

HEALTH AND SOCIAL IMPACT OF ARSENIC TOXICITY IN RURAL AREAS OF KAMRUP DISTRICT, ASSAM, INDIA

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ABSTRACT

Arsenic exposure on human society is potentially grave and may extend from general malaise to death. Arsenic in water is a vital problem in many countries around the world including Bangladesh, India, and China etc. Arsenic patients of the study area are suffering from several clinical and non-clinical symptoms. Arsenic contamination in ground water and related health hazards has serious concerns in the study area. Excessive intake of arsenic in human body causes skin pigmentation, skin cancer, cardio-vascular diseases, lung and liver carcinoma etc. In the study area levels of arsenic contamination in ground water is higher than the WHO limit (10µg/L). All surveyed villages of the study area are situated in the flood plain region of river Brahmaputra. The aim of this research paper is to investigate the spatial distribution pattern of arsenic contamination in the study area. Another aim is to study about arsenic toxicity. Water samples were collected from six selected villages that are Gopeswar and its neighbouring villages to know the level of arsenic contamination in groundwater. Samples were collected from tube wells used for drinking, cooking and other household purposes. Based on field data arsenic distribution map have been prepared with the help of Geographical Information System. The coordinates of the locations were recorded using Geographical positioning System machine. It was found that Gopeswar and its neighbouring villages have arsenic contamination more than World Health Organization limit i.e. 10 ppb.

Key Words- Health, Social, Arsenic and toxicity

INTRODUCTION

Arsenic is naturally occurring chemical element that found in the earth crust with symbol 'As' raised greatly concern from environment and health perspective. According to United States Environment Protection agency arsenic is a harmful substance and a group 'A'- carcinogen. Arsenic is a group 'V' heavy element which atomic number 33 and its atomic weight 74.9amu, specific gravity 5.73g/cm. Drinking water is one of the main source of arsenic toxicity. According to World Health Organization the limit of arsenic in drinking water is 10 million of a gram per liter (10 μ g/L) of water (WHO, 1996). In developing countries many people use drinking water with arsenic contamination higher than WHO limit. Arsenic is added into water through the dissolution of rocks, minerals and ores from industrial effluents, including mining wastes and via atmospheric deposition.

Arsenic in water is a vital problem in many countries around the world including Bangladesh, India, and China etc. According to the United Nation, 2006 more than 1 billion people already lack access to fresh drinking water (UNDP, 2006). Global consumption of water is doubling in every 20 years, more than twice the rate of human population growth. Water which is used by human must be free from physical, chemical and biological contamination. Arsenic is known water contaminant raising big health issues in India (ATSDR, 2005).

In India groundwater arsenic contamination and health effect was first reported in 1997 in Chandigarh (Datta, 1976). Nearly 80 per cent of the rural population of the rural domestic needs is fulfilled by groundwater (Agulier, 2011). In present time groundwater potential of 4, 22,900 million cubic meter is available for utilization and about 1,00,000 million cubic meters is being exploited (Kumar,2004). Arsenic can be found in groundwater of Brahmaputra valley in Assam because Assam valley is highly ferrous. Many people of the study area use drinking water with high level of arsenic contamination because they are not concern about arsenic.

OBJECTIVES

Based on the background outlined above, the main objectives for the study are

- (i) To understand distributional pattern of groundwater arsenic contamination of the study area
- (ii) To investigate the impact of arsenic toxicity in six villages of Kamrup district of Assam

STUDY AREA

Study region lies approximately between $26^{\circ}17'56.05''$ and $26^{\circ}20'32''$ north latitudes and $91^{\circ}43'26.93''$ and $91^{\circ}45'51.55''$ east longitudes. Six villages of the study area are Katnipara Village, Bhitarkhola Village, Bhitarkhol N.C village, Barmula Village, Alipub Village and Gopeswar village.

