

Impact of River Pollution on Human Health: A Case Study of Shitalakhya River, Dhaka, Bangladesh

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Abstract: Fresh water is an essential amenity to survive. However, every year many people are directly or indirectly either dying or suffering from water-borne diseases. The main purpose of this study is to make a clear view of the pollution which is happening in Char Chanpara and how frequently the residents of that area are getting affected due to excessive pollution. Shitalakhya River and its surrounding area are suffering due to water pollution every year and now the situation is becoming worse. The polluted water from the river is infecting men, women and children in every possible way. Water is the most essential requirement to perform household chores, which are done by women and hence they are more prone to diseases caused by polluted water. Because of the poor economic status, they have no other option rather than using this water for their day to day activities. Proper initiatives by the government, awareness among people, disseminating news of this polluted river, constructing deep tube wells and availability of alternative uses of water are measured by which people can be saved from problems being caused by polluted water. This study aims to identify the causes of water pollution and how the residents of the area are affected by various types of water-borne diseases through their daily usages.

Key words: Polluted water, environmental pollution, water-borne diseases, human and nature, Char Chanpara.

Introduction

River pollution has always been a vital issue all over the world as it is directly and indirectly connected with all aspects of humans and nature. In Bangladesh, traditionally the main occupation of people is agriculture and irrigation is easier for the farmer if they stay beside the river. Since the 19th century, industrialisation process has also flourished alongside the rivers. Industries need water, and the river is a natural source for fulfilling the provision of water required in factories. Pollution of a river is vital issue of conversation concerning the conservation of environmental matters in the

capital city, Dhaka. The industrial development of Bangladesh has had adverse consequences on the quality of water (Islam et al., 1997). Water quality hinges on sewage and quantity of expulsion from different types of industrial units, biochemical productions, and regular rainwater and reduction competence by the scheme of river water (Hasan et al., 2014). With the progression of mechanization, raw trashes and extremely contaminated emission's, substantial metals and biological waste products is cleared in a straight line into the normal arrangements that damage the water quality, dust and residue. Productions have been up-surging over the preceding

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years all over the place of Dhaka City (Ahmed et al., 2010). Fabric and dyeing factory runoffs provide the modification of physical, chemical, and organic belongings of water surroundings by calculating the variation in high temperature, fragrance, sound, turbidity, and to the unique assets which are destructive to the health community, livestock, flora and fauna, fish, and other biodiversities (Goel, 2006). In Dhaka Tribune, a report published by the Department of Environment (DOE) stated that at least 344 industrial units dump liquid waste into the river, and among them, at least 287 have an effluent treatment plant (ETP). In this case, the people who are living alongside the river are dealing with health issues as they are directly connected with the river on a daily basis. That's why, it is high time to take the necessary steps to stop river pollution as it is affecting human lives in a very dangerous way. Dara (2017) studied that the surface water of Bangladesh is polluted in various ways such as industrial wastes, agricultural inputs including fertilisers and pesticides, sewage slugs and domestic wastes, etc. This polluted water cannot be used for drinking, domestic and agricultural purposes as it may cause health risk (Goel, 2006). The people of Dhaka City depend on the groundwater for their daily habits and due to the over pressure of population and water demand, ground water is also decreasing. Around Dhaka City, the foremost peripheral canals are Buriganga, Balu, Shitalakhya, Turag and Tongi canal which receives a great quantity of unprocessed sewage, industrial fluid and municipal waste daily and leads to contamination of severe surface water (Ahmed, 1985). According to the annual report of 2018-2019, Dhaka Water Supply and Sewerage Authority (DWasa), uses around 78% underground sources water and 22% from surface water for water supply system. This surface water comes through four water treatment plants by treating the river water of Shitalakhya and Buriganga (Authority, 2019). Improper discharge of untreated wastewater from various industries adulterates river water quality (Subramanian, 2004; Rahman and Hossain, 2008; Rahman et al., 2013). A previous study stated that industrial wastage is one of the reason of river pollution and the Ministry of Shipping mentions the list of seventy industries which are involved in the land degradation and river pollution (Karn and Harada, 2001). People are talking about the protection of the river but unfortunately, no one has come to visit the area around this river to observe the situation and find a solution to get rid of the crisis which is being faced. Many seminars and conferences have focussed

