

# PHYSICOCHEMICAL AND MICROBIOLOGICAL QUALITY ASSESSMENT OF DRINKING WATER FROM COMMERCIAL SUPPLIERS AT SELECTED LOCATIONS IN DHAKA, BANGLADESH

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## Abstract

With the increase of population in the capital city, Dhaka of Bangladesh, it is becoming a challenge day by day to supply safe, sufficient and fit drinking water to its population. In the recent years though a few water treatment plants are trying to supply drinking water after treating surface water from the rivers flowing around Dhaka city, ground water extraction using deep tube wells remains the main drinking water supply source to provide water for the city's people. However, with the concern of different health related issues, it has become necessary to assess the quality of water feed by the city's mass population supplied by different commercial suppliers at different places around the city. Physicochemical and microbiological property parameters of drinking water supplied by five different commercial suppliers at five selected locations in Dhaka city are assessed in this research to investigate the quality of water consumed by people at the sampling sites. Some physicochemical parameters like hardness and iron concentration were very much below the Bangladeshi recommended limits compared to other parameters in most of the collected water samples. This may impart nutrition deficiencies and related diseases to the long time consumer in this area. Other than this, presence of alarming level of total and fecal coliform bacteria in the water samples indicates the poor hygienic condition for which water borne diseases has become a regular scenario at these sites. Lack of strict implementation and monitoring of rules and regulations to maintain the prescribed standard of drinking water supplied by the different companies was also another critical issue that has made the scenario worse.

**Key Words:** Drinking Water Quality, Fecal Coliform, Total Coliform, Hardness, and Iron

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## 1. INTRODUCTION

In addition to the main water supplying authority Dhaka WASA (Dhaka Water supply and sewerage authority), some nongovernment organizations (commercial suppliers) also supply drinking water using the standard 20 liter plastic container or bottle throughout Dhaka city. WASA operates 600 deep tube wells to extract ground water in Dhaka city. Again, there are about 2000 private tube wells throughout the city [1]. About 87 percent of supplied water in Dhaka city is ground water [2]. Commercial suppliers supply bottled water as drinking water in the commercial places or organizations, offices and educational institutions etc. Usually, the water supplying organizations apply reverse osmosis, ultraviolet treatment and ozonization processes to destroy bacteria, viruses and different organisms in water. However, the city dwellers suffer from frequent illness after consuming the supplied water at different locations. International Centre for Diarrhoeal Diseases and Research Bangladesh reported on 23rd April 2012 that about 250 to 300 people were being treated for diarrhea per day. With the growing concern of numerous water borne diseases and health related issues, it has become essential to assess the quality of bottled drinking water [3-5]. To assess the quality of bottled drinking water physicochemical parameters such as pH, turbidity, CO<sub>2</sub>, alkalinity, chloride, hardness, iron concentration and microbiological parameters namely total and fecal coliform bacteria counts of the collected water

samples have been determined in the present study. The tested results of the above mentioned parameters have also been compared to the drinking water standard of Bangladesh to investigate the quality of water at the sampling sites.

## 2. MATERIALS AND METHODS

### 2.1 Collection of Water Sample

In order to investigate the physicochemical parameters of drinking water, water samples were collected from five different areas in Dhaka city. In the selected areas people consume drinking water supplied by five different commercial suppliers in plastic container or bottle. The site locations of water sampling and the name of respective commercial water suppliers are listed in Table -1. Fig. 1 shows water collection system by the consumer at one sampling site. At first the 20 liter drinking water bottle supplied by the commercial water supplier is attached with the water dispenser. Then the consumers get the drinking water from the dispenser.

