



Section D: General Section

Research Article

Drinking water quality surveillance in Hyderabad

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ABSTRACT

It is well established that a large number of infectious diseases are transmitted primarily through water supplies contaminated with human and animal excreta particularly faeces. The purpose of the study was to assess bacteriological quality of drinking water in Hyderabad City, Andhra Pradesh. It is a cross sectional descriptive study performing the Hyderabad city during the months of June and July 2011. A total of 50 water samples were collected from different localities of the Hyderabad city. These represented areas with different socio-economic conditions. The samples were collected in sterilized containers and brought to the laboratory within two hours of collection. All the samples were tested for contamination with bacteria using multiple tube method to determine most probable number of total coliforms and faecal coliforms using standard procedure. Among 50 water samples, 20 samples (40%) were positive for bacterial contamination. It was observed that bacterial contamination was maximum in areas with low SEC (52%), followed by intermediate SEC (40%) and high SEC (10%). The difference was found to be statistically significant ($p < 0.15$) between areas with high and low SEC while it was non-significant ($p > 0.5$) between areas with low and intermediate SEC. Bacterial contamination is significant problem in Hyderabad City. Regular monitoring and chlorination/cleaning of water filtration plants and change of old water distribution pipelines can improve this situation.

Keywords: Bacterial contamination, Drinking water, Quality, Multiple tube method, Surveillance.

INTRODUCTION

It is well established that a large number of infectious diseases are transmitted primarily through water supplies contaminated with human and animal excreta particularly faeces. Outbreaks of water borne

diseases continue to occur throughout the world but especially serious in developing countries¹. The human pathogens that present serious risk of disease whenever present in drinking water include *Salmonella* species, *Shigella* species, *Yersinia enterocolitica*, *Campylobacter* species, various viruses such as Hepatitis A Virus, Hepatitis E Virus, Rota Virus and parasites like *Entamoeba histolytica*, *Giardia lamblia*².

Keeping in view the importance of safe drinking water, drinking water is routinely examined to ensure safety for drinking in developed countries. It is not practicable to monitor drinking water for every possible pathogen. Therefore, normal intestinal organisms are used as indicator of faecal pollution. These include coliform group of organisms. They are considered as suitable indicators because they are easy to detect and enumerate in water³. Multiple Tube Method for estimation of total coliforms and faecal coliforms, is a standard test used as indicator of sewage contamination of water supplies. Present study was carried out to determine the current status of bacteriological quality of drinking water in different areas of Hyderabad city.

MATERIALS AND METHODS

Its residents are served with water through a piped water supply system. In the present study, water samples from piped water supply of Hyderabad City were tested during the months of June and July 2011. A total of 50 water samples were tested from different localities of Hyderabad City. These localities belonged to areas with High Socio-economic conditions (SEC), Intermediate SEC and Low SEC. High SEC areas included Banjara Hills, Jubilee Hills, Rajbhavan, Hitech City, Begumpet, DRDL. Intermediate SEC areas included Dilsukhnagar, Pathergatti, Abids, Secunderabad, Kukatpally. Low SEC areas included Bholakpur, Talab Katta, Chatrinaka, Makhta Krishna Nagar, Yousufguda. Water samples were collected in 200 ml capacity sterilized containers from the household water taps using standard water collection techniques. These water samples were transported to microbiology lab within two hours of collection⁴.

In the laboratory, all the samples were subjected to Multiple Tube Test for determination of most probable number (MPN) of coliforms and faecal coliforms. The test was performed according to standard procedure. The water samples were considered as having doubtful quality. Aseptically, one 50 ml volume and five 10 ml volume water was added to bottles and tubes containing 50 ml and 10 ml each of double strength MacConkey Broth Medium. Additionally five 1 ml volume of water sample was added to tubes containing 5 ml of single strength MacConkey Broth Medium. All the bottles and tubes contained inverted Durham tubes and were pre-sterilized in autoclave. All the bottles and tubes were incubated at 37°C for 48 hours. The bottles or tubes which showed acid and gas production were considered positive for coliforms. From the distribution of these positive bottles and tubes Most Probable Number (MPN) of Total Coliforms was determined by referring to standard probability table for estimation of Total Coliforms.

