



CYANOBACTERIAL CYANOTOXINS AND WATER QUALITY IN WELL WATER AT CKDU ENDEMIC GIRANDURUKOTTE AND DEHIATHTHAKANDIYA, SRI LANKA

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ABSTRACT

Global occurrences of cyanobacterial blooms in aquatic systems have increased over recent decades due to anthropogenic eutrophication. Many of the blooms are highly toxic, presenting a serious hazard to human and animal health. The most commonly occurring toxins are the hepatotoxins (Microcystin-LR (MC-LR) and Cylindrospermopsin (CYN)) which are produced by many species of cyanobacteria. Recent studies have revealed the contamination of drinking dug wells by toxin producing cyanobacteria in the North Central, Uva and Eastern provinces. The increasing occurrence of toxigenic cyanobacterial densities, along with the increasing cases of CKDu, with no associated risk factor, therefore there is a need to investigate any correlation between cyanotoxins in CKDu prevalence areas. The present study records the presence of MC-LR and CYN producing cyanobacteria and cyanotoxins with reference to some important water quality parameters of well water in Girandurukotte and Dehiaththakandiya. The study was carried out for both dry and wet seasons. Water samples were collected from 32 ground water wells within the area. Water temperature, pH, conductivity, Dissolved Oxygen (DO) were measured at the site itself using standard methods. N-NO₃⁻, N-NO₂⁻, N-NH₃, Total Phosphorous and Total Hardness were measured by standard spectrophotometric and titrimetric methods. Water samples were subjected to quantify CYN and MC-LR using ELISA detection kits (minimum detection limit 0.1 ppb). Identification and enumeration of cyanobacteria were carried out under the light microscope (×400). Water temperature of the wells varied between 26.7 to 29.5°C during dry season and from 25.6 to 29.2°C during wet season. The pH values of water fluctuated from 6.08 to 7.89 during dry season and from 5.37 to 7.69 during wet season. DO ranged from 2.05 to 7.21 mg/l in both season. EC (90.7 – 596 S/cm and 87.6 – 478 S/cm), total hardness (28 to 142 mg/l and 37 – 98 mg/l) were within the range of drinking water standards in both seasons. The N-NO₃⁻, N-NO₂⁻, N-NH₃ and total phosphorous were recorded less than 0.01 mg/L in both seasons. All the tested general water quality parameters were within the SLSI standard given for drinking water. *Cylindrospermopsis* sp. was the dominant cyanobacteria during both seasons in all tested ground water wells. Mean cell densities of *Microcystis* sp. during dry (23 ± 0.03 cellmL⁻¹ - 57 ± 0.09 cellmL⁻¹) and wet (16 ± 0.09 cellmL⁻¹ - 80 ± 1.73 cellmL⁻¹) seasons. However, MC-LR was not detected. Mean cell densities of *Cylindrospermopsis* sp. during dry and wet season were 67 ± 0.04 cellmL⁻¹ - 998 ± 1.29 cellmL⁻¹ and 72 ± 0.19 cellmL⁻¹ - 678 ± 1.78 cellmL⁻¹ respectively, where as the mean concentrations of CYN during dry and wet season was ranged between 0.3 ± 0.01 µg l⁻¹ - 3.6 ± 0.08 µg l⁻¹ and 0.67 ± 0.04 µg l⁻¹ - 2.99 ± 0.06 µg l⁻¹. The CYN concentration in five sampling sites in well water in Dehiaththakandiya and three sampling sites in well water in Girandurukotte were exceeded WHO maximum permissible level (2 µg l⁻¹). Interestingly, relationship was found between CYN detected wells and CKDu patients who consume water from the wells (0.05 > p). Thus, the results of the present study showed a relationship between cyanobacteria, cyanotoxins and CKDu records in the study area. Accordingly, further comprehensive research studies are being carried out to confirm the relationship between CYN and CKDu in Sri Lanka.

Keywords: Microcystin –LR (MC-LR), Cylindrospermopsin (CYN), *Cylindrospermopsis* sp., *Microcystis* sp., Chronic Kidney Disease (CKD)