Journal of Biodiversity and Environmental Sciences (JBES)
ISSN: 2220-6663 (Print) 2222-3045 (Online)
Vol. 8, No. 5, p. 128-135, 2016
http://www.innspub.net

INNSPUB

RESEARCH PAPER

OPEN ACCESS

# Quality Analysis of Potable Water at Dakshin Khan in Dhaka City, Bangladesh

**Sadia Afrin Nitol[1], Mohammad Mahbub Kabir[1*], Ferdousi Sultana[1], Nargis Sultana[1], Md. Saddam Hossain[2], A.H.M. Saadat[1]**

[1]*Department of Environmental Sciences, Jahangirnagar University, Dhaka, Bangladesh*

[2]*Department of Microbiology, Jahangirnagar University, Dhaka, Bangladesh*

Article published on May 27, 2016

**Key words:** Potable Water, Water quality, Microbial contamination, Dakshin Khan, Bangladesh.

**Abstract**

The aim of this study was to assess the physiochemical and microbiological quality of DWASA supplied drinking water in Dakshin khan area, Dhaka, Bangladesh. A total of twenty one water samples in three groups were collected from DWASA water supply pumps, house taps and tube wells. The physiochemical properties i.e. Dissolved Oxygen, pH, Total Dissolved Solids, Turbidity, Electrical Conductivity, were studied by to evaluate the quality of drinking water. Total coliform was studied to assess the microbiological quality of water by membrane filtration method. The physicochemical properties of different sources varied with location and were found in acceptable range in accordance with WHO and Bangladesh guidelines except for EC and TDS. The electrical conductivity was very high, ranged from 170 to 552 µS/cm. On the other hand, TDS value was in limit 100 to 200 mg/l which is very low. Significantly higher bacterial counts (33 CFU/ml to $1.0 \times 10^3$ CFU/ml) were recorded in the samples from house taps which might be injurious to health but was acceptable in tube wells and WASA pumps. Hence, the intrusion of wastewater through leakage in distribution lines of Dhaka WASA supply chain might be the source of microbiological contamination of drinking water.

***Corresponding Author:** Mohammad Mahbub Kabir ✉ mahbubkabir556@gmail.co

## Introduction

Safe water is mostly crucial for good health and in our environment where we belongs to (Islam *et al*., 2010; Acharjee *et al*., 2011).In many developing countries even in Bangladesh, providing safe drinking water is a major goal. Recently, public awareness has been increased to get safe supply of water which is very praiseworthy (Praveen *et al*., 2008). Consequently, in developing countries many types of technology are using for preventing water related diseases (Oguntuke *et al*., 2009; Nahar *et al.,* 2011).The population of Dhaka city, capital of Bangladeshis approximately 12.5 million which is increasing with time and its annual rate is over 5% (Haq, 2006). In such condition, Safe Drinking water is really a vital need for the inhabitant of Dhaka city.

Dhaka Water Supply and Sewerage Authority (DWASA) of Bangladesh has taken many investment for supplying safe water. They have installed a number of deep tube wells that tap the upper aquifers and the current groundwater abstraction exceeds the recharge rate, causing the ground water to be mined systematically and be consumed of its reserve. Thus, use of ground water and surface water is an urgent need to alleviate the demand on the upper aquifers and explore more sustainable sources. But, the surface water along the external rivers of Dhaka city is extremely polluted because of municipal and industrial untreated wastewaters that are discharged (Kamal *et al*., 1999; Subramanian, 2004).

In Dhaka city, most of the people depend on Water and Sewerage Authority (WASA) as a main source of municipal water supply. People use the water source for drinking and other domestic purposes. Unfortunately, the water supply process is often goes in wrong way with pathogenic microorganisms (viruses, bacteria and other types of germs) and as a result many kinds of water related diseases including diarrhoea, dysentery, typhoid, salmonellosis, listeriosis, parasitic worm infestations, and viral infections are occurred (Mahbub *et al.,* 2011).There is a reason behind it which is almost two-thirds of Dhaka's sewerage remains microbiologically untreated. This in turn contaminates ground and surface water ways, thereby causing serious water pollution. The current study was conducted to determine the suitability of potable water for using in household purposes. The study was carried out by measuring water quality parameters and the microbiological quality of Dhaka WASA supplied drinking water at Dakshin Khan, Dhaka, Bangladesh.