### 2.2 Analytical and Experimental Program

The Standard test procedures were adopted to assess the selected water quality parameters of collected water samples. HACH pocket pH meter was used to measure the pH of water. Turbidity was measured using 2100P HACH

Turbidimeter. Standard titration methods were adopted to determine alkalinity, hardness, chloride and CO<sub>2</sub>. Spectrophotometer (DR 2500 HACH) was used to evaluate the amount of color in the collected water samples. Iron concentration was determined following standard test procedure. To investigate the fecal and total coliform counts present in the collected water sample, membrane filter method was used in this study.

presented in the following discussions. The measured values of selected physicochemical and microbiological parameters namely pH, turbidity, CO<sub>2</sub>, alkalinity, chloride, hardness, iron, total coliform and fecal coliform counts of water supplied by the mentioned commercial water suppliers around Dhaka city are summarised in Chart-1 and -2.



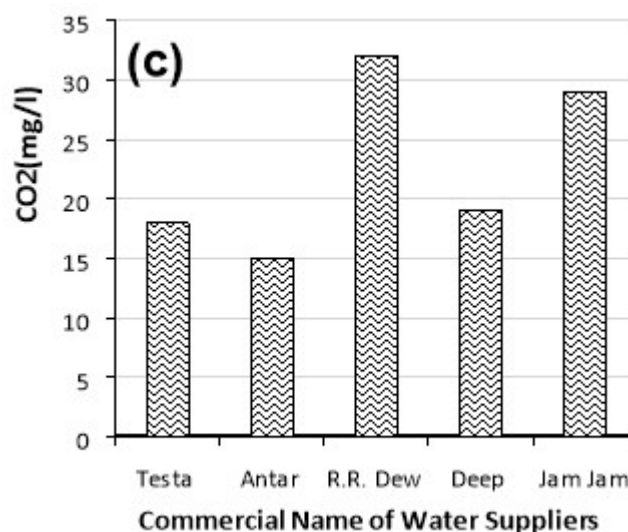
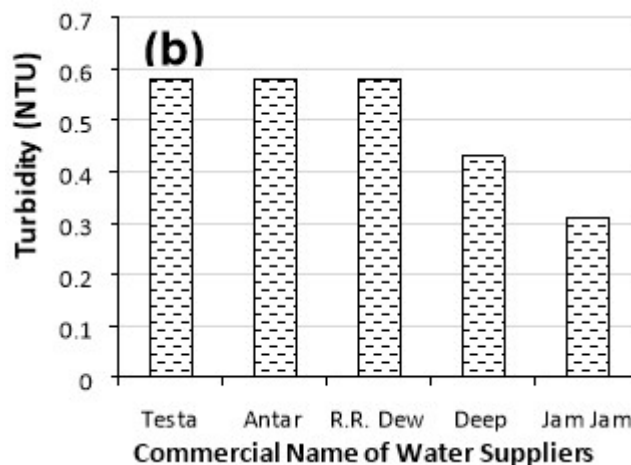
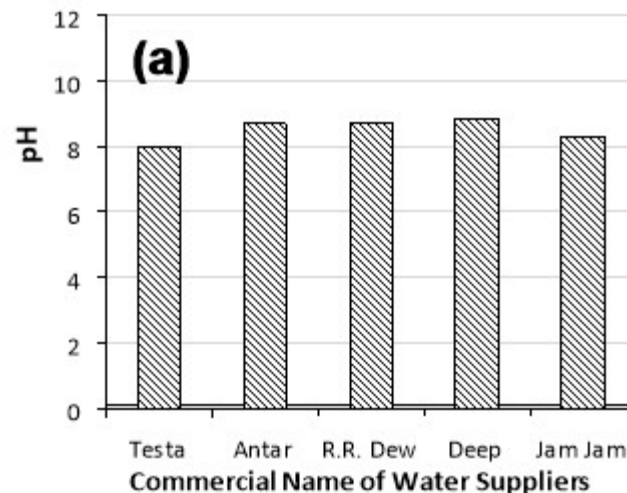
Fig -1: Water collection system from the 20 liter standard bottle through dispenser.

