WATER SUPPLY, SANITATION SYSTEM AND WATER-BORNE DISEASES OF SLUM DWELLERS OF BASTUHARA COLONY, KHULNA

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ABSTRACT

Slum population has been increasing in Bangladesh day by day. But slum facilities are very much unsatisfactory for them due to lack of proper water supply and sanitation system. Therefore, the major portion of excreta is deposited into water bodies and open places, as such polluting water sources, groundwater, and the environment. As a result, the majority of the population in Bangladesh suffers from different kinds of water and excreta-borne diseases. This study was conducted to investigate the water supply and sanitation facilities at Bastuhara Colony, Khalishpur, Khulna. During the study period, data and information were collected by questionnaire survey with focus group discussion, some photographs were taken to relate this study and tube-well water of this slum was conducted to laboratory analysis. It is found that out of 500 families 70.67% families use to supply water, 24.67% families use tube-well water and 4.67% families use surface water for daily use. It is seen that 58% families use the sanitary latrine, 17.33% use open pit latrine and 24.67% have no latrine. Yet, 59.33% solid waste is disposed of in open place, 25.33% is disposed in open ditch and only 15.33% waste is collected. Contrary, total 58% families use a septic tank, 11.33% families use an open place and 30.67% families use the open canal for disposal human waste. Majority slum people use tube well water for drinking while a significant amount of open defecation is also found. Normally Bastuhara Colony has sanitary latrines, which are partially hygienic as they don't have a proper septic tank. The drainage system is the most neglected sector in the slums. Besides, in the slum area, solid waste management and drainage system are not satisfying. So, some effective ideas about water supply and sanitation system according to health education program has been suggested for slum dwellers.

Keywords: *Slum, Sanitation system, Water supply system, Hygiene condition.*

1. INTRODUCTION

In Bangladesh, most of the people die every year due to various types of water borne diseases like Diarrhea, Cholera, etc. The World Health Organization estimates that each year 500 million people suffer from various types of water borne diseases due to unsafe water supply (WHO, 1991). For inadequacy in pure water supply, 500,000 infants die each year in the world (Unicef, 2005). Whereas the health situation in Bangladesh however, is gradually improving with the infant mortality declining to 77 per 1000 live births in 1996, with the gradual improvement of the sanitation coverage (33% of rural population and 42% of urban population in 1993) and more importantly, with the introduction of an integrated approach water, sanitation and hygiene education (Halder & Islam, 2015). Invariable the progress of sanitation, throughout the world has been closely associated with the availability of water, and the larger the quantity and the better the quality of the water, it has been advanced among public health more rapidly and extensively. The WHO's figures for 1980 show that, among the urban population of the developing countries, only about 55% had house connections and an additional 20% had access to taps (WHO, 1991). In 1983, over 62% of people in developing countries, some 1100 million people lacked an adequate water supply (Hoque, Juncker, Sack, Ali, & Aziz, 1996). The situation is not the same in all developing countries. 97% of the population had access to water form improved sources in 1996; those served to be 97% in rural and 99% in urban as compared to 1% in 1980, the situation less positive; although important progress has been made (Hoque et al., 1996). It is important to understand that the improvement of health is not possible without sanitary disposal of human excreta. However, neither sanitation nor water supply alone is good enough for health improvement. It is now well established that health education or hygiene promotion must accompany sufficient quantities of safe water and sanitary disposal of excreta to ensure the control of sanitation related disease (Cairncross et al., 2010). Proper sanitation can control many excreta related diseases. However, to improve health conditions through improved sanitation, it is necessary to have a clear understanding of the diseases that are prevalent in the absence of proper sanitation, and their transmission routes. These diseases are excreta-related and are caused by microorganisms such as viruses, bacteria, protozoa and helminths or worms. There are some preventive measures particularly helpful in interrupting disease transmissions such as Safe human excreta disposal, Personal hygiene, Domestic hygiene (and animal management), Food hygiene, Water hygiene/consumption of safe water, and Safe wastewater disposal and drainage (Gross, Schell, Molina, Leão, & Strack, 1989).