on protecting this river but still, no effective result was concluded to save and preserve it from extinction. According to the photo news report, the oxygen level of this river water now ranges from 0.4 mg to 0.74 mg, however, the level should be more than 5 mg per one liter. The water condition is so worse that people who are living beside the river have a great threat towards contamination due to unhygienic water quality. This paper shows evidence of people being affected by water borne and skin diseases. This study focussed on the reasons for the water pollution in the Shitalakkhya River and how the life of the residents in the area is affected by various types of diseases because of its daily usages by different groups like children, women and men.

Materials and Methods

Study Area

The study area is Char Chanpara village under Rupganj union, Rupganj Upazilla, Narayanganj alongside Shitalakkhya and Balu Rivers. The total population of Rupganj Union is 44013 approximately, among which the male population is 22703 and the female population is 21310 and the land area is 29.21 km² (Pulak, 2020). The satellite and GIS image of the study area has been shown in Figure 1.

Sources of Data

Data is collected both from primary and secondary sources. The primary data is collected by following the mixed method approach, i.e., the combination of quantitative and qualitative methods considering the objectives. Secondary data also provides backing to the primary information and regulates its validity and reliability. In this paper, the secondary sources of information include websites of publications, books, journal articles, newspaper articles and blogs.

Data Sampling

In order to obtain the most desired result from the study, a simple random sampling technique has been adopted. The sample size was selected based on the people's dependency on the river of Char Chanpara union. Here the formula is $n = N * X / (X + N - 1)$, where, $X = Z_{\alpha/2}^2 * p * (1-p) / MOE^2$. So, considering the formulas, 150 households have been surveyed.

Data Collection and Analysis

This study has been aimed to collect qualitative data through two Key Informant Interview (KII) and three Focus Group Discussion (FGD). Microsoft Excel and