## Materials and methods

*Study area and sampling*

The study area, Dakshin khan Thana, is a part of Dhaka city and the water sources are situated in the coordination of 23° 51′N latitude and 90° 25′ E longitude. It is a growing urban area and new extension of Dhaka City Corporation situating 5 km far from Uttara facilitate with most urban amenities. The housing and sanitation system is acceptably good.

A total of twenty one water samples were selected for sampling purpose. 7 samples were collected from DWASA water pumps, 7 from nearby tube wells and 7 from nearby household taps. Fig. 1A and 1B show the study area and the sampling sites respectively.

The water samples were collected randomly during August, 2014 to September, 2014.The samples were collected in two sets. One set was used to determine the physicho-chemical parameters of the water samples and another was used to analyze the microbial quality status of the water samples. For physicho-chemical parameter analysis polyethylene bottles of 250 ml were used.

The sampling bottles were washed with detergents, 5% $HNO_3$, distilled water and with WASSA supplied pump water several times. For microbiological analysis sterile glass bottles of 250 ml were used. After collection the samples were stored in ice box to maintain the temperature within 4-8° C and carried to the laboratory. All experiments were carried out within 24 hours after collection of samples.

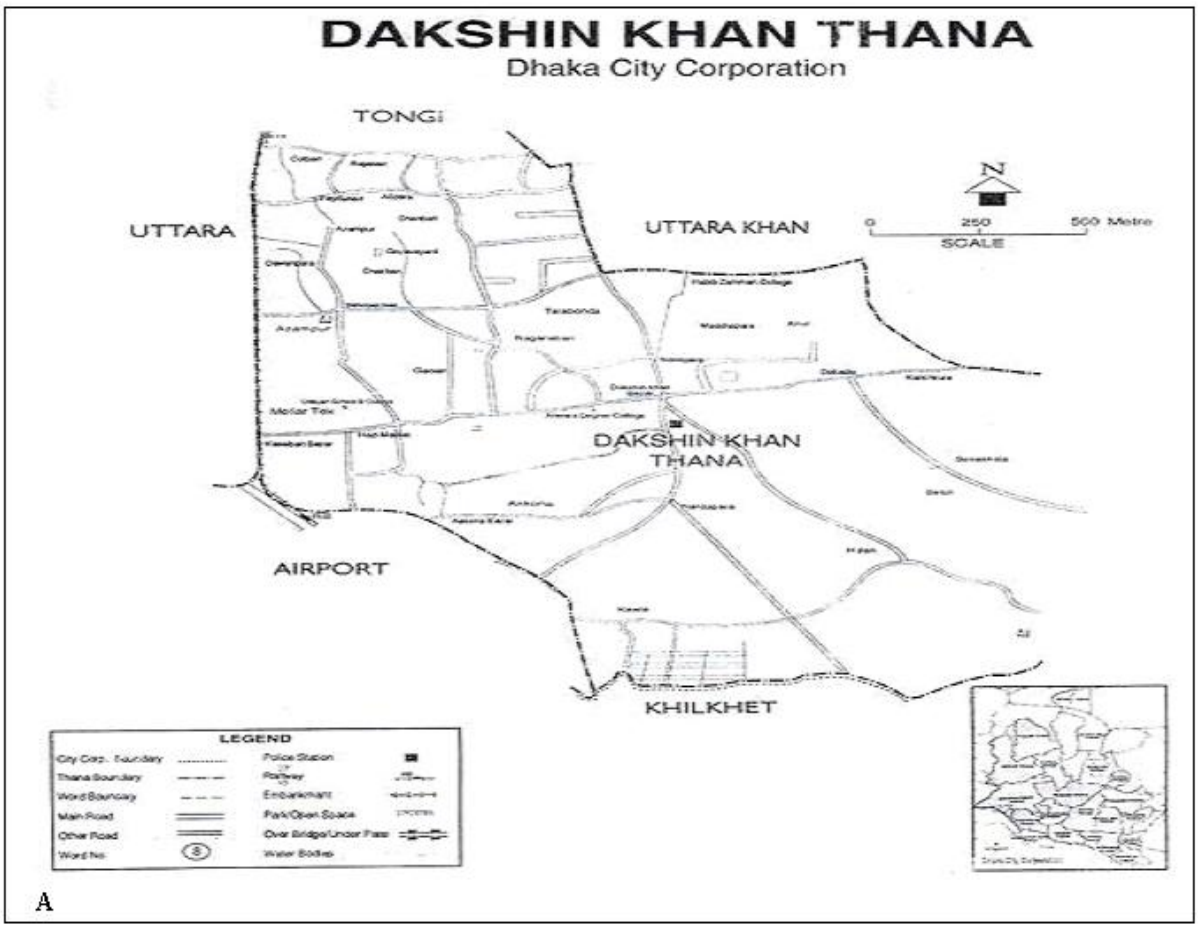



**Fig. 1.** Map of the study area (A) and sapling sites (B).

*Determination of water quality parameters (pH, DO, TDS, EC and Turbidity)*

The water quality parameters including pH, Dissolve oxygen (DO), Total dissolved solid (TDS), Electrical conductivity (EC) and Turbidity were measured by using pH meter (Model- HI 211, HANNA), DO meter (Model- DO 110, ECOSCEN), TDS meter( Model - HI 8734, HANNA), EC meter (Model - HI 8033, HANNA) and Turbidity meter (Model - 93703, HANNA) respectively. All the instruments were calibrated with standard solution before using and the chemicals used in the study were of analytical grade.

*Microbiological analysis*

