

Abstract No: 201

Geomedicinal aspect of widespread geogenic arsenic in south-and-northeast Iran (Bijar and Chelpu) with its hazardous molecular immunotoxicity for inhabitants

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Abstract

Background: Geologically, arsenic (As) appears in water, feed/food and soil in Bijar and Chelpu districts, Kordistan and Khorasan Razavi provinces. Determination of as in macro-and-microenvironments in the region with its impact on some health and immunity were the purpose of this study.

Materials & Methods: As in soil/drinking water and urine/hair (n=56) was measured by ICP-MS and atomic absorption, respectively. Urine and hair samples were collected from individuals living in the area. Many questionnaires were completed and analyzed accordingly, and observed health disorders in human and animals, especially sheep, living in Bijar and Chelpu districts were recorded. Finally, in vitro, 20 ng/ml of As was exposed to human monocyte-derived dendritic cells (MoDCs) for 2h and gene and protein expression of key innate immune molecules, TLR2 and TLR4, was analyzed with qPCR and flow cytometry. As concentration in soil and water was 7000-6000 µg/Kg and 20-700 µg/l, respectively. With many related health disorders in inhabitants, urine as concentrations (µg/l) in human and sheep ranged 9-63 and mostly >1000, respectively (more severe in Bijar). Hair/wool as concentrations (µg/g) in human and sheep ranged 0.37-3.8 and 0.3-52, respectively. Compared to nontreated MoDCs, expression levels of both TLR2 and TLR4 genes and proteins were remarkably upregulated in As-treated MoDCs.

Results & Conclusion: Our finding shows that exposure to geo-genetic As not only deteriorates human's and animals' health but also causes immunotoxicity, and this immunotoxicity is partially caused through signaling on key TLRs. Molecular aspects of geogenic As versus geomedicine, health and immunity are being taken into deep consideration in Faculties of Veterinary Medicine and Science at Ferdowsi University of Mashhad.

Keywords: Arsenic toxicity, Drinking water, geogenic, Immunotoxicity, Toll-like receptors, dendritic cells