

Cyanotoxin Contamination in Human Urine in CKDu High Prevalence Padaviya and Low Prevalence Rajanganaya and Galnewa in Anuradhapura District, Sri Lanka

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Abstract

The naturally derived cyanotoxin, Cylindrospermopsin (CYN) and Microcystin-LR (MC-LR), has been recorded in freshwater systems worldwide and this toxin poses a threat on human health. The extraction and detection of CYN and MC-LR in source water was well documented and information on contamination of CYN and MC-LR in biological samples are limited. CYN and MC-LR are the most toxic cyanotoxins that affects the function of kidney, liver and listed as one of the hypothesis for CKDu in Sri Lanka. Thus, the present study was carried out to determine contamination of CYN and MC-LR in randomly selected CKDu patients' and non-patients' (as control) urine. According to the statistics published by the Ministry of Health, Padaviya was selected as high prevalence of CKDu area for the study where Rajanganaya and Galnewa were selected as low prevalence of CKDu in Anuradhapura District. Angunakolapallessa in Hambanthota district was selected as control area considering the occupational exposure, climate and other demographic factors. Eight medical clinics were conducted in two districts (Anuradhapura and Hambanthota) and 225 people including CKDu patients and non-patients were recruited to collect urine samples. Along with the medical clinics, well water sample from each recruitment was collected for CYN and MC-LR analysis using the ELISA method. The collected, urine samples were subjected to CYN and MC-LR analysis, following centrifugation, pH manipulation and Solid Phase Extraction (SPE). CYN and MC-LR quantification was done using the High Performance Liquid Chromatography (HPLC). CYN and MC-LR concentrations in well water of Padaviya-Bogaswewa, Padaviya-Parakramapura, Galnewa and Rajanganaya were ranged between; MC-LR=1.0±0.01 µg l⁻¹-2.6±0.16 µg l⁻¹, CYN=1.0±0.01 µg l⁻¹-3.6±0.18 µg l⁻¹, MC-LR=1.0±0.01 µg l⁻¹-2.4±0.12 µg l⁻¹, CYN=1.0±0.01 µg l⁻¹-7.6±0.34 µg l⁻¹, MC-LR=1.0±0.01 µg l⁻¹-1.6±0.02 µg l⁻¹, CYN=1.0±0.01 µg l⁻¹-2.9±0.06 µg l⁻¹, MC-LR=1.0±0.01 µg l⁻¹-1.9±0.07 µg l⁻¹, CYN=1.0±0.01 µg l⁻¹-2.2±0.03 µg l⁻¹ respectively. Excitingly in Angunakolapallessa samples, neither MC-LR nor CYN detected in well water. Mean concentrations of CYN and MC-LR in urine samples were ranged between 1.0±0.01 µg ml⁻¹-8.6±0.26 µg ml⁻¹ and 0.2±0.01 µg ml⁻¹-2.4±0.12 µg ml⁻¹ in Padaviya-Bogaswewa where concentration between 0.8±0.23 µg ml⁻¹-4.1 ±0.16 µg ml⁻¹ and 0.6±0.01 µg ml⁻¹-1.2±0.12 µg ml⁻¹ recorded in Padaviya-Parakramapura. In Galnewa and Rajanganaya, mean concentrations of CYN and MC-LR were vary between 0.1± 0.01 µg ml⁻¹-1.6±0.09 µg ml⁻¹ and 0.1±0.01 µg ml⁻¹-0.7±0.04 µg ml⁻¹ respectively. However, none of urine samples were positive for either MC-LR or CYN in Angunakolapallessa. Thus, the results of the present study showed a positive relationship between MC-LR, CYN contaminations in well water and urine in CKDu patients of the study area. However, to clear out the hypothesis, further comprehensive studies are being investigated.

Keywords: Cylindrospermopsin (CYN), Microcystin-LR (MC-LR), Human Urine, Chronic Kidney Disease (CKD), HPLC