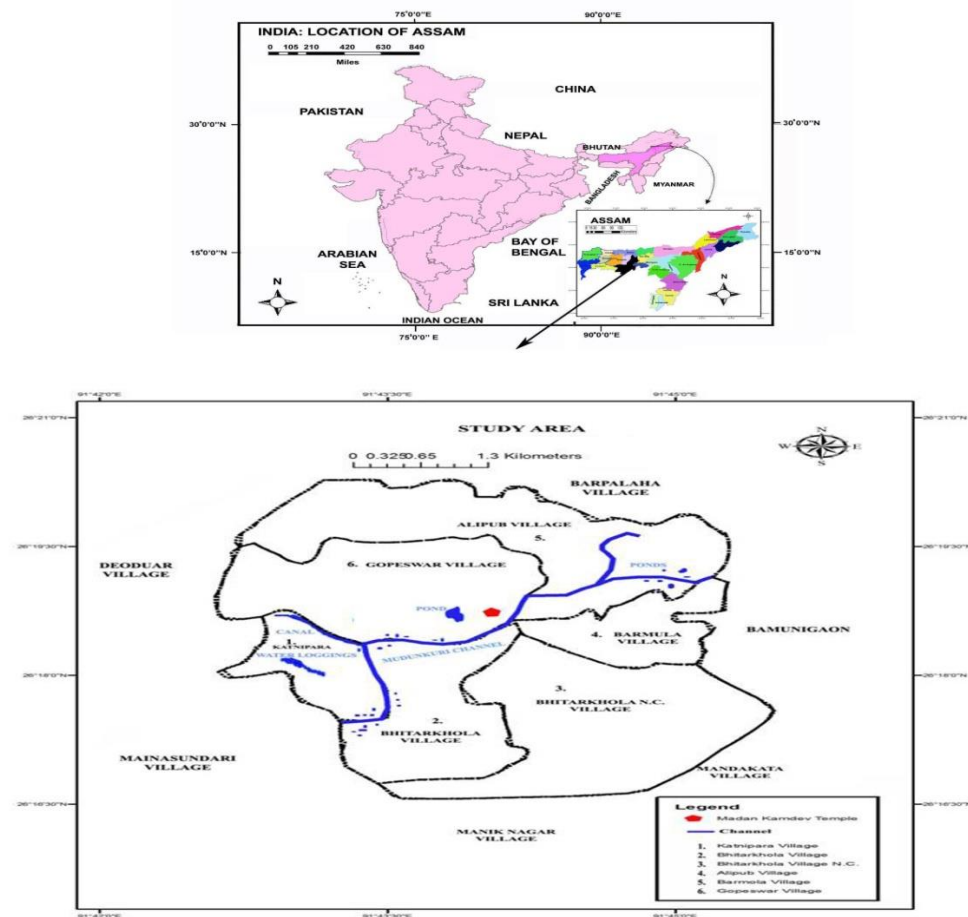


Figure 1: Location of the study area

METHODOLOGY

The data necessary for the study have been gathered from both primary as well as secondary sources. Spatial distribution pattern of arsenic concentration groundwater samples were collected from different sources like private and public tube wells from different villages. With the help of G.P.S. groundwater points have been located. Spatial distribution map for arsenic have been prepared with the help of GIS software. Secondary data have been collected from published and unpublished books and journals, census records, topographic map of India, along with data and information collected from circle office, census of India, and other Government office. Household survey for arsenic presence has been conducted with the help of questionnaire. Meaningful quantitative, cartographic and computer techniques and software like Arc GIS 10.4, MS Excel etc. have been applied in processing and representing the data in the form of tables and maps.

