Socio-economic Status of Arsenicosis Symptomatic Patients in Santpur, Rautahat, Nepal.

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Abstract

Introduction Arsenic contamination in drinking water has been one of the epidemics of the global concern including Bangladesh, India and Nepal.

Objective The general objective of the study is to find out the prevalence of arsenicosis symptomatic patients and their socio-economic status in Santpur VDC, Rautahat District, Nepal.

Methods The tools and techniques applied were the Questionnaires, Direct Observation, Interview, Arsenic Field Test Kit (ENPHO), Arsine Generator Method and Statistical Tools (c^2-test at 95% confidence level). 124 people were examined from 36 risk households who used to drink water from 42 tube wells (some household had more than one tube well).

Results The overall prevalence of arsenicosis symptomatic patients among the risk households of Santpur was found to be 15.3 percent (19 out of 124) with 84.21 percent Melanosis in trunk and 15.79 percent keratosis in sole and palm. The highest occurence was 22.8 percent (13 out of 57, c^2=4.553, P< 0.05) in males, 29.09 percent (16 out of 55, c^2=14.518, P<0.05) in illiterate people, 17.50 percent (18 out of 103, c^2= 2.172, P> 0.05) in the poor, 51.72 percent (15 out of 29, c^2=152.792, P<0.05) in agricultural workers. All positive patients (19 out of 19, 100.0%) were above 40 years of age and had been drinking arsenic contaminated water for 1.5-25 years. Positive correlation (R^2=0.9741) was found between ENPHO arsenic test kit and laboratory method.

Conclusion Poor, illiterate and agricultural worker group people are found to be more exposed with arsenic. So the study recommends launching the long-term management strategy in the region which includes uplifting the socio-economic status of Terai people.

Key words Socio-economic status, Arsenicosis, Nepal.

Introduction

Presence of arsenic in groundwater in the Terai districts was known for the first time in 1999 from the research work assisted by WHO[1]. Since then there has been a growing concern among the Nepalese scholars towards understanding more on arsenic and its human health impacts. Arsenic dissolved in water is toxic and can lead to a number of health problems. Long-term exposure to arsenic in drinking water causes increased risks of cancer in the skin, lungs, bladder and kidney. It also leads to other skin-related problems such hyperkeratosis and changes in pigmentation, disturbance of the cardiovascular and nervous system functions leading to death. The disease is chronic in nature and most of the time the victims do not have any complaint or symptom until they are detected through a screening survey. The symptoms of Arsenicosis are also very difficult to differentiate from other clinical conditions. The present experience to diagnose arsenic case is by external manifestations on the skin called melanosis and keratosis in combination with a history of consuming arsenic contaminated water[2]. The general objective of the study is to find out the prevalence of arsenicosis among the risk household in Santpur VDC, Rautahat District, Nepal.

Methods

Study area

Santpur Village Development Committee (VDC), located in the west of Chandranigahpur, Rautahat

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District, is situated in Narayani zone and belongs to central region of Nepal. It is about 300 km away from Kathmandu.

The Terai area has been known to have many people affected with arsenicosis since few years. Besides, analyzing population in a small geographical area (Santpur) would come to good result, due to the constant environmental factors that determine arsenicosis.

Study Design
This is a cross-sectional study conducted in the study area. Household exposed to high level of arsenic concentration in drinking water were selected on the basis of blanket testing data of NRCS (2004).

Water Sampling and Sample Preparation
A total of 42 water samples were taken from 42 tube-wells for the field test kit. Again, 8 water samples from the 8 tube wells of the arsenicosis patients were collected for the cross checking in the laboratory. In the laboratory of Central Department of Environmental Science, Tribhuvan University, these samples were stored in a refrigerator to prevent changes due to chemical or biological activity as well as loss due to evaporation.

Field Test Kit
A total of 42 tube well water samples were tested with the help of the ENPHO (Environment and Public Health Organization) field test kit.

Laboratory Analysis
To verify the field test kit results, water samples were cross-checked by the Arsine Generator method to check the accuracy. The procedures, chemicals and apparatus used during the lab analysis .