All the bottles and tubes positive for Total Coliforms were sub-cultured into 10 ml of single strength MacConkey Broth with inverted Durham tubes and 5 ml of Peptone water to determine presence of faecal coliforms. These tubes were incubated at 44°C for 24 hours. The tubes showing acid and gas and indole productions were taken as positive for Faecal Coliforms. From the number of these positive tubes, MPN of Faecal Coliforms was calculated by referring to the table as for Total Coliforms.

The samples with MPN of one or more were considered as contaminated while samples with zero MPN were considered free from bacterial contamination according to WHO⁵ standard for drinking water in the piped water supplies. Statistical analysis of the results was done by application of chi square test.

RESULTS

A total of 50 water samples were tested from piped water supply system of Hyderabad City in the present study. These were taken from different localities of Hyderabad City including areas with high, intermediate and low SEC. Out of 50 samples, 20 (40%) water samples were positive for bacterial contamination. Bacterial contamination was maximum in areas with Low SEC (52%), followed by 40% in Intermediate SEC and 10% in areas with High SEC as shown in **Table 1**. The difference was statistically significant between areas with Low SEC and High SEC ($p < 0.01$) and non significant between areas with Low SEC and Intermediate SEC ($p > 0.05$).

Table 1: Bacterial contamination among water samples collected from areas with different Socio-economic conditions (SEC) of Hyderabad City.

Areas	No of Samples	Bacterial Contamination	
		Present	Percentage
High SEC	10	01	10
Intermediate SEC	15	06	40
Low SEC	25	13	52
Total	50	20	40

* $p > 0.05$ (No significant difference between areas with Low SEC and Intermediate SEC)

** $p < 0.01$ (Significantly higher contamination in areas with Low SEC as compared with High SEC)

DISCUSSION

In the present study an effort was made to assess the bacteriological quality of drinking water in Hyderabad City. According to WHO there should be no coliform bacteria/100 ml of treated water in distribution as tested by multiple tube test. The present study 40 percent water samples were positive for bacterial contamination (unfit for human consumption). Present study was carried out in the month of June and July 2011. These findings indicate that over last couple of years there appears to be deterioration in the water supply system in Hyderabad City.

It is also observed that there is progressive increase in the frequency of contaminated water samples from areas with High SEC to Low SEC. Therefore, level of sanitary conditions in the community appears to have inverse relationship with the contamination of water supplies. Water in distribution is contaminated during its passage in water pipes. This contamination can occur due to defective joints, back siphonage, rusted pipelines crossing over the sewage pipes and low/ high pressure in the pipelines⁶. Proximity of water pipes to the main sewer pipelines also leads to contamination of water in distribution.

Situation of water supply in other parts of India and neighboring countries is also not good. In India, 68.9% of samples while in Indonesia 45.7% samples were found to be unfit for drinking. In a study carried out in Iran, it was observed that 30.2% of water samples from rural areas were contaminated with bacteria⁷. In Pakistan, 38 to 56.2 percent of water samples in Rawalpindi/ Islamabad have been reported to be bacteriologically contaminated in different studies. These figures are higher when compared to that in the present study. In Karachi, much higher contamination (87%) of tap water samples has been reported. Similarly high percentages of samples of water were found to be contaminated with fecal E coli in Sukkur city and different districts of Khairpur, Sindh (82% and 100% respectively). All this data indicates that bacteriological contamination of drinking water is a significant problem not only in India but also in other developing countries. Bacteriological

contamination of drinking water is a significant problem in other parts of the world also like Sudan (45.2%) and Makkah al-Mokaarama (31.2-37.5%)⁸.

Keeping in view the high level of contamination of drinking water in our country, it is essential that water be examined regularly and frequently throughout the year as contamination may be intermittent. At the same time there is need for making the water supplies safe for human use by regular chlorination and taking immediate appropriate remedial measures whenever contamination is observed. It may also be pointed out that even drinking water from water dispensers has also been observed to be contaminated with bacteria. As water coolers are popular in office buildings and commercial stores nowadays, the quality of this source of drinking water also has the potential to cause water borne outbreaks. Therefore, there is a need for adopting appropriate routine monitoring system to prevent or to diminish the chances of contamination of this water source.

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