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Case Report

Water Supply System in Pabna Municipality of Bangladesh: A Case Study

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Abstract: Safe and adequate water supply is a challenging task in many developing cities like Pabna. People have been facing water supply problems e.g. odor, turbidity, iron, etc., thus leading to public health risk e.g. typhoid, skin disease, allergy, etc. This paper presents the existing water supply system of ward no. 5 of Pabna municipality. Primary data were collected from the householders through questionnaire and field visit to the study area during October, 2018 to April, 2019. The valuable information, ward map, etc. were collected from the respective officials of Pabna municipality. The collected data and information were then analysed. 19% householders use groundwater, 9% householders use public supply water and the rest use both. They use groundwater for drinking purposes and supply water for domestic purposes. 71% householders use water 80~100 lpcd and 29% householders use water 60~80 lpcd for their daily usages e.g. drinking, cooking, bathing, washing, defecation, etc. They use more water at morning and noon. 17% householders face occasionally and 32% householders face rarely the shortage of water. In supply water, odor is high at 46% houses, medium at 30% houses and low at 12% houses and turbidity medium at 10% houses and low at 76% houses. Supply water contains iron; high at 2% houses, medium at 39% houses and low at 46% houses. Arsenic is not present in both groundwater and supply water. Drinking water quality is very good at 12% houses, good at 15% houses and satisfactory at 73% houses. Some householders use filtered or boiled water for drinking. 90% householders use economic water closets. 20% householders are affected by water borne diseases e.g. skin disease, allergy, etc. The study helps understand the nature and type of water supply problems faced by the dwellers of Pabna municipality.

Keywords: Groundwater, Health Risk, Supply Water, Water Scarcity, Water Supply System

1. Introduction

Water covers more than 70% of the earth surface. All living things consist mostly of water. Only 2% of the total volume of water is fresh water, which can be used for consumption and for agriculture [1]. About 11% of the global population remain without access to an improved source of drinking water. Such sources include household connections, public standpipes, boreholes, protected dug wells, protected springs and rainwater collections [2]. Water scarcity is reaching worryingly high levels all over the world due to intensive exploitation and pollution of water resources. Climate change intensifies this pressure in some regions of the world, resulting in an infallible decrease in water resources in the coming years [3].

Every living soul e.g. animal, plant, etc. requires water for its survival. It is essential for life, health and sanitation. The importance of water in human life is so much that the development of any city of the world has practically taken place near some sources of water supply [4]. People use water not only for drinking and culinary purposes but also for bathing, laundering and other domestic purposes. Safe, adequate and accessible water supply, combined with proper sanitation, are basic needs and essential components of primary health care. Health problems related to the inadequacy of water supply are universal but generally of greater magnitude and significance in developing countries [5]. Environmental sanitation and safe water supply are vital for protecting the environment, improving public health and alleviating poverty. About 80% of all diseases and over one

third of deaths in developing countries are caused by the consumption of contaminated water, and on average as much as one tenth of each person's productive time is sacrificed to water related diseases. Human excreta and sewage are important causes of the deterioration of water quality in developing countries [6]. At present, as much as one third of the world population live in countries suffering from moderate to severe water resources stress in terms of water use relative to availability. As much as two thirds of the world population could be living in water stressed countries by 2025. With population increase, economic growth and rising living standards, it may be necessary to use most of the readily accessible renewable water resources to satisfy the needs of agriculture, industry and households, as well as the need to maintain adequate river flows and to protect aquatic ecosystems [7].

The quality of drinking water is closely associated with human health. Providing safe drinking water is a major public health priority. Deteriorating water treatment facilities and distribution systems pose a significant public health threat [8]. The extent of availability of drinking water supply is an indicator to the standard of quality of life in an urban area. Though the capital and other metropolitan cities have higher population coverage under piped water supply but the other urban centres and even the old district towns have population coverage as low as about 10%. A large number of urban citizens in the district towns are to depend on other sources e.g. tubewells, ponds, shallow wells, rivers and canals to meet their demand which are hazardous to health and sometimes inefficient and expensive as well. Moreover, those sources are not always adequate and available to fulfil their requirements round the year. The scarcity of drinking water results in water borne diseases and polluted environment in the urban centres [9]. Sanitation is often closely related to water supply systems, although the situation is generally worse. The challenge of water supply and sanitation in urbanized regions in developing countries is evident. Causes are not easy to pinpoint, since they are a complex interaction between various factors such as a high rate of population growth, lack of infrastructure and investments in infrastructure, and limitations to natural water resources [10].