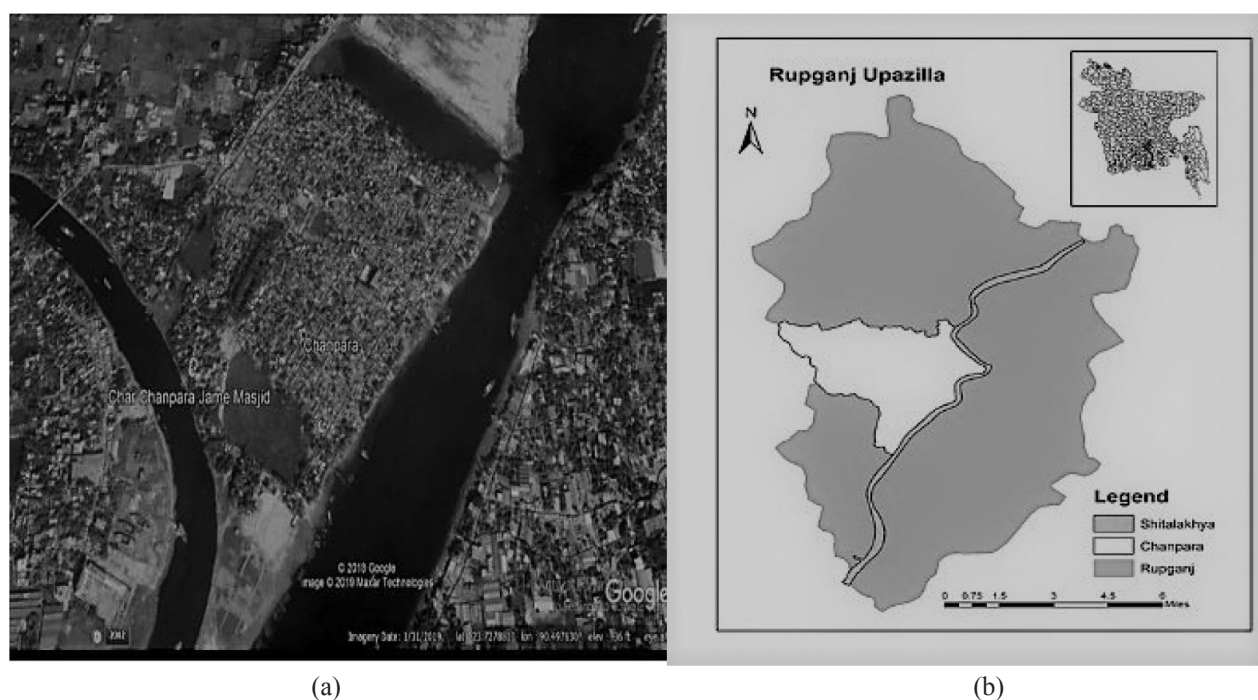


Figure 1: (a) Satellite image of the location and (b) GIS image of the study area.

GIS mapping have been used for data analysis and showing study area, respectively.

Results and Discussion

Physiochemical Test

In a study conducted by Munna et al. (2014), the physiochemical test had been done on the samples taken from these rivers by which the potential of hydrogen (pH), colour, turbidity, total dissolved solids (TDS), total suspended solids (TSS), biochemical oxygen demand (BOD), and chemical oxygen demand (COD) were determined. Table 1 represents turbidity which is a measure of clarity or transparency in water varied among the rivers. The amount of TDS is an acceptable range in all the rivers but the TSS is high in all the rivers. BOD is a measure of the oxygen used by microorganisms to decompose the waste. If there is high BOD in the water that means the water is highly polluted because the dissolved oxygen level will be decreased. Chemical oxygen demand (COD) is the total measurement of all chemicals and determined the inadequate oxygen level in the water. As seen in Table 1, all the rivers have crossed their BOD and COD standard levels. Due to the pollution of the Shitalakhya River, people who are directly connected with water are the most vulnerable ones. The waterborne diseases can turn into the leading causes of other diseases like kidney

diseases, maternal and reproductive health problems. River bathing increases the amount of free carbon dioxide (CO_2) and decreases the amount of dissolved oxygen (DO) in rivers (Bhatnagar and Sangwan, 2009). The usage of river water for washing and hygiene can lead to an enlarged existence of Coliform bacteria, which are related to unsafe pathogenesis known to cause nausea, vomiting, and bloody diarrhoea, especially among infants and people with conceded invulnerable organisms (Joshi and Sati, 2011). According to the city development plan (Alam et al., 2003) of the country, it has been found that only 60-million-liter of water have been treated each day while the rest 190 million liters of water remained remains polluted. Diarrhoea, typhoid, cholera, jaundice, causing liver and kidney damages, are some of the critical and dangerous water borne diseases. Another report revealed that the children were hospitalised after drinking polluted water and locals suffered from severe skin diseases.

Gender and Educational Status

The participants were mostly female from the household survey as they were available at the time of data collection and the highest male and female participants were in the age group ranging from 26 to 45 years. In addition, the females (21/29) were mostly illiterate and literate people had mostly primary and secondary level education (Table 2).

Table 1: Physiochemical test results of different rivers

<i>Sample Water</i>	<i>Location</i>	<i>pH</i>	<i>Colour (Hazen)</i>	<i>Turbidity (NTU)</i>	<i>TDS mg/L</i>	<i>TSS mg/L</i>	<i>BOD mg/L</i>	<i>COD mg/L</i>
Buriganga	Upstream	6.50	0.50	3.23	140	400	7	40
	Downstream	6.70	0.50	4.70	152	380	8	30
Shitalakhya	Upstream	6.70	0.50	2.28	80	200	4	25
	Downstream	6.90	0.50	3.90	92	220	5	22
Balu	Upstream	7.20	0.50	19.50	192	400	5	20
	Downstream	7.10	0.50	22.50	205	350	6	25
Turag	Upstream	6.50	0.50	2.97	122	100	11	35
	Downstream	6.40	0.50	3.80	135	100	9	31
Bangshi	Upstream	6.60	0.50	6.23	225	400	27	20
	Downstream	6.70	0.50	5.20	255	380	15	18
Karnatali	Upstream	6.60	0.50	5.50	150	200	12	22
	Downstream	6.70	0.50	5.00	172	180	9	19
BD Std.		6.5-8.5	15.00	10	1000	10	0.2	4.0
World Std.		6.5-8.5	-	-	500	-	-	-

