



IMPACT OF SALINITY INTRUSION ON HEALTH OF COASTAL PEOPLE: REFLECTIONS FROM DACOPE UPAZILA OF KHULNA DISTRICT, BANGLADESH

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KUS: 19/06: 01072019

Manuscript submitted: June 19, 2019

Accepted: March 18, 2021

Abstract: Increasing salinity in ground water, arable lands and many rivers of the southwest coastal area are important consequences of sea level rise as well as climate change. The scarcity of fresh drinking water was the very initial impact of salinity intrusion that possessed multidimensional threats on human existence. Thus, the current study is designed to know the potential problems caused by salinity intrusion and the protective measures and coping mechanisms adopted by coastal people for salinity. To meet the objectives, two southwest coastal villages Joynagar and Parjoynagar of Kamarkhola union at Dacope upazila in Khulna district of Bangladesh were selected purposively as over past few decades along with other southwest coastal areas these two villages were suffering from increasing salinity intrusion. A collection of qualitative techniques including case study, FGDs and KIIs were adopted to gather vivid data. The results of the study found that apart from physical and psychological health salinity intrusion also possessed adverse impact on social health. The very common physical problems include acidity, stomach problem, several skin diseases and psychological problems include hypertension. Besides, there happened social health problem because of the physical and psychological problem. For example, early marriage happened because salinity gradually changed the skin color from light to gray. However, the findings also presented that all preventive measures of community and authority were taken only for securing fresh drinking water instead of taking preventive measures for purifying washing and cooking water that led to several diseases and problems. In conclusion, it can be recommended that increasing freshwater reservoirs can be a suitable solution for salinity intrusion of the coastal areas.

Keywords: Salinity, Climate change, Health, Diseases, Coastal people

Introduction

Due to climate change, human health is being affected, directly or indirectly, through the flood, cyclone, drought, and salinity intrusion in water. Additionally, in coastal areas of Bangladesh, natural drinking water sources, such as rivers and groundwater have been threatened by saltwater intrusion from the Bay of Bengal (Talukder, 2016). Furthermore, groundwater, cultivable lands, and many

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DOI: <https://doi.org/10.53808/KUS.2020.17.1and2.1906-S>

rivers are being increasingly affected by saline water from higher tidal waves and storm surges due to the impacts of climate change (Shahid, 2010). Estimates indicated that Bangladesh has about one fifth of the total area of the country which is affected by salinity and many people are already struggling for access to water resources for sustaining livelihoods, domestic uses, and health services (Rabbani *et al.*, 2016). Salinity, both surface and groundwater, in the coastal zones of Bangladesh is really vulnerable to the health of local communities while the incidence of health vulnerability has become quite significant in those areas (Azam & Sarker, 2014).

The coastal areas around the globe, especially in the low-lying developing countries like Bangladesh are facing the problem of salinity intrusion day by day (Baten *et al.*, 2015). The coastal land of Bangladesh is highly threatened by a sea-level rise which consequents saltwater intrusion whereas an increase in salinity intrusion and increase in soil salinity have serious negative impacts on agriculture which eventually contributes to households' food insecurity (Zaman, 2017). Consequently, this ultimately results in the low-calorie intake and chronic malnutrition of coastal people (Moumita, 2015). Moreover, the cumulative effects of salinity intrusion may cause increased blood pressure, hypertension, soreness in the body, and waterborne diseases as well (Khan *et al.*, 2011; Shammi *et al.*, 2018).

The adverse impact of salinity intrusion on health goes through drinking water as the coastal people of Bangladesh use the natural source of drinking water and after the super cyclone- Aila in 2009 their major sources of drinking water had been contaminated by salinity (Rasheed, 2014; Kabir *et al.*, 2016). About 20 million people in the coastal regions of Bangladesh who extensively depend on rivers, tube wells, and ponds for washing, bathing, and drinking water is affected by varying degrees of salinity (Rony *et al.*, 2016). Khan *et al.* (2011) found that generally the coastal people's average estimated sodium intake from drinking water ranged from 5 to 16 g/day in the dry season, compared with 0.6 to 1.2 g/day in the rainy season. Besides, women who drank shallow tube-well water were more likely to have urine sodium ≥ 100 mmol/day than women who drank the water of deep tube - well or rainwater.