In order to microbiological analysis of the water samples, the standard method for the examination of water and wastewater was used (APHA, 1998). For this, 100 ml of water from each sample of DWASA water supply pumps, house taps and tube wells were used for membrane filtration. The filter paper was then inoculated into MFC (Membrane Fecal Coliform) medium plate and incubated at 37°C for overnight. Following this, total coliform count in water samples were performed by the observation of blue colony on the medium plate.

**Results and discussion**

*Determination of water quality parameters*

The pH values of the DWASA pumps, house tape water and deep tube wells ranged from 5.11 to 6.40, 5.13 to 6.80 and 5.26 to 7.70 respectively. The mean pH values of the DWASA pumps, house tape water and deep tube wells were 5.58, 5.80 and 6.70 respectively.

**Table 1.** Water quality parameters with guideline values.

| Water quality parameters | Standard values for drinking water | |
|---|---|---|
| | Bangladesh (ISW-BDS-ECR,1997) | WHO, 2011 |
| pH | 6.50-8.50 | 6.50-8.50 |
| Turbidity(NTU) | 10.00 | 5.00 |
| EC (µS/cm) | - | - |
| DO(mg/L) | 6.0 | 6.0 |
| TDS(mg/L) | 1000 | 1000 |
| Total Coliform (CFU/ml) | 0.00 | 0.00 |

(CFU= Colony forming unit).

It was found that, the mean pH values were almost same for DWASA pumps and house taps, but it was varied in the samples of deep tube wells (Fig. 2). This may be occurred due to the contagion of groundwater by lactates of acidic origin which is greater in shallow surface than deep water surface.

As a result the pH is higher in water from tube wells than the WASA pumps and the pH level is slightly different in house taps from pump because of the chances of contamination of water in the supply pipeline. Although, pH value of deep tube wells was between the ranges of WHO guideline, the pH value of DWASA pumps and house tape water were lower than pH value of (6.50-8.50) according to WHO guideline (WHO, 2011) (Table1). Sabrina et al., 2013 studied the quality of DWASA supplied drinking water and found the higher pH value (7.22-7.69) of the analyzed samples.