Table 2: Gender and educational status of survey area

		<i>Educational status</i>						<i>Total</i>
		<i>Illiterate</i>	<i>Primary</i>	<i>Secondary</i>	<i>SSC</i>	<i>HSC</i>	<i>Graduation</i>	
Gender	Female	21	27	28	18	5	2	101
	Male	8	11	10	10	8	2	49
Total		29	38	38	28	13	4	150

Sufferings from Physical Problems and Diseases due to Interaction with River Water

According to Dipta and Akhie (2018), 80% people in the study area suffer from different physical problems. People admitted that they suffered from diseases and frequently get sick in a year due to river water pollution. Moreover, a total of 64.83% of people got sick 4-6 times in a year. The highest number of sick people went to the pharmacy for treatment and collected medicine from the pharmacist. The second highest is local quacks because they are cheaper than the other medical facilities. According to Haque (2003), maximum women uses cloth in menstrual period and very less women use pad because it is expensive and readily affordable. Our study also observed that children play near the river side and indulge in fun activities like swimming in river water (Table 3).

Variation in Health Impact based on Gender and Children

According to the survey by Kamal et al. (1999), male

and female adult members of the family were mostly affected by diarrhoea. Another report by WHO stated that water borne diseases such as cholera, diarrhea, dysentery, hepatitis A, etc. are directly interrelated to the unsanitised and unhygienic drinkable water leading to the death of more than 842,000 people from the diseases of diarrhea universally (WHO, 2017). Our findings stated that more than 33% and 28% female and male adults, respectively, were sick due to diarrhoea. Besides these causes, they are affected by cold fever, skin diseases, allergy, typhoid, hair loss, respectively. On the other hand, diarrhoea and skin diseases also affect most children. Sultana et al. (2009) reported similar results which support the present findings (Table 4).

FGD with Fisherman

Focus group discussion was done with seven participants of whom three fishermen are below 20 years and the others are middle aged. One fisherman who has been residing in the community for about 20 years said, "When I was young, me and my father caught

Table 3: Frequency of getting sick in a year, treatment for diseases and using materials for menstrual hygiene

<i>Items</i>	<i>Options</i>	<i>Frequency</i>	<i>Percentage (%)</i>
Getting sick in a year	1-3 times	51	35.17
	4-6 times	94	64.83
	Total	145	100
Treatment for diseases	Community clinic/hospital	39	19.02
	Pharmacy	101	49.27
	Local quacks	65	31.70
	Total	205	100
Using materials for menstrual hygiene	Pad	14	13.86
	Cotton	35	34.65
	Cloth	52	51.49
	Total	101	100
Get in touch with river	Swim	51	40.47
	Working in boat	19	15.07
	Bathing	38	30.16
	Fishing	18	14.29
	Total	126	100

Table 4: The rate (%) of getting affected by water-borne and skin diseases

<i>Options</i>	<i>Male</i>		<i>Female</i>		<i>Children</i>	
	<i>Frequency</i>	<i>Percent (%)</i>	<i>Frequency</i>	<i>Percent (%)</i>	<i>Frequency</i>	<i>Percent (%)</i>
Diarrhea	88	28.39	75	33.33	60	28.71
Hair loss	20	6.45	12	5.33	19	9.09
Typhoid	35	11.29	23	10.22	14	6.69
Cold fever	63	20.32	42	18.67	38	18.18
Allergy	49	15.81	35	15.56	36	17.22
Skin diseases	55	17.74	38	16.89	42	20.09
Total	310	100	225	100	209	100

many fishes from this river but now the situation is different.” According to their view, fishes are dying due to industrial pollution in this river. Another fisherman said, “He wants to switch his profession and restart as a rickshaw puller in Dhaka City”. Participants declared that people are suffering from various types of diseases and go to the local pharmacy and local quacks for treatment. Neither government NGO nor private NGO come to the rescue or bring about awareness among the residents about the critical situation.