Saline water is an important factor for hypertension or high blood pressure in coastal areas. Whereas it can also lead women, especially pregnant women, to an increased risk of hypertension, as well as infant mortality (Khan *et al.*, 2011; Shammi *et al.*, 2018). Zaman (2017) also indicated that water salinity has become the pathway of hypertension, diarrhea, dehydration, and respiratory problems. As a result, health risk due to salinity intrusion has been predicted to increase severely in coastal regions of Bangladesh.

After all, according to McDowell (2006), a sound mind and good health condition are important to maintain a healthy social relationship and perform appropriate social roles and responsibilities. Similarly, to discuss social health George (2020) stated, 'social relationships have an impact on our mental health, physical health and mortality risk'. Besides, George (2020) has defined social health as the ability to interact and form meaningful relationships with others in a comfortable manner within a certain social setting. However, although several scholars have speculated several potential health risks regarding salinity intrusion, none of the scholar has study on the impact of salinity on social health. So, clear literature gaps have been visible in this ground. The aim of this study is to mitigate the gaps by exploring the impact of salinity intrusion on physical, psychological, and social health from the perspectives of local people in the southwest coastal area of Bangladesh. Further, some earlier studies (i.e. Sony, 2018) described local coastal people of Bangladesh have some traditional coping mechanisms like a rainwater harvesting system to cope with salinity intrusion. Following this point of view, this study also has tried to know how local coastal people coping with other salinity induced problem.

Materials and Method

Following qualitative research technique, this study was adopted to carry out in purposively selected two villages (Joynagar and Parjoynagar) of Kamarkhola union at Dacope upazila in Khulna district of Bangladesh, as along with other the southwest coastal areas these two villages have been suffering from serious salinity intrusion (Dasgupta *et al.*, 2015). Another purpose of these village selections was the high adverse impact of salinity intrusion on local peoples' physical health rather than other areas of the Kamarkhola union at Dacope upazila which have been noticed by researchers during a pilot study. Becoming descriptive in nature, three qualitative techniques, *i.e.*, Case Study, Focus Group Discussion (FGD) and Key Informant Interview had been adopted to collect primary data. To know the current situation and their adopting mechanism, the 13 case studies from Joynagar and Parjoynagar villages have been helpful where six male and seven female respondents of different age, and occupational groups have been purposively selected as they have been suffering from several health problem and trying to cope with this problem.

Two FGDs were used to gather community-level data. One of the FGD consisted of 12 male respondents who were staying in a tea stall of their village market and another FGD has consisted of 10 female respondents who were used to attend a local co-operative organization (*i.e.*, We for Us). Here, the FGD respondents have been gathered both from Joynagar and Parjoynagar villages. Prior to data collected they were invited to participate in FGD through describing the research objectives. On the other hand, KIIs (N=3) were adopted to get intensive information about the actual health problem. Due to having sufficient knowledge about the study area and study population, a 38-year-old male teacher of Joynagar high school, the 57-year-old male union Parishad chairman of Kamarkhola union and a 40-year-old male village doctor of Parjoynagar were selected purposively as the key informant.

The data collection process took place between 12th November and 30th November of 2018 and people who had been living in the study area for more than 20 years and experienced salinity related problems were selected as respondents. However, according to the village doctor's recommendation, two exceptional cases also had been selected, since they were suffering from salinity related health problem, whose age was between 14 and 16. The average duration of the interviews was 55 minutes and average duration of FGDs was 1 hour and 36 minutes. The local people of this study area were involved in prawn seed collection, shrimp farming, agriculture, woodcutting, and honey collection from the Sundarbans as a means of living. The villages are located in the southwest coastal areas of Bangladesh and adjacent to the coast of the Bay of Bengal. In addition, because of frequent natural hazards and sea-level rise, the increasing salinity is the major problem of these study areas.