Figure 3 shows the various patterns of turbidity levels of different sources of DWASA supplied drinking water. Observing the variation of turbidity levels in different sources; it is obvious that with the change of layer turbidity must change. The turbidity level was found high in the tube well water for some samples (Sample 4 comprised turbidity of 13.23 NTU). Which exceeds both WHO guideline value (5.00 NTU) and

Bangladesh (ISW-BDS-ECR, 1997) standard which is (10.00 NTU) for drinking water (Table1). The main reason of different results is water from upper aquifer contains more iron and magnesium than deeper layer. The tube wells pump water from about 100 ft. depth but the WASA pumps do it from about 500 ft. and for this reason turbidity is low in pump water. Some changes in turbidity occur in supply pipeline so the turbidity of water from house taps varies slightly from pump water.

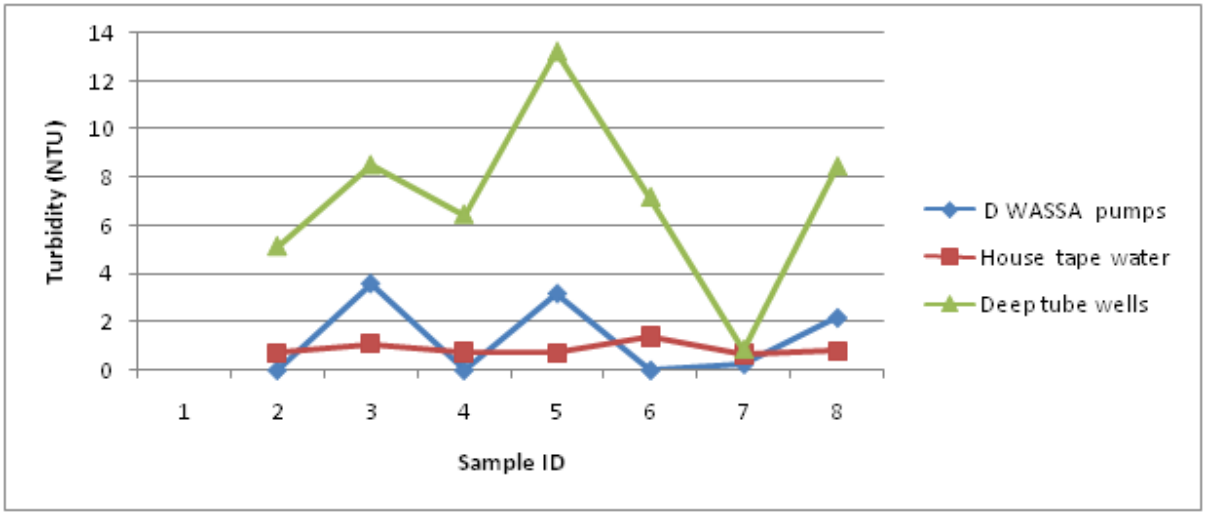


**Fig. 2.** Variation of pH level in different water sources.

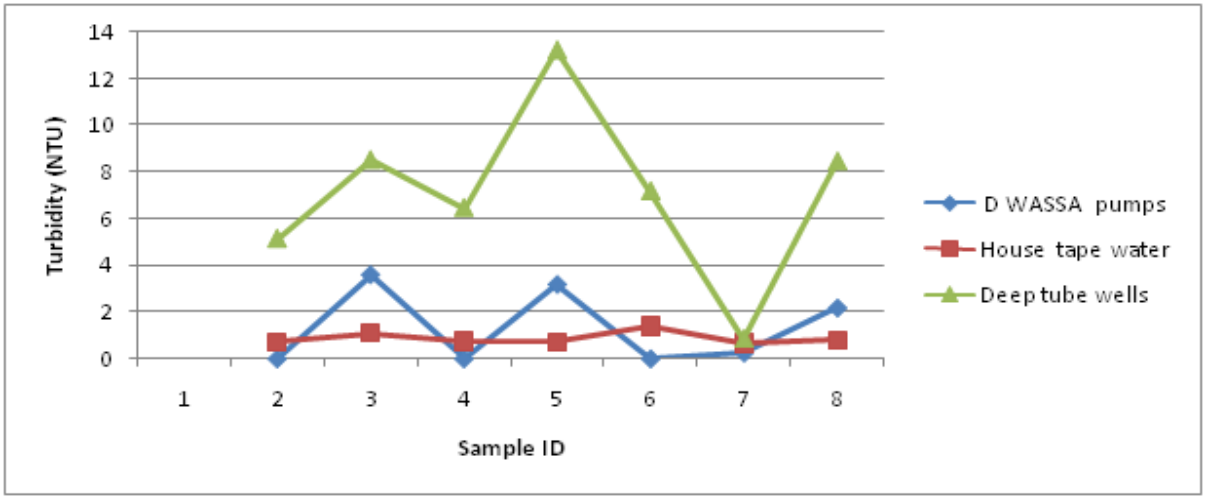


**Fig. 3.** Deviation of turbidity level in different water sources.

The Electrical conductivity of the water samples varied in the range of 170 µS/cm to 552 µS/cm. The highest value was observed in sample 5 from tube well and the lowest is observed in sample 1 from tube well. In the water from tube well variation of conductivity was very significant, but for house taps and pump the values were mostly invariant (Fig 4). The reason for high conductivity of tube wells water may be due to high availability of iron and magnesium. The EC values of DWASA supplied drinking water in several region of Dhaka city was found in the range of 180 - 620 µS/cm (Sabrina et al., 2013) which was nearly similar to the present study.

The dissolved oxygen (DO) concentration of the examined samples varied from 1.70 mg/L to 5.10 mg/L and it was very low according to WHO guideline (WHO, 2011). The amount of dissolved

oxygen varies in every source (Fig 5).The mean level of the dissolved oxygen is acceptable in the water from house taps. The reason may be the level of dissolve oxygen mainly depends on the temperature and pressure of the surroundings. When water extracted from ground level the temperature and pressure is different from environment. Indifferent depth of ground the temperature and pressure may vary so the level of dissolved oxygen varied highly in groundwater from tube wells.

