



Serum and urine fluoride levels in populations of high environmental fluoride exposure with endemic CKDu: a case–control study from Sri Lanka

W. B. N. T. Fernando · Nishantha Nanayakkara · Lishanthe Gunarathne · Rohana Chandrajith

Received: 21 June 2019 / Accepted: 9 October 2019
© Springer Nature B.V. 2019

Abstract Chronic kidney disease of uncertain etiology (CKDu) is a common health issue among farming communities in the dry zone of Sri Lanka where groundwater fluoride is known to be higher than recommended levels. Excessive environmental ingestion of fluoride is widely considered as a possible factor for the onset of CKDu. This study was carried out to evaluate the serum and urine fluoride levels in biopsy-proven, non-dialysis CKDu patients. Control subjects were selected from the same area without any deteriorated kidney functions. Serum and urine fluoride levels were determined by ion-selective electrode method. Higher content of serum and urine fluoride levels were observed in patients with chronic renal failures. In CKDu cases, the serum fluoride concentrations ranged between 0.47 and 9.58 mg/L (mean

1.39 ± 1.1 mg/L), while urine levels were varied between 0.45 and 6.92 mg/L (mean 1.53 ± 0.8 mg/L). In patients, urine fluoride levels showed a significant difference with the CKDu stage; however, no difference was obtained between genders and age. In endemic controls, serum and urine fluoride levels ranged between 0.51 and 1.92 mg/L (mean = 1.07 ± 0.3 mg/L) and 0.36 and 3.80 mg/L (mean = 1.26 ± 0.6 mg/L), respectively. Significantly higher fluoride in serum and urine was noted in CKDu patients compared to endemic control groups. Higher fluoride exposure via drinking water is possibly the reason for higher fluoride in serum, while excessive urinary excretion would be due to deterioration of the kidney, suggesting a possible nephrotoxic role of environmental fluoride exposure.

W. B. N. T. Fernando
Centre for Education, Research and Training on Kidney Diseases (CERTKiD), Faculty of Medicine, University of Peradeniya, Peradeniya, Sri Lanka

N. Nanayakkara
Transplant and Dialysis Unit, Teaching Hospital, Kandy, Sri Lanka

L. Gunarathne
Base Hospital, Girandurukotte, Sri Lanka

R. Chandrajith (✉)
Department of Geology, Faculty of Science, University of Peradeniya, Peradeniya, Sri Lanka
e-mail: rohanac@pdn.ac.lk

Keywords Chronic kidney disease of uncertain etiology (CKDu) · Ion-selective electrode · Kidney failure · Potable water · Human biomonitoring

Introduction

Fluoride is the most electronegative and chemically reactive element that naturally occurs in many geological environments. It is ingested by humans mainly through drinking water, while the essentiality and toxicity to humans remain controversial (Usuda