A Checklist has been used for case studies and KII whereas an FDG guideline has been used for FGD data collection tools. The checklist for case study contained some specific points *i.e.*, identification of the respondents, recent problems experiencing by respondents, protective activities from the salinity intrusion for health and mechanism to cope with coastal people. Furthermore, in FGD guideline the specific points for data collection were identification of the group (based on homogenous criteria), recent problems experiencing by respondents, protective activities from the salinity intrusion for health and mechanism to cope with coastal people. Moreover, the checklist for KII was developed specifically for village doctor, UP chairman and school teacher. The checklist for village doctor focused mainly on impact of using saline water (drinking, cooking, bathing and washing) for long time; UP chairman was asked about the mechanisms to cope with salinity intrusion and lastly, school teacher was inquired about protective measures from the salinity intrusion for health. After completion of the fieldwork, data were processed by reducing logical inconsistencies, dropping improbabilities and by solving ambiguities. Finally, the processed data had been presented

in descriptive way. To protect the confidentiality of the respondents the pseudonym has been used throughout the paper. Overall, the authors have followed the guidelines of the qualitative research ethics provided in SAGE Handbook of Qualitative Research Ethics (Iphofen & Tolich, 2018).

Results

The findings of this study exhibited that due to regular uses of saline water most of the respondents had been suffering from several physical, psychological, and social health problems. According to the findings, the very common diseases were skin problem, stomach problem, hypertension, high blood pressure and so on. Focusing on the aim of the study the findings, firstly, presented how salinity causes health problems and, secondly, the protective measures and coping mechanisms adopted by respondents in confronting with salinity intrusion induced problems.

Physical and psychological health problems due to salinity intrusion: All respondents have mentioned that the cyclone Aila induced tidal surge in 2009 and upstream river water flow, especially in the summer season, contaminated both freshwater reserves and arable lands of the study area. As a result, the scarcity of clean and safe drinking water was very common. Most of the respondents mentioned that freshwater scarcity forced them to use saline water for washing, cleaning, and even, for cooking from open sources. Though they tried to collect fresh drinking water as much as possible sometimes they failed to meet their need.

Consequently, several health problems took place because of this situation. Firstly, the very common regular health problem was stomach problem caused by drinking saline water and taking food cooked with saline water. Thus, one of the female respondents of the third case study stated that,

"Sir, all of my family members are suffering from stomach problems, acidity and, less frequently, dysentery. I know these problems happen because of using pond water for cooking. I'm confident about it because during rainy season I used rain water to cook and then my family members feel batter. (Dasi, 43 years, homemaker, Kamarkhola)"

Not only the above statement but also other respondents' opinions also reveal that using saline water for cooking causes multidimensional stomach related problems. Similarly, a school boy said that,

"Most of my friends fail to attend school because of stomach problems and I also experienced by this sometimes. (Anik, 14 years, student, Kamarkhola) "

Secondly, the hair damage or hair fall problem was another common problem addressed by respondents. Like above, respondent accused that only saline water caused this problem. As they had no alternative source of fresh water, so they had to use saline contaminated ponds, canals and river water for their daily use. According to all the respondents, they generally suffer from salinity problems more acutely in the summer season than in any other season. On this point a respondent of eighth case study said disappointedly,

"In the dry season, the big problem for women is to find out the clean water for bath. You already have known that we have limited fresh water ponds which are restricted for bath and cleaning but for drinking. So, we the women are compelled to take saline water for bath and day by day losing our hair. I almost lost half of my hair and it always remained adhesive. (Rubya Khatun, 16 years, student, Kamarkhola)"

Further, this study found that not only the female but also the male members of the local area had been suffering from the hair fall problem due to salinity. From the FGDs and case studies it is found that most of the men had been experiencing hair fall problem from the early age of adulthood. During summer, the density of salinity became high but hot weather forced them to take bath more than one time per day. Besides, some respondents stated that due to using soap and shampoo

regularly they are facing some health problem like hair fall. For instance another respondent of first case study stated that,

"I regularly used soap and shampoo during bath but when I didn't used it, my skin feels sticky. So, I used to take bath in every four/five-hours interval. It may be the cause of my hair fall problem. (Sarafat Mia, 47 years, shopkeeper, Kamarkhola) "

Thirdly, the common skin diseases like *Scab* and *Itchiness* faced specifically by the child and old aged people. Apart from the body, the existence of this disease has also been found on the scalp of the head. Like others they also accused the dry season and salinity. Almost all farmers and those who worked in the field experienced by *wound diseases* in fingers of both hands and legs. On the other hand, from female FGD it has been found that the female up to 30, suffered from several critical diseases like Lucuria and so on. Along with this, change in skin color was another health problem. Most of the respondent's body color was darkish. One of the respondents of first FGD stated that,