There are two sources of water available, one is surface water and another one is ground water. Surface water is the source of an abundant amount of water. Before and during the early stages of tube-wells installation, the rural water supply was largely based on protected ponds (Winter, Harvey, Franke, & Alley, 1998). The biological quantity of water in this pond is extremely poor due to unhygienic sanitary practices and the absence of any sanitary protection. On the other hand, Groundwater is water located beneath the earth's surface in soil pore spaces and in the fractures of rock formations. Groundwater is free from disease-producing micro-organisms which are normally present in large numbers in surface waters (Winter et al., 1998). In Bangladesh, it is available in adequate quantity, but the availability of groundwater for drinking purposes has become a problem because of arsenic, dissolved iron, salinity in the shallow aquifers in the coastal areas, lowering of groundwater level, and rocky/stony layers in hilly areas. Sanitation system has arrangements of excretion and storage, collection and transportation, treatment, and disposal of human excreta and other forms of wastes back to nature in a safe manner (Koola & Zwane, 2014). Combination of these functions depends on the local conditions. When the wastes are collected, treated and disposed of at the point of generation it is called an on-site system e.g. pit latrines and septic tank systems. However the wastes are collected and transported to somewhere else for treatment and disposal, the system is called off-site, e.g. bucket latrines systems and conventional sewerage systems (UNICEF/WHO, 2005). In dry systems, no water is used for the dilution of the waste and usually applied in answered areas with no piped water supply. But in the wet system the waste is diluted with flushes of water and suitable where piped water supply systems are available. With respect to sanitation, people's needs are primarily health, privacy, and convenience, and resources include the availability of money, space, and skills. The local factors that influence greatly the nature of sanitation development include the existing environmental setting, e.g. the soil, climate, surface and groundwater, tradition, religion,

culture and local leadership patterns, hygiene awareness and the institutions serving the people (WHO/UNICEF JMP for Water Supply and Sanitation, 2014). A sanitation development program should carefully consider these key factors particularly for low and middle communities of developing countries as well as for planning a sanitation development program should consider the collection of background information, cultural aspects, motivational factors, contribution in cash, and social organization for improvements.

Bangladesh experienced extremely rapid growth in the urban population, 4.9% as compared to 2% national coverage in the recent decade, resulting in the present size of the urban population of about 23 million by the year 2000 (Rana, 2011). The available data for the district towns indicate that approximately 33% of the urban population has reasonable public water supply, 10% by house connection calculated @ 13 persons per connection, 6% by public hand posts @ 100 per stand post and 17% by public hand pumps @ 75 persons per hand pump (Rana, 2011). The urban drinking water coverage is 75%, while the coverage under the facility in the suburban areas is 58% only. About 16% of the 90 million rural population use sanitary latrines. In addition, another 22% use the so-called home-made pit latrines. People are now conscious of using latrines and about 62% of the total populations have access to some form of latrine (Hoque et al., 1996). Of about 30 million urban dwellers, sanitation coverage is only about 42%. In urban areas, a range of on-site options such as septic tanks, single and double pit pour-flush latrines are used. Conventional sewerage systems are used only in parts of Dhaka and cover only 18% of the city's 8.5 million people (The World Bank Group, 2007). In this study, a slum area called Bastuhara Colony of Khulna City Corporation has been taken up to consideration as the study area's ongoing development work with water supply and sanitation system particularly related to environmental improvement. Khulna is situated on the southwest side of Bangladesh. It is surrounded by the river Bhairob and Rupsha. At the end of 1984 Khulna City Corporation (KCC) was developed whose land area 45.6 square km and the number of wards are 31. It is to be noticed greatly that the suburban areas of Khulna city are developed in a scattered way. The water supply and sanitation of these areas are far lagging behind the residential area (Sohel Rana, 2009). Main sources of water in these areas are shallow tube-well. In residential area municipality, water supply and sanitary system is also better. The aim of this study was to investigate the current situation of water supply and sanitation system, assess the environmental and social conditions, and improvement of water supply and sanitation system of the Bastuhara colony, Khalishpur, Khulna.

