



Subject Area : Environmental

HEALTH HAZARD CAUSED BY DRINKING ARSENIC CONTAMINATED WATER AND STATUS OF DRINKING WATER SUPPLY IN THREE ARSENIC ENDEMIC BLOCKS OF MURSHIDABAD DISTRICT OF WEST BENGAL

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ARTICLE INFO	ABSTRACT
Received 13 th May, 2025 Received in revised form 25 th May, 2025 Accepted 19 th June, 2026 Published online 28 th June, 2026	Background and Objectives: Health hazard due to arsenic contamination of ground water is a major problem in West Bengal. An epidemiological study was conducted in Murshidabad, one of the severely arsenic affected district of West Bengal. Prevalence of arsenicosis along with quality of drinking water and its availability to the people have also been assessed.
Key words:	Methods: A population based cross sectional study was done in three arsenic affected blocks of Murshidabad. Identification of arsenicosis cases was done. Water from household tube well and other sources was tested for arsenic and availability of safe water was assessed. Results: 812 cases of arsenicosis with typical skin lesion and 14 cases of suspected skin cancers were detected out of 6229 participants examined in 2340 households studied in three arsenic affected blocks of Murshidabad. Out of 890 household water samples tested 57% samples were found to be contaminated with arsenic (>0.01mg/L). Out of 85 habitations surveyed, 51 habitations had pipelines for supplying arsenic safe water. However, supply was regular in 28 habitations only.
Arsenic epidemiology, Arsenicosis, Water quality, Safe water accessibility, availability,	Conclusion: Significant number of arsenicosis and cancer cases were identified in Murshidabad district. Large number of home tube wells were found contaminated with arsenic. In spite of presence of Government tube wells and pipelines in arsenic affected habitations, safe water was not available to most people.
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INTRODUCTION

Arsenic contamination of groundwater, used for drinking and cooking purposes has been considered as a problem of global concern. Arsenic contamination in drinking water has been reported from many countries, but the severity of this contamination in India and Bangladesh is unprecedented. In India, occurrences of arsenic in groundwater have also been reported from Bihar, Jharkhand, Chhattisgarh, Uttar Pradesh and Assam besides West Bengal.¹ Over and above pigmentation and keratosis, arsenicosis produces manifestations like weakness, chronic respiratory disease, peripheral neuropathy, liver fibrosis, peripheral vascular disease etc.^{2,3} Chronic arsenicosis leads to irreversible damage in several vital organs, and arsenic is an established carcinogen. Despite the magnitude of this potentially fatal toxicity, there is no effective therapy for this

disease; patients once affected may not recover, even after remediation of the arsenic-contaminated water.

Though various states of eastern India have been affected with the arsenic problem, West Bengal has been affected most. In West Bengal, 26 million people are potentially at risk from drinking arsenic-contaminated water (above 0.05mg/L). The estimated number of tube wells in 8 of the highly affected districts is 1.3 million, and estimated population drinking arsenic contaminated water above 10 and 50 µg/L were 9.5 and 4.2 million, respectively.² The contamination of ground water with arsenic was first detected in 1978, and the first cases of chronic arsenic toxicity were reported in early 1980s.³⁻⁵ Most of the affected villages are located along the eastern side of the Ganges River. A survey which was limited to regions with levels >0.05mg/L in West Bengal indicated that the arsenic concentration was generally between 50 to 500 µ/L (permissible limit <10µ/L WHO) in the drinking water supplies.⁶ However, concentrations have reached nearly 3400 µ/L in some villages⁷

The reported clinical manifestations resulting from ingestion

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of arsenic-contaminated drinking water include pigmentation and keratosis of skin, weakness, conjunctival congestion, anaemia, hepatomegaly, portal hypertension, respiratory system effects, poly neuropathy, solid edema of limbs, and malignant neoplasm.⁷ Skin abnormalities such as pigmentation change and keratosis have been known to be hallmark signs of chronic arsenic exposure. Skin lesions pose an important public health problem because advanced forms of keratoses are painful and debilitating.⁹ The arsenic-induced skin lesions may be associated with increased risks of skin, bladder and lung cancers, although increased cancer risks may result even without skin lesions being present.¹

Arsenic contamination in ground water has been detected in 83 blocks in 8 districts of West Bengal. Out of these, Murshidabad is one of the severely arsenic affected districts situated farther north from Kolkata with a population of 5.3 million residing in an area of 5324 km². To understand the severity of the arsenic crisis in the district, a detailed, 3-year study was undertaken in Murshidabad, earlier. (Rahaman et al 2005) During the study the investigators analyzed 29,612 hand tube well water samples for arsenic from both contaminated and non-contaminated areas, and out of the tube wells 53.8% had arsenic above 0.01 mg/L. Of the 26 blocks in Murshidabad, 18 Blocks surveyed were having significant contamination of water with arsenic >0.1mg/L. A Population of 1343866 live in these 18 blocks having 354 villages. Arsenic patients were identified in 12 blocks of the district. A total of 4813 (19%) patients were found out of 25274 subjects examined. Out of these, more than 100 patients were found in each of 7 blocks out of 12 blocks having patients.⁸

