Full Length Research Paper

ArSENIC CONTAMINATION: Food Toxicity and Local Perception

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Abstract. This study was performed based on local perception on arsenic toxicity with respect to socioeconomic status at the Achintanagar village in the southwestern part of Bangladesh. The questionnaire was distributed randomly at the local scale in the study area. It was found that the respondents are highly contaminated with arsenic and most of them have suffered from economic crisis and ignorance. Arsenic contamination and food poisoning concept has direct bearing on educational level which is emphasized on socioeconomic status. Correlation coefficient matrix had revealed that the whole aspects of socioeconomic component negatively correlated with arsenic toxicity for group one and two. Female participant were observed to be more unconscious than male respondents on food contamination through arsenic accumulation. Results showed that, most of the respondents continued to eat and practiced the sale of contaminated food in the community. It was observed that this practice is highly contagious for human and environmental health.

Keywords: Arsenic food Toxicity, Local perception, Male & Female and Knowledge variability

1. INTRODUCTION

Arsenic contamination and its consequence is an emerging issue for public health with respect to social aspects in Bangladesh. Scientific evidence of arsenic contamination and socioeconomic condition of a society has direct linkage with health hazards and behavioral attitude. Consequently, most of the countries in Asia have been reported to suffer from this problem most especially in Bangladesh (Chowdhury et al., 1999; Biswas et al., 1998; Nickson et al., 1998; Nickson et al., 2000; Dhar et al., 1997; Khan et al., 1997). It acts as a limiting factor for sustainable development (Ongley, 1999). About 110 million people in Vietnam, Nepal, Pakistan, India, China, Myanmar, Laos, Cambodia, Taiwan and Bangladesh have been suffered from Arsenic contamination (Sharma, 2009).

The alarming content of As in groundwater resources has been identified as the biggest single source of arsenic contamination in Bangladesh (Hossian, 2006). About 100 million people in the world have been affected due to naturally occurring As in ground water (Ahuja, 2008). It was estimated that 97% people living in rural areas used As-contaminated water for drinking and irrigation purposes (UNICEF, 2001; WHO, 2001). According to WHO guideline, 10 μg L⁻¹ count as a permissible limit for drinking purpose, while the national standard is five times higher (50 μg L⁻¹) in Bangladesh (Mosler, 2010). A few studies (Tondel et al., 1999; BGS, 1999; Erickson, 2003) reported that this level has been exceeded with it reaching up to 2000 μg L⁻¹ in many cases.

Arsenic contamination in groundwater and its degree of toxicity could cause arsenicosis due to excessive intake in human body. At the preliminary stage, it is characterized by the different symptoms occurring on the skin such as skin alteration. Arsenicosis disease is a great threat of social implications such as social prejudice, insecurity and refusal of victims by the society and family member (Brinkel et al., 2009). But advancing from this stage, it may result to death due to its complications including cancers of the lung, kidney, bladder and skin (WHO, 2001). Arsenic contamination through drinking water and its consumption is also associated with peripheral vascular diseases and neuro developmental impairment in children (Wasserman et al., 2004). One study tried to investigate the key factor responsible for enhancing As contamination such as economic and social agent in Bangladesh (Hassan et al., 2005). However, scientific evidence reveals the situational condition in a specific time and place for arsenic hazards and public health. In addition, observational statement on arsenic contamination shows the
2. METHODOLOGY

2.1. Justification of the Sample Site Selection

High levels of arsenic in ground water are causing wide spread poisoning in the Jhenaidah district, Bangladesh. Significant attempts have been made in recent decades to identify arsenic contaminated tube-wells and food contamination in this locality by different national and international organizations. Unfortunately, a very little effort has been made to identify the relationships between arsenicosis patients and perceptual attitude towards the food contamination in this area. Preliminary survey in this study indicates that large numbers of persons in this area have been affected from arsenic contamination. To assess the health effects from arsenic contamination, knowledge and to awareness buildings have been chosen to proper management of public health issues in the Jhenaidah district.

2.2. Study Area

The study was performed at Achintanagar village in the Jhenaidah districts, Bangladesh. It is situated in the southwestern part of Bangladesh. The study area was covered by Ganges flood plain sediments which is rich in arsenic containing pyrites (Mandal et al., 1998; Chowdhury et al., 1999). The average rain fall was 3000 mm and the temperature ranges from 32 to 33°C as recorded respectively. A group of people was identified as arsenicosis patients (Rakib et al., 2013). Most of the people were agro-economic dependent. Their ages varied from 18 to 76 years. The people’s behaviors were congenial who were victimized by environmental stress and inferiority complex in terms of social status.