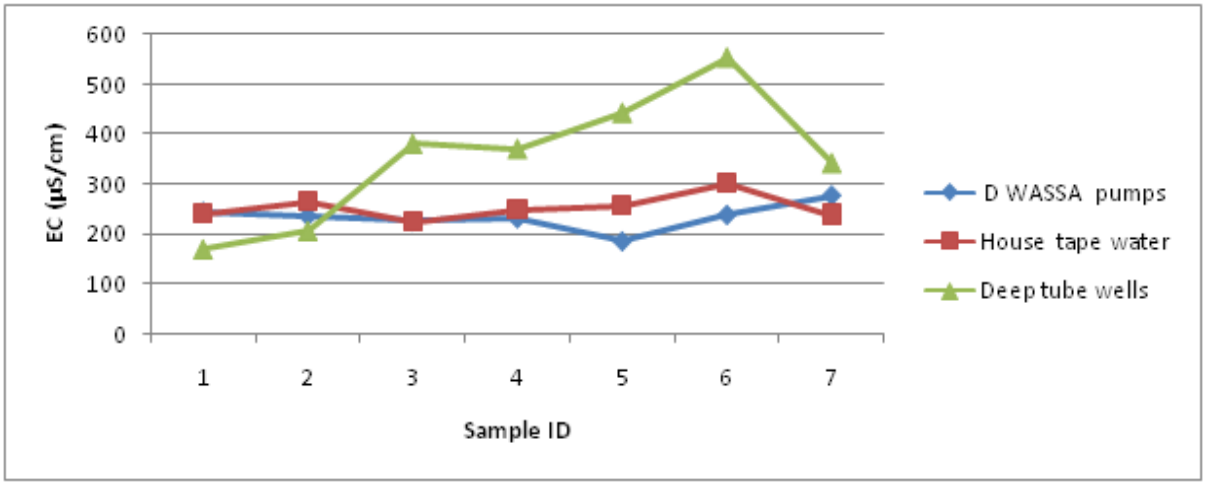


**Fig. 4.** Difference of Electrical conductivity in different water sources.

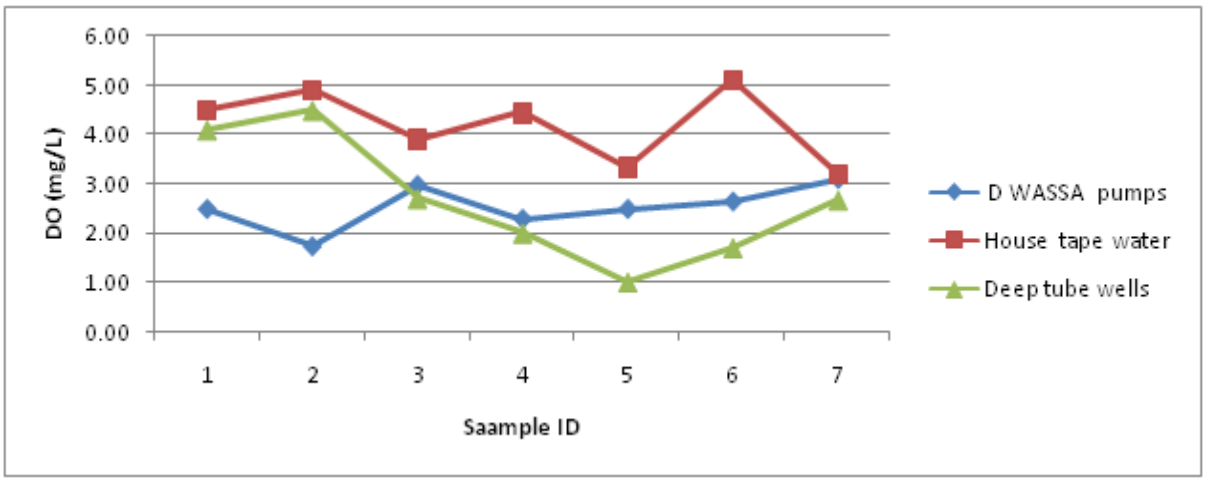


**Fig. 5.** Dissimilarity of DO level in different water sources.

The concentration of total dissolved solids (TDS) in all the examined samples ranged from 101 mg/L to 221 mg/L while according to WHO guideline value it is (1000 mg/L) and Bangladesh (ISW-BDS-ECR, 1997) standard it is (1000 mg/L) for drinking water (Table1). As it is seen that TDS of all the samples is below this maximum range, it can be considered to be suitable enough for drinking purpose without any treatment.

The variation was highly observed in samples from tube wells, but in the other samples the values were mostly invariant (Fig 6).The concentration of total dissolved solids in groundwater is related with the layer of aquifer. A large variation was found in samples from tube wells. The amount was mostly invariant in the samples from different WASA pumps. A significant change was observed in data for house tap sources. The reason may be due to some contamination occurs in the supply pipe line.

*Microbiological quality of DWASA supplied drinking water in Dakshin Khan, Dhaka*

To determine the microbiological characteristics of the samples under study, both presumptive and differential tests were carried out. The presumptive tests gave the amount of colony forming unit (CFU). A large amount of total coliform was found in every sample from house taps that exceeded the WHO and Bangladesh standard for drinking water(Fig. 7).

