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Determination of the Relationships between Consumption of Rice (*Oryza sativa*) With Heavy Metals and the CKDu Prevalence in Riddemalliyadda, Sri Lanka

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Abstract

Chronic Kidney disease of unknown etiology (CKDu) is one of the major national health problems in Sri Lanka, and the dietary patterns of people can be considered as one of the causative factors for this kidney malfunctioning .Rice is the staple food in every metal among the CKDu patients, which gets supplied from their own paddy fields and nephrotoxic contaminants in the environments like toxic metals can be easily transported through rice. Therefore, the present study attempts to determine of the relationships between consumption of rice (*Oryza sativa*) with toxic metals and the CKDu prevalence in Rideemalliyadda-south, Badulla district, Sri Lanka. Triplicated ten rice grains samples (ground and powdered) were analysed by inductively coupled plasma mass spectroscopy (ICP-MS) for heavy metals such as lead, chromium, nickel, zinc, copper, iron and manganese followed by microwave digestion. The mean metal concentrations in (mg/kg) of rice grains were Pb;1.23±0.29, Cr;6.68±0.15, Ni;3.15±0.23, Zn;19.34±0.16, Cu;2.75±0.37, Fe;52.60±0.15, and Mn;7.77±0.27. Human health risk assessment via rice consumption was determined by calculating the estimated weekly intake (EWI) comparing with the Provisional Tolerable Weekly Intake (PTWI), which has been set by FAO/WHO. Calculated EWIs (mg/kg) for the concerned metals were 0.051(Pb), 0.28(Cr), 0.13(Ni), 0.81(Zn), 0.12(Cu), 2.19(Fe), and 0.32(Mn) respectively. EWIs for Pb, Cr, Zn, Fe, and Ni were exceeding the PTWI values and EWI for Cu complied with the PTWI levels. Hazard Quotient (HQ) is used to determine the non-carcinogenic effects of the consumption of rice. All the metals concerned in these samples HQ is less than one, therefore no significant risk of systematic toxicity. The total hazard index for rice consumption was 0.00387 with relative contribution of metals, Pb(41.97%), Cr(0.607%), Ni(21.478%), Zn(8.782%), Cu(9.375%), Fe(10.236%) and Mn(7.556%). According to the HQs, the analysed metals can be responsible for the concerned health risk in the order of Pb>Ni>Fe>Cu>Zn>Mn>Cr. Hence rice in the sampling area was more or less contaminated with heavy metals, long -term exposure to those metals can be cause for the kidney malfunctioning and the CKDu prevalence in Rideemalliyadda-south, Sri Lanka. Therefore, farmers are strictly advised to adhere to the rules imposed by the government and to follow health guidelines in cultivating their paddy fields.

Keywords: CKDu, *Oryza sativa*, EWI, Hazard Quotient, Long-term exposure.