2.3. Research Design

A qualitative research was performed to find out the real effect of environmental crisis on social aspects through background analysis. A structured questionnaire was developed which contained the entire demographic information (Part-1), educational status and concern with arsenic contamination (Part-2). It has been structured considering partial factor including requisite information to complete a potential research.

A number of respondents (male, n=43 and female, n=43) were selected randomly in the community. Most of them were showing arsenicosis symptoms. The interview was taken to complete the purposive work and prospective research with social significance. It is laid on specific research interest “arsenic contamination” and social “perception” based on education and socioeconomic condition. They willingly agreed to talk with the interviewer about arsenic contamination. Significant information was drawn from the participants. To serve the study aim and objectives, total participants were split into four groups (G-1, G-2, G-3 and G-4) depending on socioeconomic status along with economic growth, arsenic poisoning with knowledge [According to group, Per capita income (annual) of the respondent was recorded Tk. 10000-15000 (US $ 128.62-192.93), Tk. 16000-20000 (US $205.79-257.23), Tk. 21000-25000 (US $270.10-334.41) and Tk. 26000-30000 (US $334.41-385.85) respectively]. It was done to make out the significant output of the correlation coefficient matrix on perceptual view on arsenic toxicity at the same time and place, followed by the same technique. On the other hand, male and female perceptions to arsenic toxicity were measured based on knowledge variability with box plot model. Group variability of arsenic poisoning perception was also measured with box plot using variability index. The measured information was confirmed to educational knowledge with respect to health perspectives.

The second part contained a number of questions. Four questions out of them were likert-scale questions. It was included to get the clear concept on arsenic contamination in categorical aspects. This question could be affirmed in depth knowledge and conclusive statement of the study. Arsenic poisoning and food contamination were defined in the following aspects: arsenic toxicity, vegetable contamination, food grain contamination and groundwater contamination. It was scored both positively and negatively through reverse order as follows: known (5), well known (4), either known nor unknown (3), unknown (2) and completely unknown (1).

Statistical analysis was performed using SPSS software (statistical package for windows 18) for generating correlation coefficient matrix. Variability test was done using Sigma Plot software (version 7) for evaluating arsenic toxicity and local perception and education level.
3. RESULTS AND DISCUSSIONS

3.1. Socioeconomic Status

The socioeconomic status is coincided with present environmental condition and future impact trends. It plays a significant role for situational impact management along with economical growth and per capita income. It is emphasized on educational levels which are governed by ethical consideration in purpose that seek out the alternative way to sustainable development. Social components and it’s worsened condition may lead to socioeconomic crisis.

Educational qualification was observed for class 1-5 (primary level) as group one, class 5-8 (Secondary Level) as group two, class 8-12 (Higher Secondary Level) as group three and class 12- Masters (Tertiary Level) for group four, respectively. However, most of the respondents fall within group one and two. In addition, socioeconomic condition of the mass participants was found below the margin of poverty. Among the total respondents, 62% were involved in agricultural activities. They normally use arsenic contaminated food grains, vegetables and water. Besides, a number of female was observed who were engaged in household and agricultural activities in the farmland. Due to poor economic condition and lack of proper education, a critical situation arises to worsen environmental condition in the study area.

3.2. Arsenic Contamination and Existing Status

A number of respondents were observed as arsenicosis patients who showed several categories of arsenicosis symptoms. Physical appearance and their utterances revealed panic situation as conclusive environmental hazards in the study area. Groundwater contamination and its magnitude were pointed out as a health disaster among the rural people. Female respondents were found to be highly affected by arsenic than male respondents. They frequently use arsenic contaminated water for drinking, household purposes and irrigation purposes. Poor socioeconomic conditions and higher residence time caused high intensity and elevated exposure level of contamination. Residence time and water using pattern act as a key parameter to make out the real situation of arsenic accumulation. Arsenic accumulation rate in human body differ to gender variation (Rakib et al., 2013) and human body physiology (Yoshinaga et al., 1990, Nowak and Kozlowski, 1998, Park et al., 2007). Average arsenic concentration in groundwater was observed 0.89 ±0.13 µg/g. Average arsenic content in female hair and nail was found to be 3.707±0.36 µg/g and 2.034±0.19 µg/g respectively. Consecutively, average arsenic concentration in male hair and nail was found to be 0.926±0.08 µg/g and 1.397±0.09 µg/g respectively (Rakib et al., 2013). The groundwater and food contamination lead to occur health hazards. Most of the respondents and children were also observed at health risk due to severe arsenic contamination. Environmental pollution is responsible to occur worsen condition for human health. The environmental components serve for generating suitable habitat for living organism but a few anthropogenic activities impede to natural dynamism.

3.3. Perceptive Evaluation

Human perception and its social aspects are interlinked to scientific view on any occurrence in a society. Arsenic contamination and social view is overlapped with each other in relation to long time exposure and pragmatic experience of the respondents.