"After cyclone Aila (2009) I went to Dhaka for three-four years. Then, I observed that my skin color was brighter than now. Brother, you can observe that most girl's and boy's skin color are light dark of this area. (Amina, 36 years, homemaker, Kamarkhola)"

Furthermore, the female FGD presented specific problems including sexually transmitted diseases (STDs). They have stated that during their menstrual period, it was very hard to maintain their hygiene. The conservative society did not allow expressing their problem even in-front of doctor too. However, though most of the females were confident about the reproductive health problems they were not sure that the saline water causes their reproductive health problems rather they accused the pond's water because in the same water both humans and animals used to bath and wash. They also added that immediate vomiting happened after drinking the saline water and the taste of saline water is also bitter.

Besides, the village doctor, the respondent of first KII, mentioned that most of his patients had been suffering from very common diseases like diarrhea, mucous diarrhea, acidity, vomiting, itchiness, ringworm, high blood pressure and skin diseases. The doctor also stated that,

"I think all diseases are happening because of salinity. Since very few patients used to come with such diseases before Aila (2009) but now a considerable number of patients are coming with these diseases. (Hasnat, 40 years, village doctor, Kamarkhola)"

Most of the respondents used to drink more or less six to eight glasses of water and consequently suffering dehydration problems. The village Doctor said that most of the patients came with this problem and most of them considered yellowish urine as a general nature of urine.

However, salinity also has an impact on mental health. From the KIIs and FGDs it had found that most of the respondents have high blood pressure. According to doctor, the hypertension and the high blood pressure were common among the patients. Besides, the findings of the study also showed that people felt psychological stress not for drinking saline water only but collecting freshwater is also challenging for them. For example, when stored drinking water runs out in any family, the family members used to get worried since it was not so easy to collect fresh water to drink. Thus, the pure drinking water was precious for them. Change in skin color was another problem.

Social health problems due to salinity intrusion: Salinity is posing many negative impacts on social health indirectly. The findings also revealed that due to salinity intrusion several social problems like early marriage and social conflicts were happening in the study area. On this point the school teacher stated that,

"In this area most girls are married at their very early teenage stage because of gradual changing in skin color which happen dealing with saline water. (Raton, 38 years, high school teacher, Kamarkhola)"

Further, most of the respondents mentioned that because of salinity the girls from the non-saline-affected areas are not generally willing to marry the boy living in this area. In addition, the teacher also said that due to hypertension people of this area had less endurance. Usual conflicts in market and family for little issue were common. It was also found that most of the people of this area always speak loudly. Salinity and little job opportunity forced people to remain idle.

Protective measures and coping mechanisms adopted by the respondents: The respondents had taken several steps against the problems caused by salinity intrusion of which some were protective measures and some were coping mechanisms. One notable finding was that the respondents were less likely to go to the hospitals. This study also found that there was no hospital except a community clinic that was not enough to support local people and most of the time it remains locked. However, they had village doctor but hardly follow his recommendations.

They used to drink rain water as a protective measure and used to store rain water in pond, clay pots, and modern water tank provided by local government and NGOs as a coping mechanism. It was called rain water harvesting system. Increasing use of boiling water, alum (Fitkari), and water purifying tablets indicated that the local people have become conscious about water-borne diseases. Ironically, the stored rainwater runs out within six or seven months, and then, they collect the drinking water from long distances until the next rainy season comes. This information was not supported by all that nowadays some have large water tanks and can use the water for years. In addition, to do this they had spent the lion's share of family income and time but they did it to secure their family members' health. To avoid dehydration one respondent of the first case study said that,

"While I go to the *Chalna bazar* (the municipal market) I used to drink as much more water to avoid dehydration, since that water is relatively fresh than ours. (Sarfat Mia, 47 years, shopkeeper, Kamarkhola)"

To avoid stomach problem, *e.g.*, acidity and digesting, caused by cooking water all the respondents used rain water in rainy season. This protective measure brings them a great success compared to use pond's water. From the FGD of women, it had been found that women used to collect ponds water very early in the morning because it seemed to them that the upper layer of the pond's water was fresh. Though they knew the pond's water was not so good for health. Besides, the cooked food with pond's water did not stay long compared to rain water and the taste was also different. One woman said that,

"The taste of cooked rice with rain water is different than pond's water (Lotifa Khatun, 53 years, homemaker, Kamarkhola)"

Another finding also indicated that the adults and the senior members of the community almost adopted the foods cooked with ponds water. Besides, the UP chairman, the respondent of the second KII, mentioned that a Reverse Osmosis (RO) water purifier plant in Kalinagar Bazer was installed by Rupantar, a local NGO, where people can buy water 0.5 BDT per liter. But still the weak communication made the difficulty to collect the water.