FGD with People in the Male Community

A group of seven men were interviewed at the vegetable market in the region. A vegetable seller told, “Their family came here when he and his siblings were

teenagers. He and his brothers have been cultivating vegetables for 3 years and selling these into the local Bazaar and to vendors. Now a day, good quality vegetables are not produced and hence not available at Char Chanpara.” Another cultivator explained they are suffering from more skin diseases as they use river water frequently to wash their vegetables. For any kind of health problems, all of them consult a local doctor, who prescribed medicine such as Neempata for their skin diseases.

FGD with People in the Female Community

A group of eight females working on handicraft items in a yard were interviewed. Among them four were middle aged, two of them being over 50 years and the

remaining two were below 30 years of age. According to them, they have been living in this community for the past 12 years and faced scarcity of water due to a supply system problem. Household activities depend on using the river and tube-well water. One female participant said, "I had suffered from typhoid six months ago because of polluted water." Another participant said, "bringing water from tube well is a task as it is very far from my house". The people who have some political power use the community tube well mostly and the other people are compelled to depend on the river water at that time. They easily fall prey to the polluted water due to washing clothes as a result, especially contacting water borne diseases and skin diseases are a common phenomenon here.

KII with the Local Doctor

A local doctor, who has been serving patients for 16 years and tries to give possible treatment to every category of people like male, female, elder, children. According to him, male patients visit more frequently than the females and suffer from diarrhoea, allergy and cold fever. His opinion is that river pollution is the main culprit for diseases and there needs to be awareness about the pollution and remedy for this problem.

KII with Ward Counsellor (Ward no-69)

The ward counsellor who has been living for more than 30 years and working for 8 months said, "15 years ago, water was clean and people used it for every activity. Now, water is full of pollutants, which is very harmful to the people of this area. That's why the water borne and skin diseases are increasing among the people more and more." Though the government did not take any initiative, he applied to the Mayor of City Corporation for a "Community Medical" so that people could get proper treatment.

Major Findings

Poor Socio-economic Structure

Our study observed that river water is used due to the scarcity of supply water and maximum people are illiterate with lower income range and unaware on how to maintain hygiene and follow sanitation. These characteristics are linked with the unsafe conditions which forces them to use river water. Since the people living here lack proper medical facilities, they mostly suffer from skin diseases. Moreover, people have to cross the river for getting medical help.

Lack of Awareness about Reproductive Health

Reproductive health is connected with the environment and pollution in various aspects. Women mostly use cloth during their menstruation cycle and wash it in the river due to scarcity of supply water. In addition, they mostly throw away used clothes after 3 months. This creates another unsafe condition that can be connected with pollution theory. As the menstruation cloth is being washed in the river, it will affect others who will use river water.

Health Impacts Based on Genders

Females from the FGD group said that children cannot bathe in the house with limited water supply as they store water for cooking and drinking purpose only. When they go to school by crossing the river, find it more fun to play and swim in the river after school and bathe themselves simultaneously. For this reason, children tend to suffer from several kinds of diseases. On the other hand, water is very unbearable and emits bad odour, making it very tough for fishermen to work because sometimes the filth is visible. People get the supply water twice a day for 10 minutes only and sometimes boil the river water for drinking. The water supplier takes 300 TK per month in provision for a little amount of water but everyone is not capable to afford it.

Conclusion

Water is an essential requirement for day-to-day living. Water borne diseases are increasing due to overpoisoned water and distressing social well-being. Now, it is high time to save thousands of lives with purity of water in Char Chanpara, which is more connected with Sitalakhya River. However, many laws and legislation are established, but still, the implementation is rare. It is recommended that there should be a proper waste disposal system and the waste should be treated before entering into the river. Educational and awareness programmes should be organised to control the pollution and focus on implementation, and punishment for any miscreation, which may create the pollution, is the only solution. Every individual has to be made aware of the reasons, which cause pollution and its devastating aftermath. This is one of the main solutions to avoid any mishappenings.

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Conflict of Interest

The authors declare no conflict of interest regarding the publication of this paper.

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