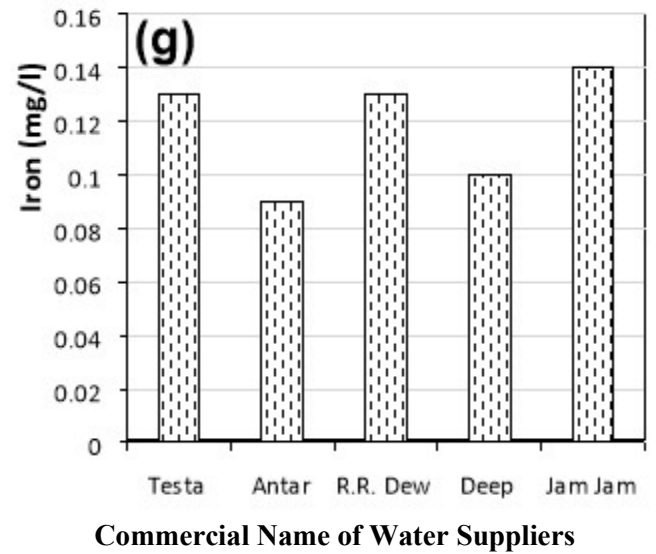
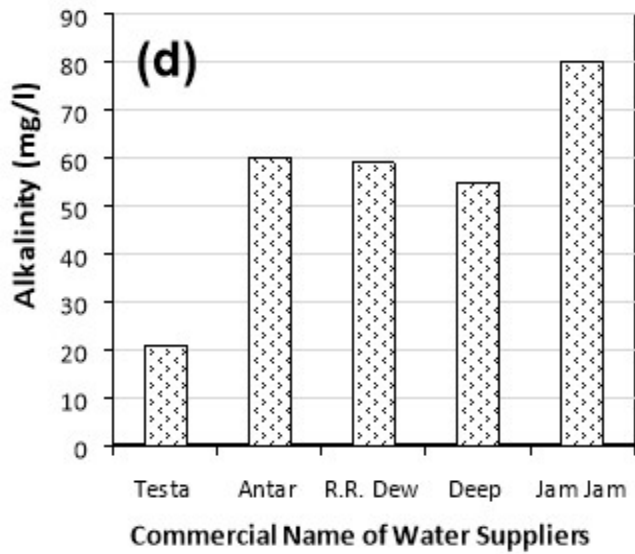
Table -1: Collection of Drinking Water from Different Water Suppliers at Different Locations in Dhaka City

Sampling Site	Name of Water Supplier	Location
1	Testa Drinking Water	Westpara, Kathgora, Ashuliya, Savar, Dhaka
2	Antar Drinking Water	77, Kawran bazar, Dhaka.
3	R.R. Dew Drinking Water	951/1, East Shawrapara, Kafrul, Dhaka.
4	Deep Drinking Water	45, Bijoy nagar, Ramna, Dhaka
5	Jam Jam Drinking Water	Mou Factory, Shajanpur, Dhaka

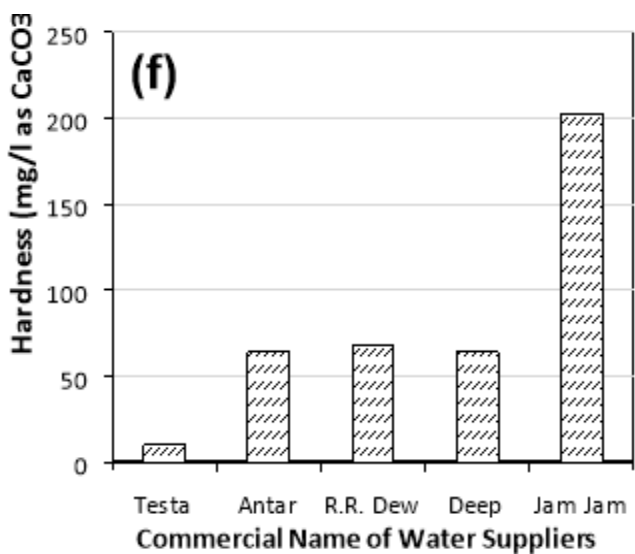
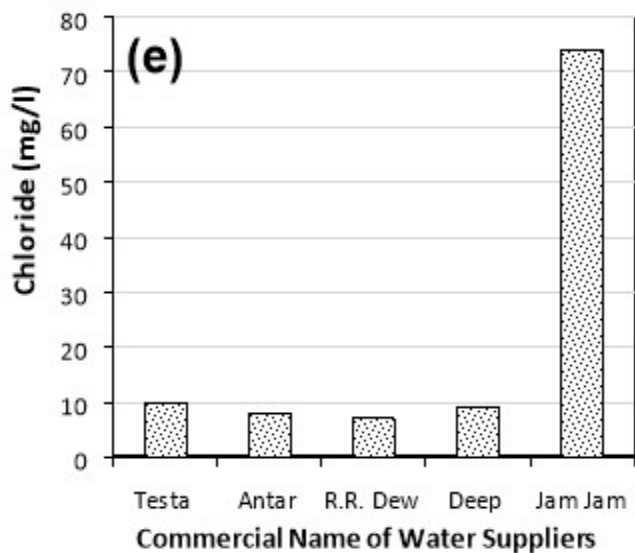
### 3. RESULTS AND DISCUSSIONS