About 97% of the people of Bangladesh have access to water and only 40% have proper sanitation. With a staggering 60% of the population that has to endure unsafe drinking water, the nation is in danger [11]. Although 80% of the people have access to some form of improved water supply, unfortunately arsenic contamination of wells has complicated the situation by causing considerable health problems. More than 25% of the people are using unsafe tubewells [12]. Two thirds of the dwellers of Dhaka, the capital city of Bangladesh, believe that current water supply management system could not fulfil their demand. About 23% city dwellers could not use the Dhaka WASA supply for drinking purpose due to bad smell and have to rely on bottled or jar water that is of dubious quality. About 66% of the consumers boil supplied water for drinking purpose and they have to boil the water at least for half an hour to make it potable. Among them, at least 50% also use water filter to ensure maximum safety [13]. Numerous water quality problems e.g. salinity exist in groundwater supply system, especially in south western coastal belt of the country. Khulna is one of the densely populated urban areas of Bangladesh with a population of about 1.5 million which has been suffering from inadequate supply of drinking water often associated with water quality problems too. The quality of drinking water in Khulna is at high risk [14]. In Chattogram, the port city of Bangladesh, the quality of water is at risk to deteriorate during its flow through the distribution system as regular monitoring of the distribution network is not usually done. The city dwellers are not only suffering from inadequate water supply but also they are posed to serious threat due to the scarcity of safe water. The microbial water quality deteriorated during its flow from treatment plant through the distribution system. Faecal coliform as well as total coliform exist at some locations of the distribution system [15].

However, the present study area Pabna municipality is one of the developing cities of Bangladesh and expanding rapidly with an enormous growth of population at a rate of around 3% a year. Pabna has been developed with fast and unplanned urbanization for recent years. The increase in population in the future without adequate water supply will make the water supply problem more acute. In Pabna, groundwater contains manganese and iron. Arsenic has recently been added to this list. Public water supply is operated and maintained by Water Works Department of Pabna Municipality. At present, municipality can extract about 8,845 m^3/day of groundwater through 11 production wells [16]. Providing safe drinking water to the householders would be the most critical challenge. The present study aimed to investigate the existing water supply system of ward no. 5 of Pabna municipality, to identify the specific problems associated with water supply, to provide some suggestive measures for proper supply of safe and adequate water.

2. Materials and Methods

The present study focuses mainly on water supply system of ward no. 5 of Pabna municipality. The valuable information and data were collected during consultations with the householders and respective officials of Pabna Municipality. The collected information and data were then analyzed. The detail of data collection and analysis is given below.

2.1. Study Area

Pabna is one of the oldest districts of Rajshahi Division of Bangladesh. It lies between 23°48" and 24°21" north latitudes and between 89°00" and 89°44" east longitudes [17]. Pabna city is the administrative capital of Pabna district. It is situated at 24°00′47″ N and 89°12′54″ E and at a distance of 216 km from Dhaka. A location map of Pabna is given in Figure 1.

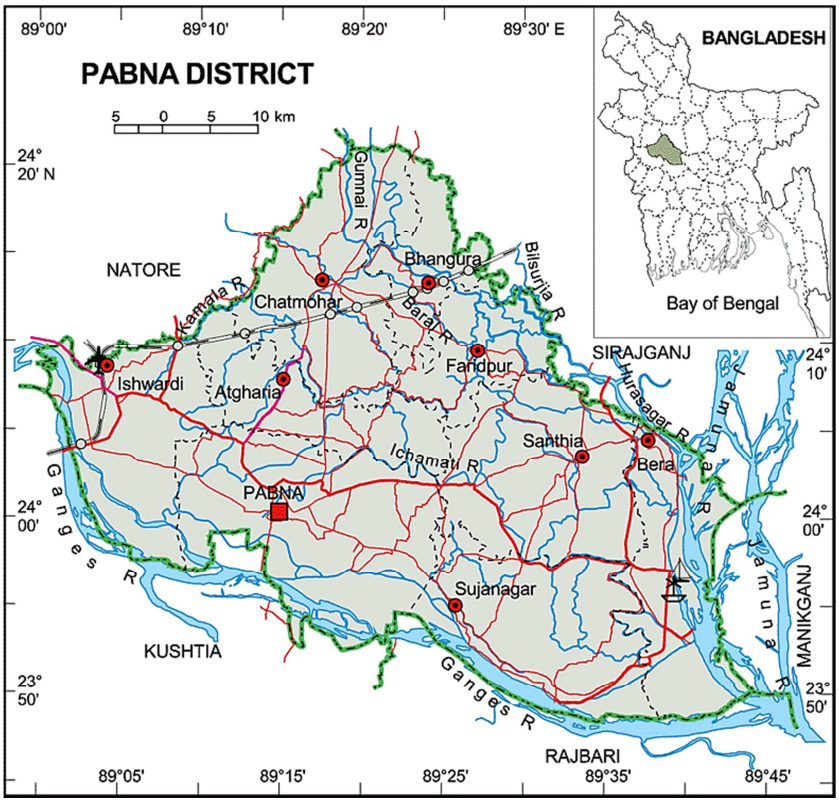

Figure 1. *Location map of the study area [18].*

Pabna municipality has an area 27.27 sq.km, ward 15, holding 33217, and population 144442 [19]. The ward map of Pabna municipality is shown in Figure 2. The present study area is ward no. 5 of Pabna municipality with an area 1.61 sq.km and estimated present population 11222.

