

STUDY OF SUBJECTIVE WELLBEING OF ADULT POPULATION IN ARSENIC CONTAMINATED RURAL AREAS OF WEST BENGAL

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ABSTRACT

Ground water arsenic contamination is a major environmental challenge in West Bengal. Arsenic concentration in drinking water of the studied location was estimated by using Atomic Absorption Spectrophotometer (AAS). Arsenic concentration in all the sampled community deep tube wells used as drinking water sources were above the permissible limit of 0.01 mg/L. In Basirhat-1 block, the range of Arsenic concentration was found to be 0.0223 to 0.0960 mg/L with mean and standard deviation being 0.06 and 0.0192, respectively. In Habra-1 block, the range of Arsenic concentration was found to be 0.0215 to 0.0723 mg/L with mean and standard deviation being 0.0403 and 0.0154 respectively. WHO -5 wellbeing index questionnaire in Likert scale was used for measurement of subjective Wellbeing of adult persons who are continuously drinking arsenic contaminated water for ten years were measured from the contaminated sources. Multivariate binary logistic regression, Chi-square test and t-test were carried out by using SPSS. Age, marital status, occupation, gender, education, chronic disease, health expenditure and Arsenic concentration showed significant difference with Wellbeing. Significant mean difference was found between health expenditure and arsenic concentration ($p=0.004$, $t=-2.902$, $F=12.684$). Respondents who were drinking arsenic-contaminated water greater than 50 ppb were more likely to report a low level of Wellbeing than the respondents drinking arsenic contaminated water within 10 to 50 ppb (OR=14.487.95% CI(8.065-26.022) $p=0.000$).

KEY WORDS : Arsenic, Drinking water, AAS, WHO-5 wellbeing index

INTRODUCTION

Arsenic (As) is a metalloid which has both carcinogenic and non-carcinogenic properties. It has no colour, no odour and no taste. So it is difficult for the people for detection. Arsenic hazard has been continuously affecting the health of people of India. WHO established 0.01 mg/L as permissible limit of Arsenic in drinking water (WHO, 2010). Arsenic is classified as group 1 carcinogenic for human being by the International Agency for Research on Cancer (IARC). National Research Council (NRC) also reported that due to low body weight women and children are much affected with arsenic poisoning (NRC, 2001). Premalignant skin lesions, high blood pressure, neurological dysfunction and chronic disease mortality are positively associated with the low to moderate level arsenic (0.1 to 864

ppb, mean 99 ppb) in Bangladesh (Chena *et al.*, 2009). Hyper pigmentation, keratosis, weakness, nausea, lung disease, neuropathy, burning sensation in eye, sleeplessness, lack of concentration, decreased vision, irritability are consequences of arsenic poisoning (Guha Majumder, 2003). Positive dose response relationship was found between arsenic concentration and hypertension (Rahman *et al.*, 1999). Exposure with arsenic for long periods may increase suffering of people (Rahman *et al.*, 2003). Economy, personal income and crop productivity are affected by arsenic poisoning (Ratnaik, 2003). Verbal IQ and long-term memory are affected by long term of injection of arsenic contaminated drinking water (Kapaj *et al.*, 2006).

Wellbeing is directly linked with health. Poor health is negatively associated with subjective Wellbeing (Dolan *et al.*, 2008). Psychological and

physical health both are strongly connected with subjective Wellbeing. The World Health Organisation has defined the general definition of health as "a state of complete physical, mental and social well-being" (WHO, 2014). To assess subjective well-being of individuals, the World Health Organization developed the WHO-Five-Well-being Index (WHO-5), a brief, self-administered questionnaire, consisting of 5 questions evaluating mood, vitality and general interests (Bonsignore *et al.*, 2001). The WHO-5 wellbeing index questionnaires consists of five simple positive affirmation questions which report the Wellbeing of the respondent. The scale can be used for the screening of depression symptoms and in various fields of research (Topp *et al.*, 2015). The study aims to investigate the arsenic concentration of used deep tube wells and to assess the subjective wellbeing of adult population drinking arsenic contaminated water.

MATERIALS AND METHODS

North 24 Paragans district is one of the worst arsenic affected district in West Bengal. Two blocks of the district, namely Basirhat-1 and Habra-1 were considered for this study. Multi-stage random sampling was done for this cross-sectional study. Two villages of each panchayat of Habra1 and Basirhat 1 block were randomly selected for the study. All total of 28 villages were chosen for the study. Deep tube wells located near temple, masjid and other community centre are being used for drinking purpose by the villagers. One common drinking deep tube well from each village was randomly selected. Twenty-eight common drinking tube wells were selected for arsenic testing. 300 households were proportionately randomly chosen from families who are using the sampled common deep tube wells for drinking purpose. 150 adult male and 150 adult female were alternatively selected from the randomly chosen household. The cross-sectional survey was conducted between March 2019 to July 2019. Socio-demographic profile, chronic disease history and family health expenditure were taken from 300 respondents. Oral consent was taken from each of the respondents before conducting interview.