OBJECTIVE

1. To detect Arsenicosis patients in the population residing in the selected households of three Arsenic selected Blocks of Murshidabad district in West Bengal: and offer treatment to arsenic cases
2. To determine current exposure of arsenic by testing water for arsenic from drinking water source among the study population
3. To assess the current status of availability of safe water in the area for future mitigation measures

METHODOLOGY

Out of 12 arsenic affected Blocks of Murshidabad District, 3 Blocks Domkal, Jalangi, and Raninagar II were selected where patients have been identified in the previous study for household survey to ascertain prevalence of arsenicosis cases in the district. The target villages have been identified on the basis of water testing data of high arsenic level in tube wells in the villages as reported by PHED on the basis of earlier testing of public tube wells of the district jointly by UNICEF and PHED, Govt of West Bengal. 31 villages were selected where at least one tube-well was contaminated with arsenic at a level >0.1mg/L by proportional allocation depending on the number of villages in the blocks (stratum) affected due to arsenic in the district. The sample villages from each block are selected randomly with probability proportional to size (PPS) sampling method.

Finally, 2340 households were selected for house survey by systematic sampling with a random start procedure based on total number of house hold planned to be studied per village after preparing a village map and listing of households.

Study tools: Predesigned and pretested proforma. and check-list

Method of data collection

A proforma was prepared with series of questions which would gather information about the clinical manifestation of the participants with Arsenicosis and water usage pattern for cooking and drinking by the family,

Each member of the household was interviewed and examined by trained field workers of DNGM Research Foundation. The trained interviewer takes history regarding presence of any symptom, especially any skin disease from the participant. A careful inspection for arsenical skin lesions is carried out and are recorded in the proforma

The trained field workers identified the signs and the symptoms and classify the arsenical skin lesions as suspected cases including Bowen's Disease and Cancer. The photographs of skin lesions were taken and saved. The photographs of the above suspected patients were re-examined in Kolkata by Arsenic Expert to confirm the final diagnosis..

Each participant are questioned briefly about his or her current sources of drinking and cooking water, and duration of water usage from the source.

The criteria for classifying arsenical skin lesions i.e. Keratosis and Pigmentation are as follows. Keratosis is characterized by diffuse bilateral thickening of palms and/or soles with or without nodules of various shapes and sizes. Pigmentation is identified if there are areas of mottled dark brown pigmentation bilaterally and symmetrically distributed on the trunk and extremities. Sometimes spots of depigmentation also occurred,

A list of patients were prepared and shared with concerned BMOHs (Block Medical officer of Health) of the above selected blocks and CMOH (Chief medical Officer of Health), and Deputy CMOH II (Deputy Chief medical Officer of Health II) of the district for information, future surveillance, follow up and necessary action

Water sample collection

Ground water samples from surveyed households were collected and given to PHED water test laboratory for testing for Arsenic.

The test reports were shared with the villagers, so that they would be careful about using their tube well for drinking and cooking..

Water supply status of the study area was assessed by surveying 89 habitations'

Ethical clearance

Approval of the study protocol was obtained from the Ethical Committee of the DNGM Research Foundation, fulfilling the recommendation of the Indian Council of Medical Research, Government of India.

RESULTS

812 (13%) cases of arsenicosis identified out of 6229 participants examined during 2340 house to house survey. Out of which 799 patients had pigmentation 56% of pigmentation were mild, 38% were moderate and 6% were severe, Out of 812 patients, 229 patients had keratosis, 55% were mild, 39% moderate and 7% severe. 115 (1.85%) cases of Bowen's disease (Locally malignant) and 14 (0.22%) cases of suspected skin cancer were also identified 1000 Water samples were collected from drinking water sources out of which 890 samples were collected from home tube wells for arsenic testing at PHED laboratory. Out of 890 Household water samples from home tube wells tested 57% of samples were found to be contaminated with arsenic >0.01mg/L (max level - up to 0.899.) Indicating 57% of study population still using arsenic contaminated water for cooking or drinking and 55.4% of water samples collected from different sources were found to be arsenic contaminated. [Table 1]

Table 1. Distribution of arsenicosis cases according to severity and presence of cancer patients. N= 812.

Nature of lesion	No	%
Pigmentation		
Mild	457	56
Moderate	291	36
Severe	51	6
Keratosis		
Mild	125	55
Moderate	89	39
Severe	15	7
Bowen's Disease	115	1.85
Cancer	14	0.22

Out of rest 110 water samples collected from other sources 67% of water samples collected from PHED pipe line and 48% from community filters were also found to be contaminated with arsenic >0.01mg/L (Max levels : 0.096 and 0.085 respectively) [Table 2].

Table 2. Distribution of water samples tested according to different source of collection N=1000

Source of collection	No of Water Sample Collected	No of Water Sample Tested	No Safe Water <0.01 mg/L	% of Safe water	Arsenic contmd Water	% of Arsenic contmd water	Max level
Home Tube well	890	890	385	43	505	57	0.899
PHED PIPE Line	12	12	4	33	8	67	0.096
Purchased Water	29	29	24	83	5	17	0.025
Community Filter	31	31	16	52	15	48	0.085
Dug Well	3	3	3	100	0	0	0-0.001
Govt Tube well	35	35	14	40	21	60	0.001-0.178
Total	1000	1000	446	44.6	554	55.4	

Results of arsenic testing report of home tube wells 's were intimated to the residents of households asking them to change to use water from safe source, e.g. pipe water for cooking & drinking purpose if found contaminated.

