

BIOLOGICAL AND STATISTICAL NATURE OF ARSENICOSIS RISKS FROM CHRONIC ARSENIC EXPOSURE IN DRINKING WATER AND FOODSTUFFS IN BANGLADESH

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Environmental pollution has been considered as one of the burning questions since the accentuated increment of the global population, whether they have been caused by artificial activities or by natural hazards. Arsenic (As) contamination in groundwater is one of such critical human health crisis. Nevertheless, groundwater As contamination and its chronic toxicity by drinking water have been reported as a global public health and environmental disaster. Such a devastating environmental catastrophe has aggravated the public health of Southeast Asian countries including Bangladesh. The severe As contamination of groundwater across southern, central and eastern Bangladesh has recently been considered as the biggest environmental and human health disaster, wherein large parts of the total population are facing tremendous health risks and challenges. Since its detection in Bangladesh in 1993, the increase in As poisoning has been causing a devastating human health crisis. This study was carried out to investigate biological and statistical nature of arsenicosis risks on a severely As affected population in the Banglish and Eruani villages under Laksam Upazila in Comilla district of Bangladesh. Six hundred and nineteen subjects (383 females, 236 males) including 390 confirmed arsenicosis patient's hair and seventeen foodstuffs (11 fishes and 6 vegetables) samples, 13 well waters, 9 pond waters, 10 agricultural waters and a coconut juice from Bangladesh were analyzed using the Proton Induced X-ray Emission (PIXE) method and arsenicosis status of the subject was examined by a physician. Assessment of biological and statistical nature of arsenicosis risk from groundwater arsenic contaminations with drinking water, foodstuffs were performed by multiple logistic regression models. Statistical analyses were performed by means of Excel and JMP 8.7i.

Obtained results of this study are summarized as follows.

High-level As is detected even in the well water which has been kept drinking by the people. Relatively high arsenic concentration was detected for some pond and farm waters even though sampling was performed just after the rainy season and the waters are expected to be highly diluted. Clear relationship was observed in elemental compositions between the pond water and the coconut juice collected at the edge of the water.

The results revealed that hair As accumulated in different pattern for males and females depending on age.

Within the patients group, male patients accumulated higher As amounts than female patients. For all individuals, adult females accumulated higher As amounts in hair than children, adolescents and ≥ 50 older females, while children, adolescents and ≥ 50 aged males accumulated higher As in hair than middle aged males in both villages. Surprisingly, high levels of As concentrations were found in hair samples, of those living near safe drinking water in both villages, irrespective of age and sex. There were found weak positive correlations between hair As levels and groundwater As levels in both villages. Furthermore, toxic levels of As were found in many food-stuffs. These results suggest that ingestion of food with high As content could be an important human exposure route. Multiple logistic regression model analysis showed that arsenicosis risks are not only the devastating toxicity of As accumulation in human body through ingestion of contaminated drinking water, but the summation of all sources of As accumulation.

Arsenicosis was found in 45% female and 61% male subjects. Well waters As levels >0.50 ppm showed greater arsenicosis risks that significantly varied with subject's sex and age. Unlike children, young (≥ 10 years) to middle aged (~ 49 years) population were significantly affected by arsenicosis. Human hair As levels were found as the biomarker ranging from $0.03\text{--}8.3\mu\text{g/g}$ in stage I arsenicosis patients, and from $1.1\text{--}56.9$ ppm in the stage II patients up to 49 age. Hair As level was declined to $2.2\text{--}25.5$ ppm at >49 aged population. The findings inferred that groundwater As affecting the public health through contaminating total environment, that in turn posing an alarming situation in the study area.

Therefore, further investigation is necessary to arsenic speciation and to find out suitable mechanisms of transportation of toxic elements in the contaminated soil or water to farm product. Furthermore, we are planning to conduct a questionnaire survey on arsenicosis affected and non affected families of severe As area in coming February, 2012. Our main objectives of proposed study to determine the association between arsenicosis and As speciation level of arsenicosis patients daily food customs.