Water Sampling: Water samples from respective 28 deep tube wells were collected in March 2019 for total arsenic testing. Water samples were collected after 5-10 minutes pumping of deep tubewells.

water samples were collected in acid-washed polyvinyl plastic bottles. The total arsenic concentration of water samples was estimated by Atomic Absorption Metre (AAS).

Measuring tool: WHO-5 wellbeing index measuring the subjective wellbeing of the respondents, World Health Organization measure of mental wellbeing (WHO5) index was used. WHO 5 index consists of 5 simple invasive questions Which measure the subjective well being of respondents (Topp *et al.*, 2015). WHO5 wellbeing index is a short consisting of five positively worded questions in 6 points Likert scale can be applied without psychological/psychiatric expertise for the measuring of subjective wellbeing of people (Sisask *et al.*, 2008). Cross sectional survey was carried out with the oral consent of respondents. Respondents answered all the five questions of WHO wellbeing index around their feeling in the last two weeks. "All of the time", "most of the time", "more than half of the time", "less than half of the time", "some of the time" and "at no time" are the responses in Likert scale of the five questions. Respondents had chosen onerresponse from these Likert scale responses. Respondents response was scored between 0 to 5 score for every five items. Respondents whose total score below 13 were classified as low level of wellbeing and above 13 were classified as moderate to high level of wellbeing.

Statistical Analysis: Multivariate binary logistic regression, Chi square test and Independent Sample t-test were applied for data analysis. Wellbeing was taken as the dependent variable. Socio-demographic elements, economic elements and arsenic concentration were taken as independent variables.

RESULTS AND DISCUSSION

All the sampled water sources were found to be Arsenic contaminated. The consolidation of test results are given in the Table 1. Arsenic concentration of a total of 28 locations of Basirhat- 1 and Habra-1 were in the range of 0.0215 to 0.0960 mg/L.

300 respondent of age 18 years and above participated in the survey. The association of wellbeing with independent variables was analysed by using SPSS version 20 and the results are given in the Table 2. 52 % of the total respondents were under low level of Wellbeing and 42% of respondents were under moderate to high Wellbeing. There was found significant difference between arsenic concentration

and wellbeing ($p < 0.05$). 87.2% of respondents who were drinking water of arsenic concentration greater than 50 ppb were reported low level of wellbeing. A significant difference in Wellbeing was found in gender ($p < 0.005$). 60.7 % of the total female respondents reported under low level of Wellbeing and 43.3 % of the male respondent were under low level of wellbeing. Significant difference in Wellbeing was found in age ($p < 0.05$). 65.2 % of the age group of 37-55 years were under low level of wellbeing. Marital status also showed a significant difference in Wellbeing. Housing patterns did not show any significant difference in Wellbeing. Occupation showed a significant difference in wellbeing with 65.1% of daily wage workers were

under low level of Wellbeing. Monthly income did not show a significant difference in Wellbeing ($p > 0.05$).

Independent sample t-test was carried out between previous health expenditure and wellbeing. Significant mean difference was found between low level of wellbeing and moderate to high level groups ($p = 0.000$, $t = 4.108$, $F = 19.422$). Significant difference was found between arsenic concentration range and previous year family health expenditure ($p = 0.004$, $t = -2.902$, $F = 12.684$).

Table 3 shows the result of multivariate binary logistic regression with wellbeing as the dependent variable. This result indicates that the age group between 18-36 years were more likely to report

Table 1. Results of Arsenic concentration in drinking water of 28 sampled sources

Block	No of Sampled sources	No of HHs using the source	Arsenic concentration (mg/litre)	Mean of test result	Standard Deviation of the test result
Basirhat-1	14	778	0.0223-0.0960	0.06	0.0192
Habra-1	14	775	0.0215-0.0723	0.0403	0.0154

Table 2. Association of Well-being with Independent Variables

Variable name	Category	Number (n)	Low levels of Wellbeing (%)	Moderate to high level of Wellbeing (%)	Chi square p-value
Gender	Female	150	60.7	39.3	0.003
	Male	150	43.3	56.7	
Age (years)	18-36	146	40.4	59.6	0.000
	37-55	141	65.2	34.8	
	>55	13	38.5	61.5	
Marital status	Married	275	54.2	45.8	0.012
	Unmarried	25	28.0	72.0	
Education	Upto Primary	158	60.1	39.9	0.000
	Upto Secondary	98	50.0	50.0	
	Upto Higher Secondary	14	64.3	35.7	
	Graduation & above	30	10.0	90.0	
Housing Patterns	Kutcha house	49	57.1	42.9	0.223
	Semi kutcha	82	58.5	41.5	
	Semi pucca	110	44.5	55.5	
	Pucca	59	52.5	47.5	
Occupation	Agriculture	95	44.2	55.8	0.015
	Wage works	83	65.1	34.9	
	Other Works	122	49.2	50.8	
Monthly Income	Less than 5000 rupees	98	61.2	38.8	0.081
	5000 -10000 rupees	149	47.0	53.0	
	More than 10000 rupees	53	49.1	50.9	
Affected with any chronic disease	Yes	256	56.6	43.4	0.000
	No	44	25.0	75.0	
Arsenic concentration in Drinking Water (mg/L)	0.01 to 0.05	118	12.8	68.1	0.000
	>0.05	182	87.2	31.9	