Data Analysis
Data were analyzed by means of table and diagrams. It was statistically tested by the χ^2 test. The result was considered to be significant if the value of P is less than 0.05 (Confidence Level =95%).

Results

The age groups 40-49 years consisted of the greatest percentage (31.57%, 6 out of 19) of the total patients with the absence of cases in age groups in 1-9 years, 10-19 years, 20-29 years, and 30-39 years. Out of total 57 males, 13(22.8%) and out of 67 females, 6(9.0%) were infected with arsenicosis with total prevalence of 15.3% (19 out of 124) were arsenicosis patients. There was significant difference of arsenicosis in different age–groups in male patients (χ^2 =26.91, P < 0.05), in female patients (χ^2 = 29.56, P < 0.05) however no significant difference was observed in male and female patients (χ^2 =5.11, P> 0.05) with age groups. There was statistically significant of arsenicosis with sex (χ^2 =4.553, P < 0.05).

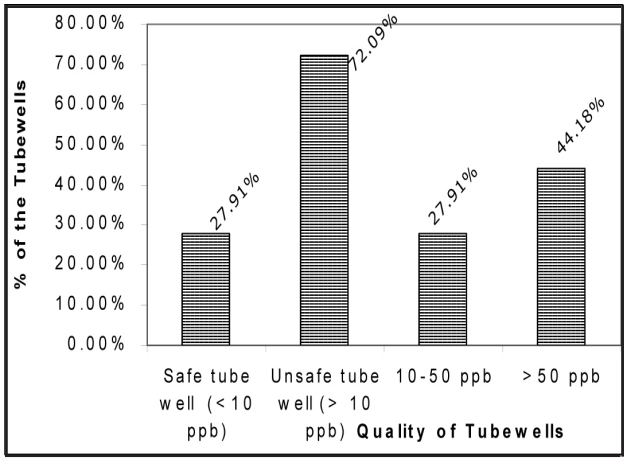
Table 1: Age Specific Characteristics of the Patients

AGE GROUPS(YEARS)	MALES			FEMALES			TOTAL		
	TOTAL	POSITIVE	%	TOTAL	POSITIVE	%	TOTAL	POSITIVE	%
1-9	11	0	0.0	5	0	0.0	16	0	0.0
10-19	9	0	0.0	17	0	0.0	28	0	0.0
20-29	6	0	0.0	11	0	0.0	17	0	0.0
30-39	6	0	0.0	10	0	0.0	16	0	0.0
40-49	7	5	71.42	9	1	11.11	16	6	37.50
50-59	9	3	33.33	6	0	0.0	15	3	20.0
60-69	5	2	40	6	3	50	11	5	33.33
70-79	3	2	66.66	3	2	66.66	6	4	66.66
80-89	1	1	100	0	0	0	1	1	100.00
TOTAL	57	13	22.8	67	6	9.0	124	19	15.3

Similarly, out of 124 respondents who were using the arsenic contaminated water, 19 (15.32%) were found to be arsenicosis patients. The Trunk melanosis was the most common of all the forms of Arsenicosis (84.21%, 16 out of

19). Keratosis on palm and sole was also observed (15.78%, 3 out of 19). And skin cancer was not detected in any of the case. Among the 19 patients, 13 were males and 6 were females. All the patients were above 40 years in their age. The highest recorded age of the patient was 82 years and the lowest age was 40 years.

Figure 1: Distribution of Arsenic concentration in drinking water by risk level



Of 36 drinking water sources, 63.88 percent were above 50 ppb and 11.11 percent samples were between 10-50 ppb. 25 percent of the samples were found to be within the safe limit of drinking water criteria by WHO (2004).

In the present study, only one middle economic status person was infected with arsenicosis. The poor were the highly infected (17.5%) with arsenicosis. There was no significant difference of economic status and the arsenicosis ($\chi^2 = 2.172, P>0.05$).

Table 2: Economic Status* and Arsenicosis

Status	Arsenicosis		Total
	Positive	Negative	
High	0 (O.OO %)	0	0
Middle	1 (5.00%)	20	21
Low	18 (17.5%)	85	103
Total	19 (15.32%)	105	124

In the present study, no student was found to be infected with arsenicosis. Out of 19 patients, 15 were agricultural workers with their prevalence 51.72 percent. The people who worked in service and business were one each. There was significant difference of occupation and the arsenicosis ($\chi^2 = 152.792, P< 0.05$).