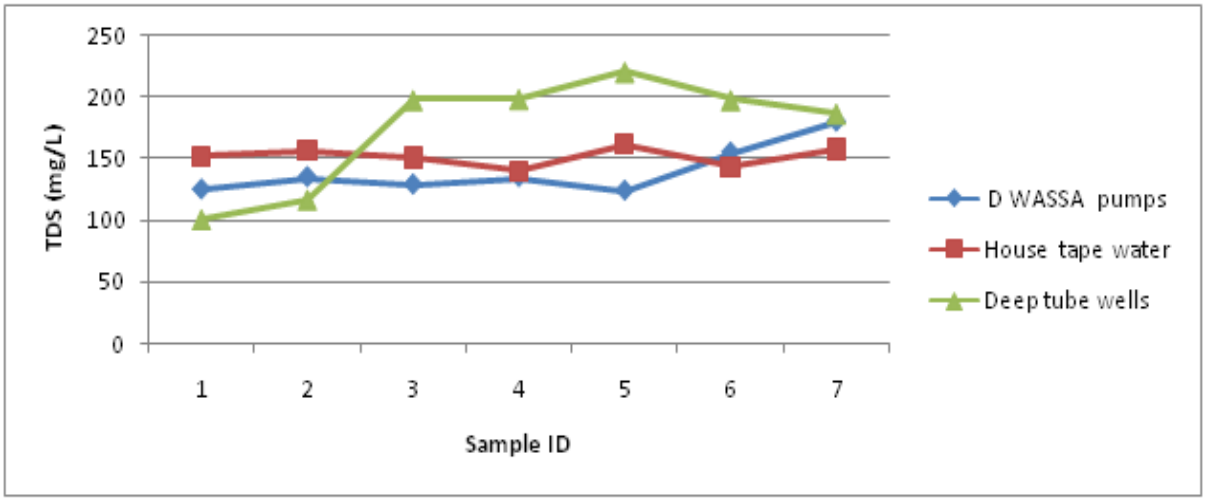


**Fig. 6.** Variation of TDS level in different water sources.

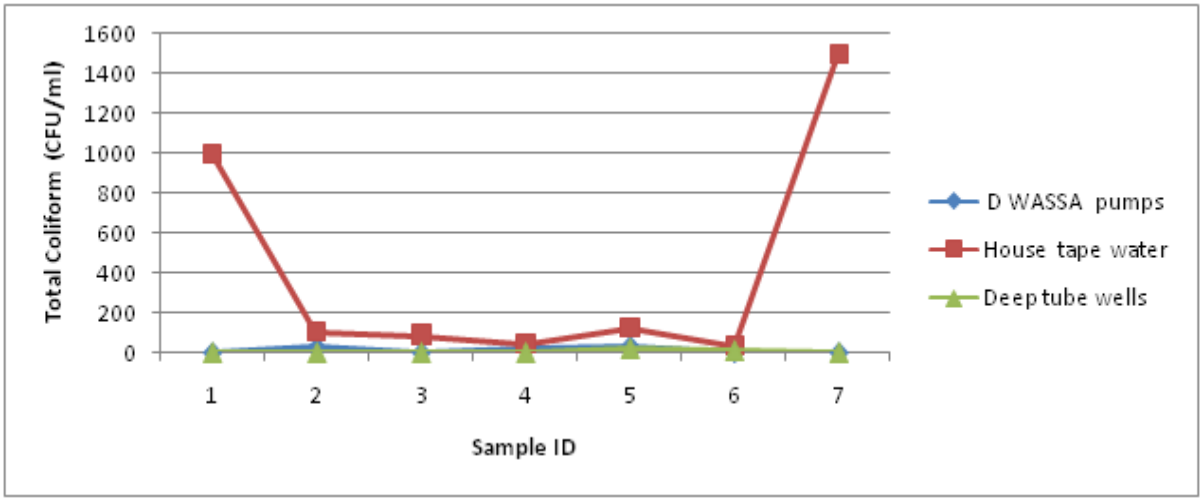


**Fig. 7.** Difference of total coliform level in different water sources.

The total coliform level in the house tap water samples ranged from 33 CFU/ml to 1.0 × $10^3$ CFU/ml. The total coliform in the deep tube wells and pumps of DWASA supplied drinking water was almost absent. Sabrina et al., 2013, investigated the DWASA supplied drinking water around Dhaka city from laboratory analysis perspective and concluded that the houses tap water of Dhaka University, Dhaka Medical Collage Hospital, Segun Bagichaa, Jatrabari, Mohammadpur, Panthapath, Lalbagh and BIRDEM Hospital areas was severely contaminated by microbial pathogens. Mahbub et al., 2011, also found that nearly 62% of the WASA supplied tap water in different areas was contaminated by elevated level of total coliform and 45% of the pump's water was contaminated by exceeded level of total coliform. In the present study it is found that, the DWASA pump's water and deep tube wells water free of total coliform contamination.

The reason for availability of microbial indicator in water from house taps can be said due to the leakage in supply pipelines and liquid with bacteria which can leach from sewerage line to water pipeline.

**Conclusion**

The present investigation reveals that, the house taps yield very poor water quality contaminated with microbes and failed to meet the zero coliform set by World health Organization in Dakshin Khan area of Dhaka city. The entire house taps and tube wells provide water quality in acceptable level but the supply chain fails to provide the requisites of the water quality. To some extent, the outcomes of this study obviously demonstrate that, the water quality obtained from WASA supply chain is inappropriate for human consumption. The microbiological quality of water from tube wells are in acceptable range but other contamination is very high. Hence, there is an urgent need to develop some form of local treatment to purify water and place new developed pipelines especially in the Dakhshin khan and other similar places in Dhaka City Corporation, Bangladesh.

