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Arsenic contamination in Sri Lankan traditional rice varieties in Anuradhapura district and probabilistic assessment of human health risk through rice consumption

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Arsenic (As) is one of major hazardous carcinogen found in foods and identified as a significant public health concern. Diet and lifestyle of Sri Lankans are mainly relied on rice. Nowadays high demand for traditional rice can be distinguished in the market. The study was aimed to determine the As contamination in Sri Lankan traditional rice varieties and to assess the adverse health effect on human through consumption of these varieties. Twenty four rice varieties were collected from local farmers, Anuradhapura district in the North Central province of Sri Lanka. Rice samples were taken without husks and dry weights were considered. Digestion procedure was carried out using microwave digestion system prior to the analysis. Total As levels were detected using Inductively Coupled Plasma Mass Spectrometry (ICP-MS). Results were verified using a certified reference material (NMIJ 7503b) with 98% recovery. As concentration detected between 39.92 (± 0.10) µg/kg to 543.00 (± 3.10) µg/kg and maximum level was reported in Rathdel while Kuruluthuda showed the lowest concentration. Ten rice varieties including Madathawalu (265.75 ± 4.34) µg/kg , Dik Wee (257.73 ± 2.90) µg/kg, Goda Heenati (249.88 ± 0.50) µg/kg, Rathu Heenati (238.65 ± 3.40) µg/kg, Kiri Murunga (268.04 ± 14.96) µg/kg, Hondaruwal (204.09 ± 6.52) µg/kg, Gurusinghe Wee (251.91 ± 6.03) µg/kg, Gonabaru (274.86 ± 2.50) µg/kg, Al Wee (284.71 ± 7.90) µg/kg and Rathdel (543.40 ± 3.10) µg/kg exceeded the maximum allowable concentration of As in rice (200 µg/kg). There was a significant difference between As amount of Rathdel with that of all the other varieties ($P<0.005$). Health risk assessment was performed based on the Estimated Daily Intake (EDI) and Hazard Quotient (HQ). EDI for all the rice varieties were within the tolerable daily intake reference limit for As. Noncarcinogenic risk of As was evaluated by HQ value and it was increased in the order, Al Wee < Bada Heenati < Beheth Heenati < Dahanala < Dik Wee < Duru Wee < Goda Heenati < Gonabaru < Gurusinghe Wee < Handiran < Hondaruwal < Kalu Heenati < Kalu Murunga < Kiri Murunga < Kiri Naran < Kurulu Thuda < Madathawalu < Marjuana < Pushparaga < Rath Suwandel < Rathdel < Rathu Heenati < Sudu Heenati < Suwandel. However, all the HQ values were lower than 1 indicating no carcinogenic health risk. Even though ten varieties exceeded the maximum allowable limit, overall health risk assessment confirmed that the consumers are safe to consume rice of these native varieties.

Keywords: Arsenic, Health risk, ICP-MS, Traditional rice

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