Table 3: Occupation and Arsenicosis

Occupation	Arsenicosis		Total
	Positive	Negative	
Agriculture	15 (51.72%)	14	29
Labor	2 (6.67%)	28	30
Business	1 (50.00%)	1	2
Service	1 (100.00%)	0	1
Student	0 (0.00%)	62	62
Total	19 (15.32%)	105	124

In the present study, illiterates were highly infected (16 out of 55, 29.09%) with arsenicosis. People of education level secondary (1), primary (2) were also infected. however, no highly educated people (education level more than 12 class) were found to be infected with arsenicosis. There was significant difference of arsenicosis with the status of education ($\chi^2 = 14.518, P < 0.05$).

Table 4: Education and Arsenicosis

Education	Arsenicosis		Total
	Positive	Negative	
Higher	0 (0.00%)	5	5
Secondary	1 (5.26%)	18	19
Primary	2 (4.44%)	43	45
Illiterates	16 (29.09%)	39	55
Total	19 (15.32%)	105	124

About 90.7 percent of the sampled respondents in the village possess fair knowledge of arsenic contamination of tube-well water on which they must rely for drinking and cooking. The majority of the respondents (92%) knew about the arsenic contamination of drinking water for the last 2 years. Most people (83%) in the study villages learned about the hazard through well testing campaign and research activities. Others (15%) learnt from mass media such as radio, television, and government and NGO sponsored publicities.

Seventy eight percent of sampled respondents in the village had knowledge about water purification and various arsenic mitigation procedures and options. Options known to respondents were water filtering (53.7%), use of deep tube well water (17.6%), collection and use of rainwater (1.8%), and the uses of ponds and well water (5.5%). Poor, less educated, and farming and laborer respondents preferred not to pay (65%) and insisted that the government and NGO should take more responsibility to assure the supply of arsenic-free water for the area.

Discussion

The households with exposition of high level of Arsenic in the groundwater were selected on the basis of blanket testing data of DWSS (2004)[3]. The significant percentages (27 out of 43, 62.79%) of tube wells were having arsenic above the WHO guideline value (10 ppb).

In this study, the prevalence 15.32 percent was highly higher than that reported in other studies[4,5,6,7,8] and lower than that reported in other study[9] which might be due to the sampling of the arsenic contaminated tube wells. Besides, to induce high prevalence, other arsenicosis determining factors are nutritional status, addiction, dose response, socio-economic status[10,11].

The highest arsenicosis symptomatic patients showed Melanosis in trunk (16 out of 19, 84.21%) and are less than other studies[8,12]. The keratosis on palm and sole (3 out of 19, 15.78%) is lower than that of other study[7]. This might be due to the low dose of arsenic with which patients are exposed (below 100ppb) and as the initial symptoms of chronic arsenic poisoning. The first physical changes are usually observed on the skin, following long-term exposure (generally 5 to 15 or more years) to arsenic. Typically, these manifests in melanosis, then thickening of the skin on the palms and the feet (keratosis), followed by skin lesions and eventually skin cancer[13].

The absence of positive case in the age groups 1-39 years out of people of this study might be due to the intake of low volume of water by the people of the age groups 1-19 years and awareness of the people of age groups 20-39 years. The high prevalence of the age-groups (80-89 years) may be due to the lower sample. Besides, the arsenicosis after 40 years suggest that arsenicosis is related to chronic toxicity, defective immune system, doses and awareness. Similar results have been found which supports the present results[4,5,9,14,15].

The higher prevalence of arsenicosis in males than females patients with statistically significant (χ^2 =4.553, $P < 0.05$) might be due to the intake of large volume of water in the daily basis by the males of the study area[7, 8,16].

All arsenicosis patients had been drinking arsenic contaminated water for 1.5-25 years being 1.5 years by one patient and 5-25 years by 18 patients Similar to other studies[4,14].