The protective measures against Itch on head are taken by balding. Findings of the study presented that Itchiness were common among child and old aged persons. To prevent this almost all respondents have shaved their hair at the very beginning of summer. Side by side, some respondents, especially women, also have used argil (potter's clay) to wash their hair to make their hair silky and strong. For other diseases they followed traditional knowledge.

The respondents was not willing to answer directly about women's reproductive health. According to village doctors, most of the women suffer from several reproductive health problems but they were not willing to disclose it and they considered that it was religiously forbidden. In contrast, sanitary pad was considered as luxury product and so they used cloths. Through

socialization the young girls learn it from elder ones. In addition, from the KIIs it has been clear that apart from local authority the NGOs are also taking several protective measures against salinity.

The findings of this study show that the people of the study area were not aware of the causes of hypertension; they considered it as common as yellowish urine. Even they did not think that salinity can impact on social health. Actually, people adopted this as their social structure. The doctor and teacher made it clear from their opinion.

Discussion

The results of the current study presented three kinds of health problems suffering from long term salinity including, physical health problems, psychological health problems and, unlike all other but silently affecting, social health problems. The physical health problems which can be divided into two categories. Firstly, internal health problems, including stomach problems, which is caused by taking saline water. Secondly, external health problems, includes skin diseases, that is caused by using saline water. Similarly, both collecting, and taking saline water increased the psychological pressure and stress for example, hypertension or stress happens due to run out of stored fresh drinking water (Khan *et al.*, 2011). Unlike physical health problems, salinity is indirectly affecting social health in terms of social role and social adjustment (McDowell, 2006).

This study also found that the coastal people are taking several protective measures and coping strategies against salinity. To protect the internal health from diseases like stomach problem, digesting problem, acidity problem, diarrhea people found rain water as an alternative source of fresh water. So, traditionally the rain water was one of protective measures (Sony, 2018) against salinity and modern knowledge is also supporting this. They also learned water purification system. But coastal people fail to adopt any kind of protective measures against external health problems like skin diseases and hair fall problems caused by salinity. Instead, they are coping with this problem by using soap, shampoo, argil, oil and so on. Similarly, no preventive measures were taken to release psychological stress.

Subsequently, the social health is affected (George, 2020). For instance, increasing salinity gradually changed the skin color of girls from light to gray dark and it increases the parents stress about girl's marriage. Girls' skin color is considered as an indicator of beauty. The coastal parents believed that gray colored girl is less desirable than bright colored girls in the marriage market. Subsequently, the early marriage and child marriage were treated as a solution. In addition, lack of patience was another cause of gradual stress and health problem which is happened due to long-term salinity. According to Sincero (2012) the coping mechanism is the ways to which external or internal stress is managed, adapted to or acted upon. Applying this theory, we can say that like external health problem the coastal people are, unconsciously, coping with this problem too. Actually, the social health problems are the product of physical and mental health problem which are caused by long term salinity intrusion. This sense may be clear in the following figure.

