions of the world. Many risk factors are hypothesized for prevailing CKDu, such as unidentified environmental toxins, chronic pesticide exposure, increased levels of nephrotoxic heavy metals in water and soil, high fluoride levels, and potential impacts of AlFx on soil and water, and growth of cyanobacteria in water resources. Our investigation's overall intention is to risk assessment of drinking water, agricultural soil, rice (Oryza sativa), and fish species (Etroplus suratensis) by evaluating the toxic metal contents in CKDu endemic areas in Sri Lanka. Further, findings were compared with a CKDu non-endemic area to grab better clarifications. With the Ministry of Health's aid in Sri Lanka, CKDu hotspots have been identified for the sampling process. An adequate number of drinking water, paddy soil, rice, and fish samples were collected in a dry season (August 2019). As CKDu hotspots, Eppawala GN (Grama Niladhari) division, Medirigiriya GN division, Giradurukotte GN division were selected, and Dambethalawa division was selected as the reference site in Sri Lanka. Results depict that, Mean concentrations of heavy metals/metalloids such as Mn, Co, As, Cd, Pb, Cu, Zn, Fe in drinking water of selected CKDu endemic areas were far below Sri Lankan water quality standards. Besides, all sampling locations dropped below the medium range of the Heavy Metal Pollution Index of water (HPI 15 – 40). Geo accumulation indexes (Igeo) of paddy soil reveal that agricultural soil in selected CKDu endemic areas is moderately polluted with toxic metals/metalloids such as As, Pb, Cu, Ni, and Cr, Zn, and Cd. However, the concentrations of Cr (p=0.44), As (p=0.36), and Cd(p=0.37) of paddy soil in CKDu hotspots were significantly higher than the reference. Among the trace metals analyzed in rice grains in the CKDu endemic areas, mean Cr, Cd, As, and Pb contents were recorded as 0.342 mg/kg, 0.011 mg/kg, 0.035 mg/kg, 0.112 mg/kg, respectively. The mean concentrations of Cd, Pb, As, and Cr in Etroplus suratensis were 84.31, 45.20, 206.85, and 115.62 μg/kg, respectively, in the Ulhitiya reservoir (in CKDu endemic area). But significantly lower Cd levels contents were observed in the CKDu hotspot than the reservoir in the reference area. Application of fertilizers that contained high doses of toxic metals could be the driving force for the agricultural soil pollution with heavy metals and long term exposure to the toxic metals via drinking water and frequently consumed foods may generate a risk for kidney tissue damage.

Biography:

W. P. R. T. Perera is working on research activities regarding Chronic Kidney Disease aiming discover root causes for prevailing of CKDu in Sri Lanka. Further, Improvement of Graphite- based sand / Nano composites for water purification purposes and assessment of the plant natural products aiming development of Ayurveda drugs against microbial pathogens.