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Food Chain Arsenic: Additional body burden on health of arsenic

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ABSTRACT

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Introduction

Arsenic: The king of poisons, the poisons of kings, and the bane of investigators¹. The IARC² has classified arsenic as a group 1 human carcinogen. Chronic exposure to inorganic arsenic can cause cancerous²⁻⁵ and non-cancerous health hazards^{6,7} in humans. Arsenic can get entry into the human body via drinking water, eating food, inhaling dust, and/or ingesting soil.

In arsenic affected areas of West Bengal-India and Bangladesh huge quantity of arsenic is falling on agricultural land.

A study in West Bengal-India reported that in a 201 km² area of the Deganga block in the arsenic-affected district of North 24-Parganas, 6.4 tons of arsenic is falling on agricultural land in one year from 3,200 contaminated tube wells for agricultural irrigation⁸. They expect tons of arsenic is coming with underground water in the arsenic affected areas of West Bengal-India and Bangladesh, and falling on irrigated land. Thus, it is expected arsenic is entering the food chain.



Figure. Using arsenic contaminated underground water for agricultural irrigation.

Rice and vegetable are the staple food for poor villagers of West Bengal, India and Bangladesh. This is true for the villagers in Kolsur gram-panchayet (G.P.) in Deganga block of North 24-Parganas district, West Bengal-India, where a group of researchers studied for arsenic in soil, rice, and vegetables from fields cultivated with arsenic contaminated water. From the results of total arsenic (drinking water + rice + vegetables + Pantavat + water added for food preparation) body burden to North Kolsur villagers [1185.0 µg for per adult per day and 653.2 µg for per child (around 10 years old) per day], as the amount of arsenic coming from rice, vegetables, and water added for Pantavat and food preparation is 485 µg i.e., 41% of total for adult and 253.2 µg i.e., 38.8% for child, and from rice and vegetable 285 µg i.e., 24% of total for adult and 153.2 µg i.e., 23.4% for child⁹⁻¹¹. Their findings show most of the arsenic coming from food is inorganic in nature¹⁰. They reported that 95% and 5% of the arsenic are inorganic arsenic and methylated arsenic in rice, and 96% and 4% are inorganic arsenic and methylated arsenic in vegetables, respectively¹⁰.

According to the WHO¹², 1.0 µg of inorganic arsenic per day may give rise to skin effects within a few years.

It has been estimated that based upon the current U.S. Environmental Protection Agency (EPA) standard of 50 µg As/L, the lifetime risk of dying from cancer of the liver, lung, kidney, or bladder, from drinking 1 liter per day of water could be as high as 13 per 1000 persons¹³. Using the same methods, the risk estimate for 500 µg/L of arsenic in drinking water would be 13 per 100 persons¹⁴. In its latest document on arsenic in drinking water, the U.S. National Research Council (NRC) concluded that exposure to 50 µg As/L could easily result in a combined cancer risk¹⁵ of 1 in 100. Comparing to the WHO, EPA, and NRC document with arsenic burden to Kolsur villagers from water and food it appears that Kolsur villagers' risk of suffering from arsenical skin effect and cancer. Compared to worldwide arsenic consumption from food, it appears Kolsur villagers are also consuming high amount of inorganic arsenic from food and vegetables. Kolsur village is an example of many such villages in West Bengal-India and Bangladesh. Furthermore, products from arsenic irrigated water- soil system rich in arsenic are also coming to common marketplace far away from contaminated areas and even people who are not drinking arsenic contaminated water may get arsenic from food products produced from contaminated fields. In West Bengal-India and Bangladesh rice, vegetables, and other products are coming to cities (including Kolkata in West Bengal-India and Dhaka in Bangladesh) from villages and possibility that city people consuming arsenic contaminated products from contaminated areas cannot be ruled out.

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