To assess the different water quality parameters duplicate samples were collected from each water supplier (the commercial names of these water suppliers are listed in Table-1) and the average value of each parameter are





**Chart -1:** Physicochemical parameters of collected water samples: (a) pH, (b) Turbidity, (c) CO<sub>2</sub>, (d) Alkalinity, (e) Chloride, (f) Hardness and (g) Iron Concentration.



### 3.1 Physicochemical Quality of Collected Water

From Chart -1it has been observed that pH of most of the collected water samples were in between the drinking water standard, 6.5 to 8.5 provided by Bangladesh Environment Conservation Rules (ECR 1997) [6]. Only Antar, R.R. Dew and Deep drinking water have slight variations from the standard range. On the other hand, the turbidity values of all the water samples were below 0.6 NTU where the drinking water standard by ECR'97 is upto10 NTU. Concentration of Carbon-di-oxide in R.R. Dew and Jam Jam drinking water samples were relatively higher than that of other three water samples namely Testa, Antar and Deep drinking water. Again, ECR 1997 has not prescribed any standard of CO<sub>2</sub> concentration for drinking water in Bangladesh.

In spite of having little public health significance of alkalinity in water, higher concentration of alkalinity in water is usually unpalatable. Except Testa drinking water, concentrations of alkalinity were relatively higher in the rest of water samples. Similar to CO<sub>2</sub>, ECR has not set any standard of alkalinity for drinking water.

Chlorides in reasonable concentrations in water are not harmful to people. Again, at a concentration above 250mg/l conveys salty taste in water and becomes objectionable to many consumers. Drinking water standard of chloride is in the range of 150 to 600mg/l and it is again relaxed to 1000mg/l for coastal people in Bangladesh. The concentration of chloride in Jam Jam drinking water was very much higher than that of the other collected water samples but was below the standard range prescribed by ECR 1997.

Hard water is satisfactory for human consumption. However, higher hardness concentration imparts adverse action with soap and creates scaling in boilers and utensils while heating. Standard of hardness for drinking water in Bangladesh is between 200 to 500 mg/l as CaCO<sub>3</sub>. Only one

drinking water supplier (Jam Jam) meets the standard of hardness while the rest of companies had hardness values below the standard.

Although, reasonable concentration of iron in water does not have harmful effect on consumers, often create offensive stains in plumbing fixtures and laundry operations, and support growth of iron bacteria in distribution systems. Drinking water standard for iron is 0.3-1.0 mg/l (ECR'97) in Bangladesh. However, from Chart -1, it has been observed that all the collected water samples had iron concentration below the standard range.