The result of the present study has showed that some patients (5 out of 19, 26.31%) found were using the water with arsenic concentration below 50 ppb as the standard set by the Nepal. This guideline is the provisional one set up by Nepal, which is much higher than the standard set up by WHO (10 ppb). As arsenic is still in the list of the chemicals, which can create cancer in human body, there is still a risk of in taking water with the amount of arsenic recommended by Nepal as safe dose. Debate also remains over whether a threshold Arsenic concentration exists below which the element is effectively safe[17].

The high prevalence of arsenicosis among the businessperson and the job holder might be due to the small sample size. The numbers of farmers seem to be considerably higher due to the usual contact of arsenic infected water. Absence of arsenicosis in the students might be due to their awareness and less exposures duration[18].

The higher occurence of Arsenicosis in the illiterate people might be due to awareness of arsenic health impacts among the literate and conduction of mitigation options, such as, arsenic filter, switch to nearby wells, arsenic free deep tube wells.

The higher prevalence of the arsenicosis in poor might be explained on the basis of the fact that the poor have low balanced diet and environmental factors, particularly diet, different methylating capacity among individuals and population groups might be important in explaining arsenic susceptibility[3,11,19,20].

The present study has not found the water storage practices in the 36 risk households of Santpur VDC. It might be due to the poverty of the people and unknown to this type of practice. There is relationship between household income and water practices. Higher income households might have greater storage facilities for their tube well water and might consequently be able to store the water for longer[21]. The arsenicosis cases found in the study can be explained on the basis of other studies[22,23,24] that follows that water storage practices reduces the amount of dissolved arsenic in water.

The correlation (97.41%) between ENPHO Arsenic Test Kit Method and Laboratory Method (Arsine Generator) was found to be highly reliabile and effective.

Arsenicosis is prevalent in santpur area and it represents the arsenic problem of the people of Terai region of Nepal. For improvement of diagnosis and management of arsenicosis, adequate facilities and support services should be developed but it should not be confined to medication, nutrition, and awareness only. For this, long-term management strategy should be launched which include uplifting the socio-economic status of Terai people.

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Annex 1: Arsenic concentrations water samples and pertinent characteristics of arsenicosis patients.

Sample no	Age	Sex	Existing Arsenic concentration in drinking water (ppb)	Current Arsenic concentra-tion in drinking water	Depth of tube well (feet)	occupation	education	Chronic arsenicosis symptoms	Duration of As drinking water (years)
S1	40	F	70	<10	28	farmer	Illiterate	Melanosis on trunk	20
S2	82	M	60	50	32	farmer	Illiterate	Melanosis on trunk	8
S3	79	F	60	50	32	farmer	Illiterate	Melanosis on trunk	8
S4	45	M	70	< 10	36	farmer	Illiterate	Melanosis on trunk	12
S5	59	M	65	<10	26	farmer	Illiterate	Keratosis on palm and sole	8
S6	45	M	35	35	36	job	literate	Keratosis on palm and sole	15
S7	65	F	35	35	36	farmer	Illiterate	Keratosis on palm and sole	15
S8	55	M	75	75	28	farmer	Illiterate	Melanosis on trunk	10
S9	70	F	55	55	46	farmer	Illiterate	Melanosis on trunk	10
S10	60	M	100	<10	16	farmer	Illiterate	Melanosis on trunk	10
S11	70	M	95	<10	32	farmer	Illiterate	Melanosis on trunk skin	25
S12	58	M	75	20	32	farmer	Illiterate	Melanosis on trunk	1.5
S13	42	M	20	15	32	labor	primary	Melanosis on trunk	5
S14	69	M	20	15	32	farmer	Illiterate	Melanosis on trunk	5
S15	69	F	20	15	32	farmer	Illiterate	Melanosis on trunk	5
S16	47	M	45	<10	55	business	secondary	Melanosis on trunk	12
S17	45	M	60	35	32	labor	Illiterate	Melanosis on trunk	5
S18	77	M	70	15	32	Farmer	Illiterate	Melanosis on trunk	10
S19	60	F	70	15	32	farmer	Illiterate	Melanosis on trunk	10