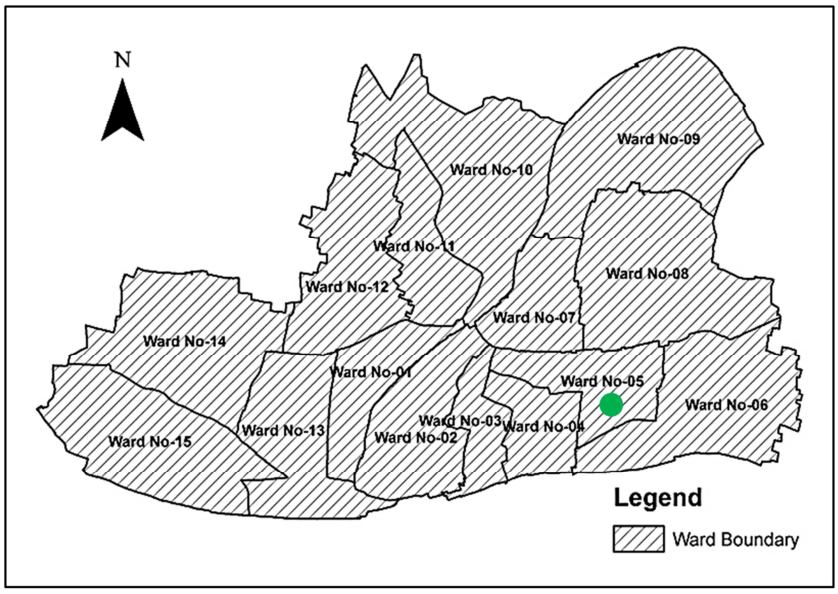

Figure 2. *Ward map of Pabna municipality [20].*

2.2. Data Collection and Analysis

Primary data were collected through questionnaire to a total number of 100 householders in the way of formal and non-formal interviews and field visit during October, 2018 to April, 2019. The questions were selected in such a way that the information on sources of water, usage of water, problems in water, etc. could be found. The maximum respondents were female. The valuable information, ward map, etc. were collected from the respective officials of Water Works Department of Pabna Municipality. The collected information and data were then analysed to investigate the present condition of water supply system of ward no. 5 of Pabna municipality.

3. Results and Discussion

In this study the existing water supply system of ward no. 5 of Pabna municipality was investigated. Primary and secondary data were collected from the householders and respective officials of Pabna Municipality and then analysed to develop an understanding of the existing water supply system. The results obtained from this study are discussed below.

3.1. Existing Water Supply Conditions

Householders use normally groundwater for drinking purposes and public supply water for domestic purposes such as cooking, washing clothes, cleaning, bathing and sanitary purposes. Figure 3 shows the sources of water in the study area. 19% householders use groundwater and 72% householders use both groundwater and public supply water. 9% householders have only public water supply connection. They use filtered or boiled water for drinking purposes and use the raw water for other domestic purposes. No householder use surface water or rainwater. Surface water is easily get polluted perhaps householders don't use it for domestic purposes. There is no arrangement for harvesting rainwater in the study area.

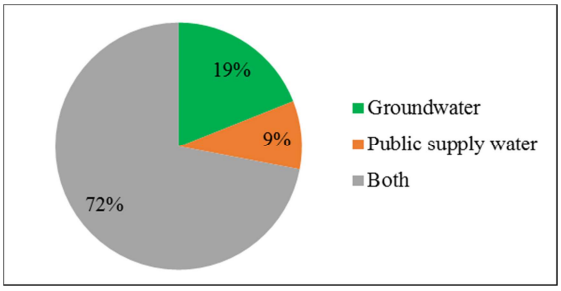

Figure 3. *Sources of water in the study area.*

74% householders reported that the house owners supply water normally at morning, noon and evening using their submergible pumps. Pabna municipality authority supplies water at three times in a day; 5.00-8.45 am, 12.00-2.30 pm and 4.30-8.30 pm. 71% householders use water 80~100 lpcd and 29% householders use water 60~80 lpcd for their daily usages e.g. drinking, cooking, bathing, washing, defecation, etc. They use more water at morning and noon. 17% householders face occasionally the shortage of water and 32% householders face rarely the shortage of water. 51% householders reported that there is no shortage of water in a day. Figure 4 shows the shortage of water in the study area.