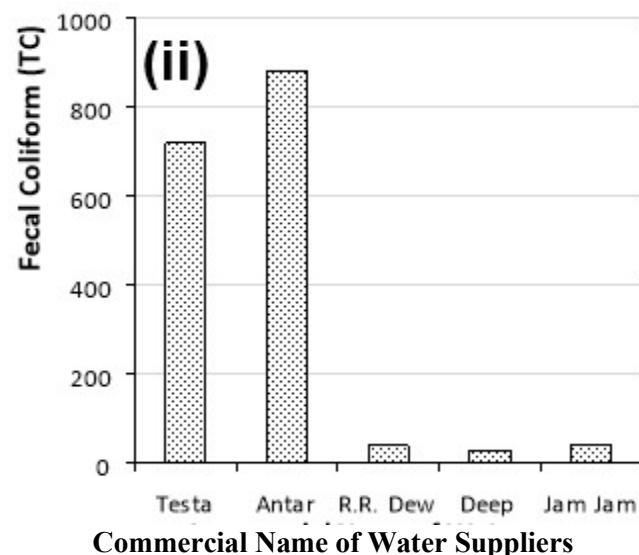
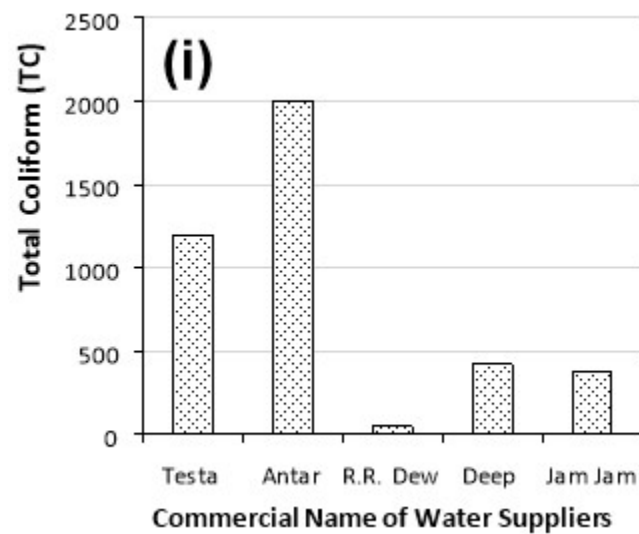


Chart -2: Microbiological parameters of collected water samples: (i) Total Coliform, (ii) Fecal Coliform

### 3.2 Microbiological Quality of Collected Water

Chart -2 points out the presence of coliform bacteria in all the water samples whereas the drinking water standard of Fecal and Total coliform is zero in Bangladesh (ECR 1997). Testa and Antar drinking water samples contain excess amount of coliform bacteria compared to the water supplied by other three companies. Presence of Coliform bacteria

indicates the presence of pathogens. This result is very alarming in the sanitation perspective of consumer as it reports significant amount of fecal coliform in the drinking water samples. Mentioned five different companies supply water in a 20 liter plastic jar to different places around Dhaka city. At first the water jar is fitted to a water dispenser machine. Consumers collect water from jar through water dispenser. Sometimes, due to the contamination of water dispenser and during the attachment of plastic water jar to dispenser microbial contamination of drinking water may happen in case of marginal user. However, presence of the excess Fecal and Total Coliform bacteria counts indicates there may be microbial contamination at the production zone of drinking water.

### 4. CONCLUSIONS

The physicochemical and microbiological parameters are assessed in this study to investigate the quality of drinking water to marginal user at five selected locations where water is supplied by five different companies in Dhaka city. The overall quality of the drinking water is not safe and fit for the consumers in these sites. There remains most concern about the microbiological counts, hardness and iron concentration of water. Presence of numerous Fecal and Total coliform counts indicates the existence of pathogenic organisms which may induce potential threat to consumers' health. People may suffer from nutrient deficiencies and subsequently heart diseases consuming soft water (hardness close to 50 mg/l) supplied by Testa, Antar, R.R. Dew and Deep drinking water for prolonged time period. Also, there may be health problem associated with the consumption of significantly low level of iron concentration in water. Therefore, there should be strict implementation of rules and regulations, and regular monitoring of the water production unit so that the standards of drinking water are maintained by the commercial water supplier companies. In addition to this, both the consumers and water suppliers should be made aware about the health and hygienic condition.

### 5. ACKNOWLEDGMENT

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