2. METHODOLOGY

2.1 Study Area

Bastuhara Colony of Khalishpur, Khulna was selected as the survey site. This study is undertaken to investigate the existing water supply and sanitation system in the study area. The map of the study area is shown in Figure 1.

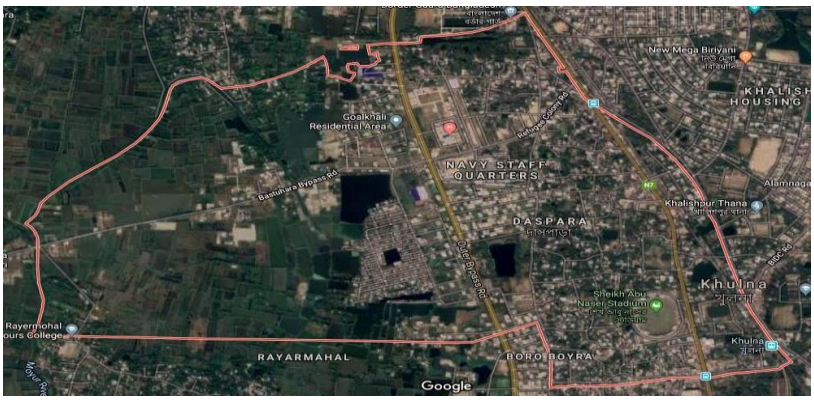

Figure 1: Satellite view of the study area (Source: Google Map)

Bastuhara colony is in Ward no. 09 of Khulna City Corporation which has 62.72 acres area with 19,500 population. It has two water points (both by KWASA) with communal sanitation systems and discontinuous semi-pucca drainage facilities. Most of the solid wastes are disposed in open places.

2.2 Field Data Collection and Laboratory Analysis

For A details questionnaire survey has been done among dwellers of the Bastuhara Colony. It was mainly done to know about water supply sources, water uses, sanitation practices, solid waste management and so on. A total of 500 families were taken into consideration. Some photographs were taken to understand the real situation of the study area. Laboratory analysis of the tube-well water and supply water was conducted. The laboratory tests are consisting of pH, Electrical Conductivity, Turbidity, Hardness, Colour, Iron, Arsenic, Manganese, Chlorine, Total Coliform, Faecal Coliform, and Total Dissolve Solid. Besides, different pieces of information were collected from different government organizations like KWASA, KCC and some non-governmental organizations like Nabolok, BRAC, etc. The types of data that are collected from the slum are tabulated in Table 1.

Table 1: Types of data collected from Bastuhara Colony

Sl. No.	Types of data
1	Educational status of household head
2	Occupation of the slum people
3	Condition of existing House
4	Water use pattern
5	Tube-well ownership ratio
6	Salinity of Tube-well water
7	Types of latrine used
8	Disposal of human excreta
9	Distance between tube-well and latrines
10	Interval of cleaning existing drains
11	Solid waste disposal pattern
12	Diseases caused by contaminated water

2.3 Pictorial View of the Study Area

2.3.1 Communal Sanitation System

In figure 2, Bastuhara Community's Toilet is shown which has some problems. The human excreta is disposed into the soakage pit but the size is very small, the low land area is overflowed at the rainy season. Fouling of latrines and urinals is common and once a latrine is fouled. Subsequent users find no other alternative but to foul it more. Thus operation and maintenance is a major problem in this system. In this slum, there is no full-time attendant for operation and maintenance.

Figure 2: Bastuhara Community Toilet

2.3.2 Over Hanging Latrine

The view of overhanging latrines is shown in Figure 3. These latrines stand by the side of the canal or river which is very unhygienic. Besides, canal water is used by many of the slum dwellers which is a cause for different water-borne diseases.