People told not to use contaminated tube wells water for drinking and cooking but can use it for other purpose

Awareness generation on Arsenicosis prevention were carried out and misconceptions about the disease was rectified during interpersonal communication

Water supply status: Out of 89 habitations surveyed,

- A) Pipeline was present in 85 habitations, Out of thesei) 28 habitation had regular water supplyii) 6 Habitations had irregular water supply and iii) 51 habitations having pipelines but no water supply
- B) Pipeline absent in 4 habitations

District PHED officials were apprised of safe water supply issues and follow up actions were taken for corrective measures to prevent arsenic exposure to the affected people.

DISCUSSION

In the current study prevalence of arsenicosis was found to be 13% in the selected blocks of Murshidabad district which was comparatively lower than that found in previous study in Murshidabad (19%)⁸ and in nearby districts like Nadia district (15.43%)⁹ and higher than Malda district (8.3%)¹⁰ in West Bengal. In the current study 6% and 7% of pigmentation and keratosis were found to be severe and 1.85% cases of Bowen's disease (Locally malignant) and 0.22% cases of suspected skin cancer were also identified. Similar study in adjacent Malda District showed that pigmentation was severe in 5.9% cases. Arsenical keratosis severe in 4.3% cases and 13.5% cases of Bowen's disease and 1.79% cases of suspected skin cancer were also identified¹⁰.

Though as many as 812 cases of arsenicosis were identified in the selected blocks of Murshidabad district adequate information was not available to local block and district health authorities.

It is alarming to note that as many as many as 505 (57%) samples out of 890 household water samples tested were found to be contaminated with arsenic (>0.01mg/L) tested from home tube wells of the participants surveyed. In a similar study conducted in adjacent district of Malda by Guhamazumder et al

2020¹⁰ it was found that out of 1638 water samples tested from home tube wells, 78% of water samples were found to be contaminated with arsenic >0.01 mg/L.

In the current study it was found that out of 83 habitations sur-

veyed, 28 habitation had regular water supply, 6 Habitations had irregular water supply and 51 habitations having pipelines but no water supply and pipelines were absent in 4 habitations. However similar study in adjacent Malda District¹⁰ showed that out of 81 habitations surveyed, 68 habitations had pipelines constructed for supplying arsenic safe water. However, supply was regular in only 4 habitations.

Household water security and availability and accessibility of safe water is the only way to prevent development of arsenicosis.

It is a matter of great concern that many of the people living in arsenic affected area are still drinking arsenic contaminated water from their home tube wells in spite of Govt.'s effort of supplying safe water. It is imperative that Government policy should be taken to test water from all private tube wells and take control on the installation and monitoring of private tube wells so that people do not continue to use arsenic contaminated water for drinking and cooking. People need to be made aware not to use arsenic contaminated water for drinking and cooking for prevention of arsenic related health hazards.

It is also a matter of concern that there was a lack of satisfaction of people in villages about the supply of arsenic free water as 55.4% of water samples collected from different sources were found to be arsenic contaminated. The reasons for dissatisfaction are non-availability and irregularity of piped water supply. It is also deplorable that there was lot of wastage of pipe water supply by pilferage of water from pipeline.

It appears that there is a gap between water supply system and community benefit of getting safe water. There is also lack of supervision for ensuring regular safe water supply through constructed pipelines and taking corrective measures for preventing pilferage. Further regular checking of quality of tube well water need to be done.

A sustained system of maintenance of regular supply of safe water with regular testing need to be developed at the level of local Government and Panchayet with active participation of local community to develop the community ownership in maintaining the water supply system for their own benefit. Addressing communication gap and creating a communication platform is essential for future mitigation of arsenic problem.

CONCLUSION

In the current study prevalence of arsenicosis was found to be 13% along with skin cancer cases in the selected blocks of Murshidabad district. Household water security and availability and accessibility of safe water is the only way to prevent development of arsenicosis. Significant numbers of arsenicosis cases were identified in the selected Blocks of Murshidabad district. Large number of home tube wells were found to be contaminated with arsenic. In spite of presence of Government tube wells and pipelines in most arsenic affected habitations, safe water was not available and accessible to most people. Awareness generation and development of a system of maintenance of regular supply of safe water with regular testing at the level of local Government and Panchayet is necessary with active participation and involvement of local community for future mitigation of arsenic problem.

Acknowledgment

Water samples collected from households of study participants were tested by chemist of PHED Department of Government of West Bengal from the Murshidabad District laboratory for which we offer gratitude to Director, WSSO, PHED for giving permission. The Foundation expresses great appreciation to all the team members of the study specially Ranjit Sardar and Ayan Kanrar, for the tireless service given by them during field work and data management at the office, without which the study would not have been possible.

Conflict of interest

The authors declare no conflict of interest.

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