moderate to high level of wellbeing being than the age group of 37-55 years

(OR=0.361, 95% CI (0.224 – 0.583)). Female were more likely to report to a low level of Wellbeing than male (OR=2.107, 95% CI (1.273 -3.195)). Respondents with graduate and above education were less likely to report low level of Wellbeing than the respondents with upto secondary education level (OR=0.111, 95% CI = 0.032 -0.390)). Married were more likely to report to low level of Wellbeing than unmarried (OR =3.014, 95% CI (1.231 -7.514)).

Respondents with income less than 5000 were more likely to report low level of Wellbeing than the respondents with income greater than 10000 (OR=1.782,95% CI(1.061 -2.992)). Respondents who were not affected with chronic disease were less likely to report to low level of Wellbeing than who were not affected with chronic disease (OR=0.255, 95% CI(0.123-0.527)). Respondents who were drinking water containing arsenic concentration higher than 50 ppb were more likely to report a low level of Wellbeing than the respondents drinking water with an arsenic concentration between 10 to 50 ppb (OR=14.487,95% CI (8.065 -26.022)). Respondents with agriculture occupation were less

likely to report low level of Wellbeing than wage workers (OR=0.426,95% CI(0.232 -0.780)).

52% of the respondents were under low level of Wellbeing. This gives a serious, alarming bell to the development of a nation. Chronic disease is positively associated with arsenic intake through drinking water. Continuous injection of arsenic-contaminated drinking water can create primary, secondary and tertiary health effects which can draw a heavy medical expenditure to the rural people (Thakur and Gupta, 2016). All the drinking water sources are arsenic contaminated above the permissible limit. This increases cancer and non-cancer hazard of rural areas. Arsenic affects the wellbeing of the productive age of people. In West Bengal, chronic lung disease, liver disease, hypertension, weakness and anaemia are positively correlated with an arsenic concentration in drinking water (Guha Majumder *et al.*, 2011). Family health expenditure was increasing with the increase of arsenic concentration. The economic condition of people goes down, which affects the Wellbeing of people.

Strengths and Limitations

Table 3. Multivariate binary logistic regression of low-level of Wellbeing in the arsenic affected area

Variable	Category	95% CI (OR)	P-value
Age	18-36	0.224-0.583 (0.361)	0
	37-55	1	
	>55	0.103-1.072 (0.333)	
Gender	Male	1	0.065
	Female	1.273-3.195 (2.017)	
Education	Graduate and above	0.032-0.390 (0.111)	0.001
	Upto Higher Secondary	0.563-5.758 (1.800)	0.322
	Upto Primary	0.907-2.506 (1.508)	0.113
	Up to Secondary	1	
Marital status	Married	1.231-7.514 (3.041)	0.016
	Unmarried	1	
Type of House	Kutcha	0.841-3.274 (1.660)	0.144
	Pucca	0.731-2.559 (1.378)	0.322
	Semi-kutcha	0.986-3.134 (1.758)	0.056
	Semi-pucca	1	
Occupation	Agriculture	0.232-0.780(0.426)	0.006
	Other works	0.293-0.923(0.520)	0.025
	Wage work	1	
Average monthly Income in Rs	<5000	1.061-2.992(1.782)	0.029
	>10000	0.580-2.035(1.087)	0.795
	5000-10000	1	
Affected with any chronic disease for 6 months and more	No	0.123-0.527 (0.255)	0.000
	Yes	1	
Arsenic level in drinking water	10-50 ppb	1	0.000
	>50 ppb	8.065-26.022 (14.487)	

This cross-sectional study has attempted to map subjective wellbeing of rural population in chronically affected area. The case-control study could be carried out in future. Wellbeing and the health of children could be further studied.

CONCLUSION

Safe water is an essential need for people. Diseases due to water degrades the growth of developing countries. Poor people are mostly affected by arsenic poisoning due to lack of nutritious food. Arsenic deteriorates the working efficiency of people, thereby reduces the wellbeing of their family. Arsenic removal plants with regular testing facility should be installed so that people may get arsenic-free water. There should be proper health centre in arsenic affected areas which help the people not to go to urban areas for treatment.

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