

Assessment of some toxic metals of commonly consumed rice by ICP-MS and their impact on human health

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Abstract

Natural and anthropogenic phenomena lead to accumulation of elements in the environment. Metal contamination of rice is one of the main concerns under food safety today. This study was conducted to distinguish some metal contents in rice and to assess possible health effects. Thirty two rice varieties in the Anuradhapura district were analyzed for Pb, Cd, Cr, Mn, and Ni under two groups identified as traditional and nontraditional rice varieties. Samples were digested using a microwave digestion system and analyzed using Inductively Coupled Plasma-Mass Spectrometry (ICP-MS). The most abundant metal among the studied elements was Mn in both traditional (27.85 ± 7.52 mg/kg) and nontraditional rice (23.57 ± 14.37 mg/kg). Cr levels were reported as 3.37 ± 1.14 mg/kg and 1.93 ± 0.58 mg/kg while Ni levels were reported as 0.72 ± 0.86 mg/kg, 0.88 ± 0.35 mg/kg in traditional and nontraditional rice respectively. Pb content in traditional rice (1.05 ± 0.45 mg/kg) exceeded the maximum allowable limit (0.2 mg/kg) while the nontraditional rice obtained a lower level (0.20 ± 0.10 mg/kg). Cd levels in both traditional (0.08 ± 0.07 mg/kg) and nontraditional (0.03 ± 0.02 mg/kg) groups were lower than the maximum allowable limit (0.4 mg/kg). Health risk exposure through rice consumption was calculated for 60 kg body weight. Target Hazard Quotient (THQ) for Pb in traditional and nontraditional groups were 37.62 and 7.08 mg/kg respectively while THQ <1 for other elements in both groups. Noncarcinogenic risk from long-term exposure to Pb was significant for traditional and nontraditional groups showing Target Hazard Quotient >1. Recommended weekly tolerable consumptions for traditional rice are 1.42, 0.41, 0.43, 2.94, 5.03 kg and for nontraditional rice are 7.56, 0.72, 0.51, 2.39, 12.77 kg in order to avoid the adverse effect of Pb, Cr, Mn, Ni, Cd respectively.

Keywords: Human health, ICP-MS, rice, toxic metals

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