Regarding to female perception, 15%, 9%, 7% and 25% female were knowledgeable about arsenic toxicity, vegetable contamination, food grain contamination and groundwater contamination respectively (Fig. 1). On the other hand, for male respondents 25%, 10%, 14% and 19% were found to be knowledgeable on arsenic toxicity, vegetable contamination, food grain contamination and groundwater contamination, respectively (Fig. 1). Results showed that both participants were found to be well educated and high income group.

For female respondents, 35%, 14%, 15% and 19% were observed to be completely ignorant about arsenic toxicity, vegetable contamination, food grain contamination and groundwater contamination, respectively (Fig. 1). Nevertheless, among male respondents 14%, 19%, 12% and 15% were found to be illiterate on that issue, vegetable contamination, food grain contamination and groundwater contamination respectively. Female participants were observed to be more unconscious than male respondents on arsenic contamination. Female respondents were found to be significantly arsenic affected compare to males in the study area (Rakib et al., 2013). Most of the female respondents were observed of lower literacy rate compare to male. The main cause could be due increased rate of drop out from school at the early stage and early marriage.
Education and socioeconomic growth is significantly expedited to social welfare and awareness build up. However, Social structure is consisted of its components which may act as a driving force for sustainable development. In addition, Arsenic contamination and its intensity is a reflection of degree of toxicity and natural stress. Public concern may lead to socioeconomic development against environmental impact. People of the study area were not so aware about their health condition and environmental impact. Arsenic accumulation may get enrich in human body due to lack of individual awareness and daily intake of contaminated food from the environment.

3.4. Correlation Study

Arsenic contamination and its degree of toxicity may influence social status. Social components play a significant role to develop socioeconomic status with respect to environmental health. Education level and family income are coincided with one another which contributed to public health issues in a society. A significant negative correlation was observed \((r=-0.21; p=0.01)\) between income and arsenic toxicity for group one. Another moderately negative correlation was found to be between education \((r=-0.13; p=0.01)\) and arsenic toxicity \((r=-0.10; p=0.01)\) for group two. On the other hand, a significant positive correlation was found to be arsenic toxicity with respect to education \((r=0.15; p=0.01)\) and income level \((r=0.024; p=0.01)\) for group two. Consecutively, similar finding was observed for group four but it implies on just only negative impact on public health as a situational or regional factor. However, a significant positive correlation was observed between arsenic toxicity \((r=0.17; p=0.01)\) and education \((r=0.42; p=0.01)\) level, it also positively attributed to correlation matrix \((r=0.29; p=0.01)\) for family income capacity. Arsenic contamination and dietary intake is correlated with degree of toxicity in human body.

3.5. Knowledge Variability on Food Contamination

Groundwater contamination and its consequences significantly affect the rooted plants and crops due to using irrigation activities. Contaminated water is frequently used in agricultural land for irrigation purpose. Plants uptake and metal availability in soil may attribute to degree of contamination of food grain and vegetables. Environmental education plays a vital role in eliminating food contamination in a society.

Results showed that, 75%, 81%, 89% and 93% respondents were informed about arsenic contamination and food safety for G-1, G-2, G-3 and G-4 respectively (Fig. 2). These concepts variation is a consequence of impulsive socio-economical components. Its ignorance and variability significantly contributed to split exposure with arsenic contamination of the local respondents. Average 78% female have heard about food contamination and arsenic toxicity (Fig. 2). On the other hand, average 86% male respondents were updated on arsenic hazards and its consequences. Education could be very much effective to ensure sustainable knowledge empowerment about environmental stress. It is an important subject on awareness development and makes them understand about environmental impacts on future health in a community.
Fig. 2: Food contamination and knowledge variability in different groups and gender

However, Perception analysis indicated to significant review to assess the health risk and arsenic toxicity. Correlation coefficient matrix study was made a linkage between factual information and social components in categorical groups. It was identified as significant information to judge the environmental stress in the study area. It would be very much effective to take the action against with arsenic hazards with respect to public health issues.

4. CONCLUSION

Arsenic contamination and its severity may attribute to health issues in a community. Education level, income and social perception are emphasized on health and family status. Its negative consequences impacted on sustainable development with respect to social component. It was observed that most of the respondents were not cognizant with health hazards and food safety. Lower income and education group were found to be highly arsenic contaminated due to ignorance and lack of awareness. Correlation coefficient matrix had revealed that, the whole aspects of socioeconomic component significantly negatively correlated with arsenic toxicity for group one and two. In addition, knowledge variation was observed in four groups which are at the lowest level in group one and two. On the other hand, male respondents were found to be highly responsive than female participants. It may appear as health disaster in absence of social component and/or without proper practice to achieve sustainability.

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