Figure 3: Over-hanging Latrines

Among community toilets and over-ganging latrines, the disposal of human excreta and urinals in open environment is much higher for over-hanging latrines because in this case direct disposal is happening in canal or river whereas community toilets have small soakage pit by which direct disposal can be avoided.

2.3.3 Tube-well

In the slum area, all the tube-wells are No. 6 tube-well. For drinking, all the slum dwellers use tube-well water. But for daily activities, they mainly use supply water though some people use tube-well water too. The main concern here is most of the tube-well is within 10 meters distance of the latrines which is the cause of groundwater contamination. A No. 6 tube-well is shown in figure 4.

Figure 4: Tube-well (No. 6) used at Bastuhara Colony

2.3.4 Drainage Condition

Figure 5 shown that the drainage condition in this slum is very poor. People of the slum area are not sufficiently aware of waste disposal. Besides, there are no places where solid waste can be disposed of. So, people throw the waste into the existing drains. Solid waste disposed over the drain thoroughly causes a waterlogging problem. Thus, it creates serious environmental pollution.

Figure 5: Existing Drainage Condition at Bastuhara Colony

3. RESULTS AND DISCUSSIONS

The necessary data were collected to analyse the project in two ways. Firstly, for the total analysis, the previous study data were collected from various governmental and non-governmental organizations. Secondly, field data were collected by the questionnaire survey. In this research, the water supply and sanitation situation in this slum area has been investigated. During the investigation, various sources of water and different types of sanitation are observed. The total numbers of families were counted and from here the percent users of different types of water supply and sanitation systems are analysed.

3.1 Educational Status of Household Head

Most of the slum dwellers are not well educated. They are either only capable of signature or having an educational status of below SSC. Only 12% of people are SSC or above SSC level, 39% are below SSC level, 45% are only signature level, and 4% are illiterate.

3.2 Occupation and Personal Income of Existing Household

The survey has been done among 500 families consists of about 2500 people. In about 2500 people, 616 numbers are businessmen, 711 are housewives, 664 are students, and 509 are service holders. Besides, the majority of the population lives under the poverty line as a huge 51.33% household's income lies between 0-5000 taka, 14.67% are lies between 5000-10000 taka, 27.3% are in 15000-20000-taka range, and above 20000-taka income households are 6.67%. It is an alarming issue for this slum.

3.3 Existing Housing Condition and Water Use Pattern for Daily Activities

There is a mixed housing pattern was observed in the slum area. Most of the family live in Pucca/Semi Pucca house (65%) but there are still some families who live in a Tin shed (26%) or Hut (8%) or other types of house (1%). The people in the slum area normally use Supply water (70.67%) for daily activities whereas some use Tube-well water (25.67) too. Besides, there are very few who use Surface water (3.66). But for drinking purposes, all of them use Tube-well water. In the slum area, most of the people don't have any private tube-well. They use water from public sources which are installed by KWASA and KCC as 71.33% of the tube-well used are public tube-well. Among the installed tube-wells, 77% provides sweet water whereas 23% of tube-wells water contains salinity.

3.4 Sanitation System and Disposal of Human Excreta

The overall sanitation system in the slum area is very unhygienic. 58% of the people use sanitary latrine, 17.33% use Open pit. But the alarming fact is that 24.67% of people do not have any sanitation coverage. It has also been observed that 58% of human excreta is disposed of in Septic tank. Others are disposed at either open place (11.33%) or open canal (30.67%). Thus, the canal water

gets contaminated. It is a major issue needs to be solved. The minimum safe distance between tube-well and latrine is 10 meters. But it is observed that a total of 84% of tube-well are within 10-meter distance with the latrines. It is not safe as latrine's infiltration sewage can be resurfaced by tube-well.

