

Toxic metal contamination in food chains via paddy plant; A study in CKDu endemic area in North Western Province, Sri Lanka

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This study addresses the urgent need for a comprehensive risk assessment of toxic metal contamination in the food chain via paddy plants in CKDu-affected areas emphasizing the health hazards associated with the transfer of toxic metals from soil to paddy grains and evaluating the health risk of consuming rice through different risk indices. Twenty composite paddy soil samples and twenty paddy plant samples with rice grains in the exact locations were collected from paddy areas in *Nikawewa Grama Niladhari* division during the *Maha* growing cycle in 2023. The analysis of Cr, Pb, As, Cd, Ni, and Cu was conducted using inductively coupled plasma-mass spectrometry (ICP-MS). Descriptive statistics revealed the average metal concentrations in rice grains as: Cr(637.42±157.44 µg/Kg), Pb(262 ±62.35 µg/Kg), As(39.29±11.97 µg/Kg), Cd(1836±192 µg/Kg), and Cu(1567 ±466 µg/Kg). Cr, As, and Cu levels in rice grains remained within WHO/FAO and codex limits. However, average Pb and Cd levels surpassed permissible limits (Pb-200 µg/Kg, Cd- 50 µg/Kg; WHO). Nevertheless, the Target hazard quotient (THQ) values of Cr and Cd were greater than 1. The estimated Daily Intake (EDI) values of Cr(3.15 µg/Kg/Day) and Cd(9.15 µg/Kg/Day) are higher than Tolerable Daily Intake (TDI) values. The transfer factors (TF) for toxic metals in the soil-root system were determined as follows: Cr-0.069, Pb-0.30, As-0.67, Cd-0.49, Ni-0.10, Cu-0.23. Toxic metal transfer factors in the soil-root system were evaluated, indicating greater uptake by plant roots. When considering a metal transfer from roots to rice grains, Cd had a transfer factor greater than 1, indicating potential accumulation in grains, while Cr exhibited a notable increase in transfer factor compared to the soil-root system. The risk of toxic metal transfer from soil to paddy grains warrants concern due to potential human exposure and related health risks, including Chronic Kidney Disease, from the consumption of contaminated rice grains.

Keywords: Contamination, Food chain, Heavy metals, Paddy soil, Risk assessment

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