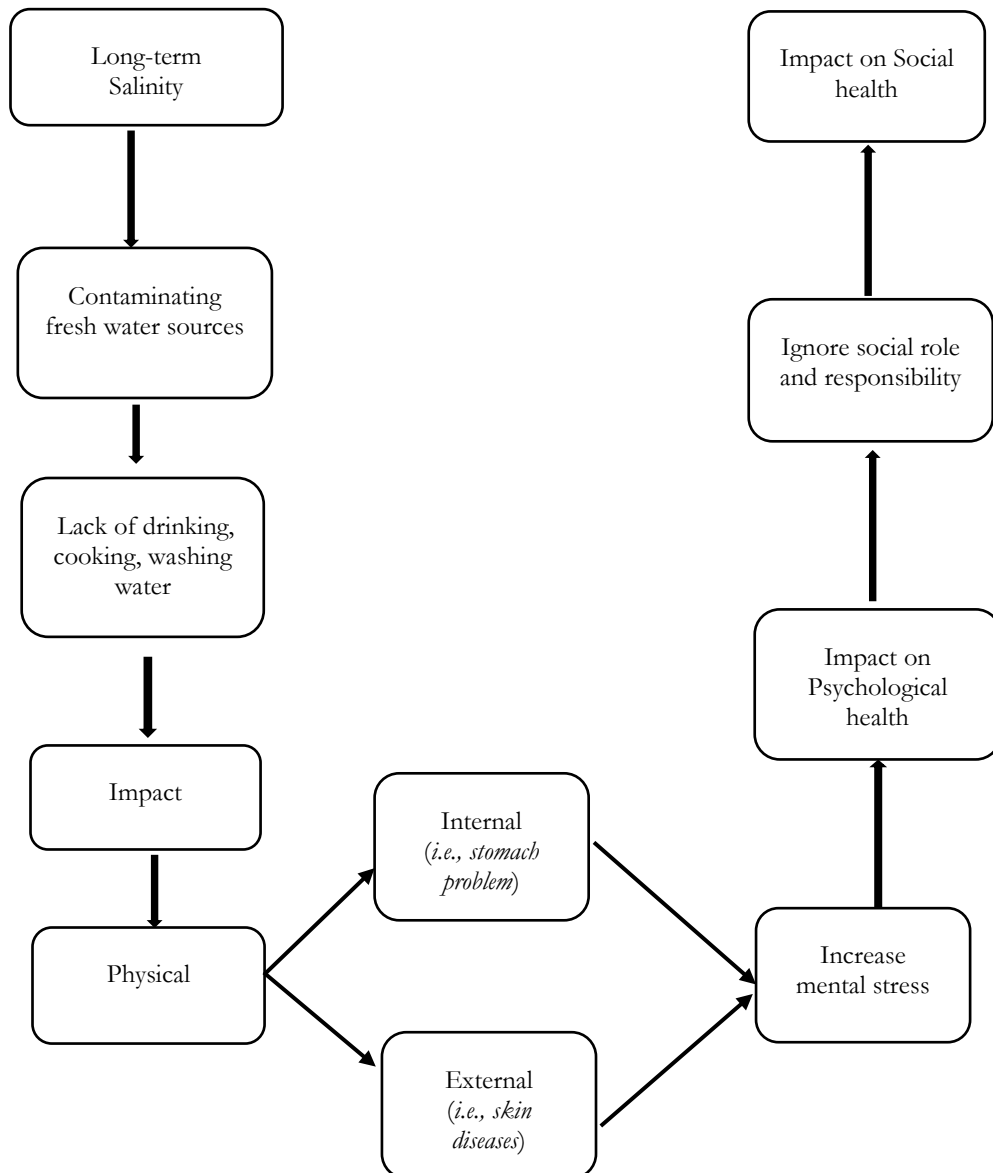


Figure 1. Impact of long-term salinity on social health

Conclusion

This study presented that the consequences of long-term salinity are not only affecting physical health but also affecting mental and social health. Initially the impact of salinity causes internal health problems like, diarrhea, acidity, digesting problems and so on. But the long-term salinity causes external health problems like, hair fall, hair damage, skin diseases, and the change in skin color. Long-term and increasing salinity also possess impact on psychological health in the form of hypertension. On the other hand, social health is a product of combination of physical and psychological health. As

salinity has effects on physical and psychological health, it possesses negative consequences on social health too. The current study found that the community people, local authority and NGOs are paying much more attention to secure drinking water than purifying cooking, and washing water. The study fails to address the reproductive health impact of salinity because of conservativeness of the community people. So, further study is needed on this ground. Though this study addresses the social health issue problems caused by salinity but a specific study is needed to understand the real scenario. Lack of methodological thickness may have impact on the study. In conclusion, it can be recommended that increasing fresh water reservoirs can be a solution to salinity intrusion of the coastal areas of Bangladesh.

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ⁱAll names used in this paper are pseudonyms