TRACE ELEMENT PROFILING IN HUMAN KIDNEYS: AN AUTOPSY-BASED COMPARISON OF DEMOGRAPHIC AND LIFESTYLE DETERMINANTS IN SRI LANKA

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Abstract

Kidney cortical concentrations provide a robust biomarker of chronic trace element exposure. This study quantifies toxic trace elements; Cd, As, Pb and essential trace elements; Zn, Se and Cr in human kidneys to characterize exposure and bioaccumulation patterns in a Sri Lankan autopsy cohort. Right renal cortical tissues from deceased individuals (N = 20, 18-70 years) resided in Colombo Polonnaruwa, Monaragala and Vavuniya districts were collected during routine post-mortem procedures during 2019 – 2021. Lyophilized tissues were digested (*in-vitro*), and profiled using ICP-MS. Associations between elemental concentrations, demographic and lifestyle factors were evaluated using non-parametric statistical methods. The study population was predominantly male (n = 19), with a mean ± SD 44.20 ± 11.88 years. Macroscopic changes suggestive of chronic kidney disease were observed in two samples from Vavuniya. Median (IQR) cortical concentrations of Cd, As and Pb were 9.43 (15.51), 0.16 (0.10) and 0.17 (0.08) µg g^{-1} respectively, while Zn, Se and Cr concentrations were; 24.17 (11.42), 0.47 (0.30) and 0.26 (0.15) µg g^{-1} respectively. Elemental concentrations did not differ significantly across age groups or genders (p>0.05). Cd, Cr and Zn showed relatively greater accumulation in the middle-aged individuals. Cd, Zn and Se concentrations were higher among smokers (p>0.05), while all elements except Cr were elevated among alcohol users (p>0.05). Cd accumulation was significantly higher among non-betel chewers (p<0.05), whereas As was significantly higher among betel chewers (p<0.05). Cd correlated positively with Zn (τ_b = 0.516, p=0.001) and negatively with As (τ_b = -0.726, p<0.001), while Zn correlated positively with that of Se(τ_b = 0.453, p<0.05). The presence of both toxic and essential trace elements in human renal tissue reflects the cumulative influence of environmental exposure and physiological regulation. These findings provide important baseline data on renal trace element status in Sri Lanka and establish a foundation for human biomonitoring initiatives.

Keywords: Heavy metals, Essential minerals, Human biomonitoring, Kidney tissues, Contaminants