RESULT AND DISCUSSION

Distributional pattern of groundwater arsenic contamination of the study area

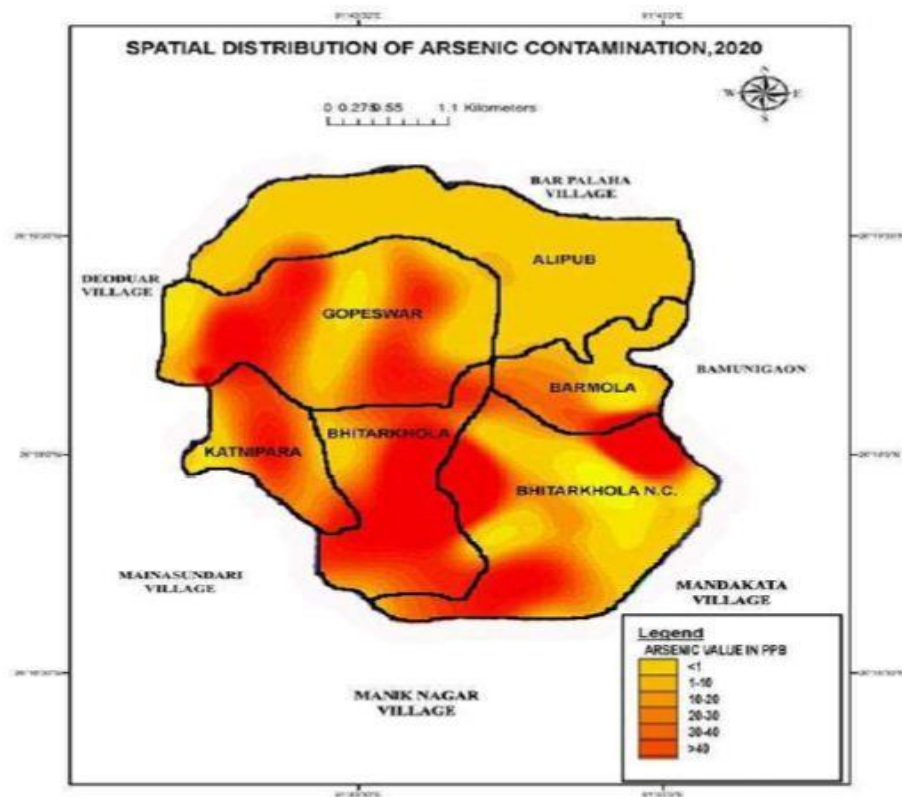


Figure2: Spatial distribution of arsenic contamination of the study area

Level of arsenic in the study area: Identification of spatial distribution of arsenic contamination has been mapped by considering the WHO standard. Village wise distributions of arsenic in six villages are shown in Table1. From the total analyzed samples (n=30), 43.30 per cent samples were found above WHO limit and 56.70 per cent samples were under safe limit. In our study area there is no any sample above 40 ppb. In Gopeswar village we have collected 5 samples. We have not fine any sample below 1 ppb in that village. We have found 3 samples above 10 ppb in that village. In Alipub village 4 samples were found less than 1ppb and only one sample found which 8 ppb. Barmula village have 2samples below 1ppb and 3 samples beyond 10 ppb. In Bhitarkhola village 2 samples were under safe limit and 3 samples were found beyond 10 ppb. Bhitarkhola Non cadastral village has no any sample under safe limit all 5 samples were found above 10 ppb. In katnipara village 1 sample found below1 ppb and other 4 samples were above 10 ppb.

Health and social impact of arsenic toxicity

Arsenic affects a broad range of organs and system including skin, nervous system, respiration system, liver, kidney, immune system etc. Arsenic poisoning occurs due to the high level of arsenic in the body. Most common symptoms for arsenic poisoning are black foot diseases, gangrene etc. There are some symptoms for arsenic poisoning which include abdominal pain, vomiting and watery diarrhea that contains blood. Due to long term expose of arsenic cancer, heart disease, darker skin etc may be occurs. Chronic exposure to arsenic causes numerous toxic effects and is classified as group -1 carcinogen in human.

Cardio-Vascular Effects

Most of the people suffering from arsenic toxicity belonged to weak economic status. Major half of them were agricultural laborers. Nutrition is a major issue of the people in the study area. Arsenic has deleterious effect on the heart and peripheral vascular system capillary dilation with fluid leakage may cause severe hypovolemia and hypotension.

Respiratory Problems

Arsenic from drinking water has been associated with different malignant and non-malignant respiratory illnesses. During survey basically screened the non-carcinogenic symptoms.

Carcinogenic Manifestation

Arsenic exposure leads to carcinogenic manifestation. Some patients from villages died from lung cancer. It is the most severe health concern from arsenic injection.

Socio-Economic Implications

Arsenic toxicity affected people face great difficulties in carrying out normal social life. They gradually lose their working ability. Village people become reluctant to establish marital relationship with those families suffering from arsenic diseases. There is strong relationship between arsenic disease and poverty.

Table 1: Survey profile of the epidemiological household's survey, 2021

Village	Household surveyed	Total people interviewed	People affected by arsenic toxicity
Bhitarkhola N.C.	05	11	02
Barmula	12	12	02
Gopeswar	32	20	01
Katnipara	40	21	04
Bhitarkhola	35	22	06
Alipub	22	14	05

Source: Household Survey, 2021

Total one hundred people were interviewed from six different villages of the study area.. Bhitarkhola village has six patients suffering from arsenic disease and Gopeswar village has only one patient suffering from arsenic diseases out of total surveyed people.

Table 2: Occupational, Income and Educational status of the arsenic patients, 2021

Occupational	Status	Income	Status	Educational	Status
Primary	50%	<10,000	80%	Illiterate	60%
Secondary	25%	10,000-20,000	10%	Below HSLC	20%
Tertiary	25%	Above 20,000	10%	Above HSLC	20%

Source: Household Survey, 2021

Table 3: Age-sex wise distribution of patients found during household survey, 2021

Age group	Below 20		20-40		40-60		Above60	
	Male	Female	Male	Female	Male	Female	Male	Female
Bhitarkhola	0	0	0	1	0	0	0	1
N.C.								
Barmula	0	0	1	0	1	0	0	0
Gopeswar	0	0	0	0	0	0	0	1
Katnipara	0	1	0	1	0	2	0	0
Bhitarkhola	1	0	2	0	1	0	0	2
Alipub	0	1	0	0	0	2	2	0

Source: Household Survey, 2021

Half of the arsenic patients have income less than ten thousands and they are engaged in primary activity. Educational qualifications of the patients are very low. Sixty per cent patients are female and others forty per cent patients are male.

CONCLUSION

The study provides an overview about the impact of arsenic toxicity through health and socio-economic consequences among the affected victims. The poor, half literate people engaged in hard physical labor are mostly affected with arsenicosis disease. Mitigation strategies are very important for arsenic contaminated area. In the study area people are not aware of arsenic contamination and its effect. People have not enough knowledge about arsenic contamination in drinking water. It is very important to give them knowledge about arsenic contamination and its related diseases. Present study will help to find out mitigation strategies in reducing arsenic contamination and related diseases.

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