**References**

**APHA.** 1998. Standard Methods for the Examination of Water and Wastewater. 20 thedn. American Public Health Association. Washinhton, D.C.

**Acharjee M, Rahman F, Beauty SA, Feroz F, Rahman MM, Noor R.** 2011. Microbiological Study on Supply Water and Treated Water in Dhaka City. Stamford Journal of Microbiology **1**, 42–45.

**Haq AK.** 2006. Water management in Dhaka. Water Resource Development **22,** 291-311.

**ISW-BDS-ECR.** 1997. Ministry of Environment and Forest, Inland Surface Water in Bangladesh, Gazette notification 27, Aug.

**Islam S, Begum HA, Nili HY.** 2010. Bacteriological Safety Assessment of Municipal Tap Water and Quality of Bottle Water in Dhaka City: Health Hazard Analysis. Bangladesh Journal of Medical Microbiology **4**, 9–13.

**Kamal MM, Malmgren-Hansen A, Badruzzaman ABM.** 1999. Assessment of pollution of the RiverBuriganga, Bangladesh, using a water quality model. Water Science and Technology **40,** 129-136.

**Mahbub KR, Nahar A, Ahmed MM, Chakraborty A.** 2011. Quality Analysis of Dhaka WASA Drinking Water: Detection andBiochemical Characterization of the Isolates. Journal of Environmental Sciences and. Natural. Resources **4,** 41-49.

**Oguntoke O, Aboderin OJ, Bankole AM.** 2009.Association of Water-Borne Diseases Morbidity Pattern and Water Quality in Parts ofIbadan City, Nigeria, Tanzania Journal of Health Research **11,** 189–195.

**Parveen S, Ahmed MSU, Tania N.** 2008. Microbial Contamination of Water around Dhaka City. Bangladesh Journal of Scientific and. Industrial. Research **43,** 273–276.

**Subramanian B.** 2004.Water Quality in South Asia. Asian Journal of Water Environment and Pollution **1,** 41–54

**Sabrina M, Hasan AM, Mohammad F, Subhagata C.** 2013. Analysis of WASA Supplied Drinking Water around Dhaka City from Laboratory Analysis Perspective. International Journal of Chemical and Physical Sciences **2**, 20-27.

**World Health Organization (WHO).** 2011. Guidelines for Drinking-Water Quality - Second Edition - Volume 2 – Health Criteria and Other.