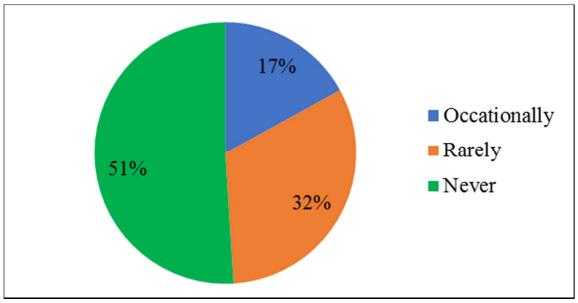

Figure 4. *Shortage of water in the study area.*

Water can have an unpleasant odor, taste, or appearance. Odor is not present in groundwater but present in the supply water; high at 46% houses, medium at 30% houses and low at 12% houses. Only 12% householders reported that there is no odor in the supply water. The pipelines used for conveying water from reservoir to the houses are mostly made of uPVC pipes. Wastewater may enter into the pipelines through the leakage of pipes and mix with the supply water, thus causing water offensive smell. Turbidity is the cloudiness or haziness of water caused by large number of individual particles that are generally invisible to the naked eye. Turbidity is present in the supply water; medium at 10% houses and low at 76% houses. Only 14% householders reported that there is no turbidity in supply water. Iron is primarily nuisance chemical with characteristic staining properties, although high levels can impart a bittersweet or metallic taste to drinking water. Water containing ferrous iron is clear and colourless because iron is completely dissolved in water, when exposed to air in the pressure tank or atmosphere. The water turns cloudy reddish brown. Iron is present in surface water; high at 2% houses, medium at 39% houses and low at 46% houses. Only 13% householders reported that there is no iron in water. Supply water contains high amount of iron. 100% householders reported that arsenic is not present in both groundwater and supply water. Figure 5 shows the presence of odor, turbidity and iron in water in study area.

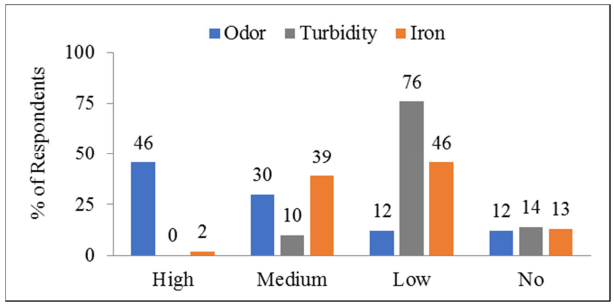

Figure 5. *Presence of odor, turbidity and iron in water in the study area.*

Householders use normally groundwater for drinking purposes. Householders reported that drinking water quality is satisfactory at 73% houses, good at 15% houses and very good at 12% houses. Filtered water is used always at 10% houses, rarely at 29% houses and occasionally at 16% houses for drinking purposes. 45% householders reported that they never use filtered water for drinking purposes. Boiled water is used rarely at 44% houses and occasionally at 11% houses for drinking purposes. 45% householders reported that they never use boiled water for drinking purposes. 90% householders use economic water closets and 10% householders use pit latrines. There is no public toilet in the study area. 20% householders are affected by water borne diseases e.g. skin disease, allergy in the study area.

3.2. Suggestive Measures

All the dwellers of ward no. 5 of Pabna municipality are not satisfied with the existing water supply system. Public awareness and participation is required for the proper usage of water.

Alternative water sources may be used for domestic purposes. Cares should be taken at the time of collection, treatment and supply of water to improve the existing water supply system. Sufficient pipelines should be constructed in the study area. Pipelines should be checked regularly to avoid the leakage of pipes. Pabna municipality may take the responsibility to manage the entire water supply system. Non-government organizations may take initiatives for arranging training programs to increase the awareness among the householders.

4. Conclusion

Pabna is one of the developing cities of Bangladesh. Most of the householders use both groundwater and public supply water. They use groundwater for drinking purposes and supplied water for cooking, washing, bathing, etc. They use more water at morning and noon and occasionally face the shortage of water. The groundwater quality is good but offensive odor, turbidity and iron are present in supply water. Arsenic is not present in groundwater and supply water. Some householders use boiled or filtered water for drinking purposes. Although maximum householders use economic water closets, but some householders are affected by water borne diseases e.g. skin disease, allergy. Starting from the local water supply management and sanitation technology, one can expect safe and healthful environment for national and international level.

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