Spatial Association Between Groundwater Geochemistry and Chronic Kidney Disease of Uncertain Etiology (CKDu): An Investigation from the Uva Province in Sri Lanka

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The prevalence of Chronic Kidney Disease of Uncertain Etiology (CKDu) in the Uva Province of Sri Lanka has received much attention over the past two decades. Many scientists have proposed that prolonged consumption of groundwater with high levels of contaminants notably fluoride is the root cause of the CKDu. Thus, the prime objective of this study is to develop a water quality index (WQI) to identify the relationship between drinking water quality and the prevalence of CKDu in the Uva Province. For this, 230 groundwater samples were collected and subjected to spectrophotometric analysis for their major cations and anions covering the entire province. To get a comprehensive overall quality of the groundwater in the study area, the weighted arithmetic WQI method was applied based on the recommended guidelines for drinking water quality by the SLS 614:2013 (Sri Lankan Standard). The spatial distribution maps of individual water quality parameters and WQI were developed by using the Inverse distance weighted (IDW) method of interpolation with power 2 in ArcGIS 10.4 mapping software. Further, a spatial map of CKDu patients was developed based on the data collected from the regional hospitals and previously published data to assess the geospatial correlation between the water quality and CKDu. According to the WQI calculation, 21.5%, 21.2%, 20.0%, 10.0%, and 27.3% of water samples were categorized under excellent, good, poor, very poor, and unsuitable categories, respectively. The most significant geospatial correlation was recorded between fluoride content in the groundwater samples and WQI (0.96). Further, the statistical analysis showed that the WQI has a strong positive correlation (0.68) with the spatial distribution of CKDu patients inferring that groundwater quality has a significant effect on the prevalence of CKDu in the Uva Province, Sri Lanka. This study highlights that effective interventions are required to be implemented to enhance the availability of pure drinking water to combat CKDu.

Keywords: CKDu, Fluoride, GIS, Hydrogeochemistry, Spatial Analysis