3.5 Solid Waste Disposal Pattern and Drainage Facility

It is seen that a total of 84.67% of solid waste is disposed of either in an open place or an open ditch. Only a mere 15.33% of solid waste is collected. Drains are mostly cleaned at an interval of more than 30 days. 77% of the drains are cleaned at an interval of more than 30 days whereas only 23% are cleaned in 30 days. To solve the waterlogging problem, the drains should be cleaned regularly.

3.6 Water Quality Parameter (Lab Analysis)

Three samples were tested in the lab to find the water quality parameters. One sample was of Supply water and the other two were from two different Tube-wells of the slum area. The laboratory data are tabulated in Table 2.

Table 2: Water Quality Parameter at Bastuhara Colony

Water Quality Parameter	Unit	Bangladesh Standard	WHO Standard	Supply Water	Tube-well Water-1	Tube-well Water-2
pH	-	6.5-8.5	6.5-8.5	7.4	7.6	7.8
Electrical Conductivity	µ-s/cm	-	-	684	899	718
Turbidity	NTU	10	5	2.37	2.04	1.67
Hardness	mg/L	200-500	500	46.25	50.87	41.63
Color	Pt. Co	15	15	45	18	35
Iron	mg/L	0.3-1.0	00	0.13	0.04	0.15
Arsenic	mg/L	0.05	0.01	0	0	0
Manganese	mg/L	0.1	0.5	0.4	1.2	0.9
Chlorine	mg/L	150-600	-	290	690	140
TC	No./100 ml	0	0	4	0	2
FC	No./100 ml	0	0	0	0	0
TDS	mg/L	1000	1000	840	960	870

From the laboratory experiment, it was found that the sample waters have a problem in color, especially the supply water was a little bit reddish. One of the tube-well has chlorine in excess quantity. Besides, both the tube-well water has Manganese beyond the tolerable limit. Finally, TC was found in supply water and one of the tube-well water. So, the water of both supply water and tube-well water needs treatment.

3.7 Diseases Caused by Contaminated Water

Figure 6 shows that the slum dwellers suffer from various diseases caused by contaminated water. A statistical survey with a duration of three months has done among about 800 slum people who are generally using water for their domestic purposes from the canal whose are polluted by the direct disposal of human excreta and urinals. For this, different diseases like Diarrhea, Dysentery, Jaundice, and Typhoid can be seen among the slum people. Among 800 people, 200 are suffered from Diarrhea, 216 are suffered from Dysentery, 144 are suffered from Jaundice and 240 are suffered from Typhoid.

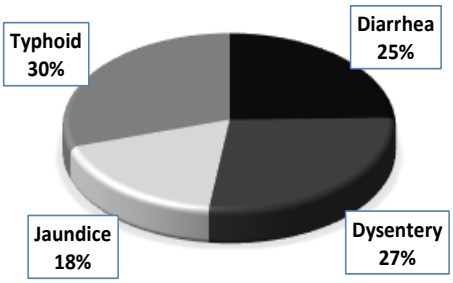

Figure 6: Diseases Caused by Contaminated Water at Bastuhara Colony

4. CONCLUSIONS

The water supply and sanitation problems in the Bastuhara colony are so acute. The problems which are created could be minimized if sufficient care is undertaken during planning and implementation. Most of the people of the colony are illiterate and a total of 88% population are below the SSC level and most of the family live in Pucca/Semi Pucca house. For drinking purposes, dwellers are depended on tube-wells and for daily activities, supply water is used but for drinking it is avoided as it is contaminated. Among the installed tube-wells, 77% provides sweet water whereas 23% of tube-wells water contains salinity. In the case of sanitation, about 58% of people use sanitary latrine whereas 24.67% of people do not have any sanitation coverage. For disposal, about 42% of human excreta are disposed of in open places which are the real cause of canal water contamination. The waste collection and disposal system in the slum area is very poor and about 84.67% of solid wastes are disposed of in an open ditch or open place which causes environmental pollution. Distance between tube-well and latrine is 10 meters or below in 84% cases which increases the chance of groundwater contamination. And the slum people are suffered from various water-borne diseases due to the use of contaminated water.

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