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Short Note

Bacteriological Quality in Drinking Water Sources and Point of Use of Mysore City, Karnataka, India

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Abstract: A study was conducted to evaluate the quality of drinking water of Mysore city. A total of 226 drinking water samples were randomly collected from 72 bore wells (hand pump), 77 taps from consumer points and 78 stored household water. The samples were analyzed for bacterial contamination. Among all the samples collected 20% of tap water samples were contaminated, followed by bore well water 11% and stored household water 73% contaminated with enteric bacteria. During the study 232 isolates of enteric bacteria were identified of which 61 of *E. coli*, 76 of *Klebsiella,* 74 of *Citrobacter* and 21 of *Salmonella* were isolated. Coliform contaminations in household water were high even when source water was of good quality. The present study highlights the population's hygiene, health behaviour and environmental sanitation.

Key words: Water analysis, coliform, hygiene, drinking water.

Introduction

Water plays a vital role in human life. The consequence of urbanization and industrialization leads to spoilage of the water. The purpose of water supply distribution system is to deliver safe potable water which is acceptable. A significant proportion of the world's population use potable water for drinking, cooking and personal and home hygiene (WHO, 2004). Over a billion people in India lack safe water. The lack of safe drinking water and adequate sanitation measures lead to a number of diseases such as cholera, dysentery, Salmonellosis and typhoid. 80% of infectious diseases are water-borne, killing millions of children each year. Potable water released into the distribution system becomes altered during its passage through pipes, open reservoirs, standpipes and storage tanks. Several parts of India are facing immune challenges to meet the basic needs of safe water. Thus arises an urgent need for understanding the status of drinking water quality, the related problem and also the reason of the problem (Tambekar and Banginwar, 2005).

The principal objectives of municipal water are the production and the distribution of safe water that is fit for human consumption. Thus, regular analysis of water at source must be carried out to determine the effectiveness of treatment process. Therefore this work is undertaken to evaluate the bacteriological quality of different water sources and hygienic practices of Mysore city.

Materials and Methodology

Study Area

Mysore is situated in the southern region of the state of Karnataka, and spreads across an area of 128.42 km^2

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(50 sq miles). Mysore city is the second highly populated, fast growing city in Karnataka equipped with all the modern infrastructural amenities. The present population of Mysore city is 11 lakh. The water demand is 135 LPCD and the water supplied is around 127 LPCD. The main source of water to the Mysore city is Cauvery river and ground water. The water distribution in Mysore city includes four stages. Majority of water distribution is from overhead tanks (OHT) and ground level reservoirs. Bore-well water is distributed directly without the treatment.

Microbial Examination of Water Samples

Drinking water samples of tap, bore well and stored household water were collected at different distribution and consumer points of residences located within the urban areas of Mysore city by following standard sampling method.

The samples collected in replicates were analyzed for microbiological quality according to the standard method. The total plate count was conducted by (HPA) heterotrophic plate technique on heterotrophic plate agar (APHA, 1998). Standard MPN procedure was followed for the detection of total coliform by using lactose double and single strength broth. The positive MPN tests were sub-cultured in brilliant green lactose bile broth, MacConcky agar and EMB agar. Enteric bacteria isolated on respective media were identified on the basis of their colonial, morphological and biochemical properties.

Results and Discussion

Drinking water samples were collected from different sources such as bore well water (hand pump), household tap water, household stored water from all over the Mysore city. Microbial analysis of all the water samples revealed that out of 226 samples, 80 samples were contaminated with enteric bacteria. The analysis of source-wise contamination revealed that 20% of tap water samples were contaminated followed by bore well water 11% and stored household water 73% were contaminated with enteric bacteria. The greatest average concentration of HPC bacteria were observed in water collected from stored household water which exceeded 100 cfu/ml. The HPC bacteria of tap water samples of poor hygienic zones were more compared to the other water samples of same source which indicates the hygienic condition of the surrounding.

In total 232 isolates of enteric bacteria were isolated and identified of which *E. coli* was 61, *Salmonella* 21, *Klebsiella* 76 and *Citrobacter* 74. The source-wise analysis of bacterial isolates revealed that highest percentage of total enterobacteria were present in stored water followed by tap and bore well water (Figure 1). Further, source-wise water samples were also analyzed to identify the different species of enterobacter and is given in Figure 2. It was found that *Klebsiella* and *Citrobacter* were found mostly in stored household water, compared with tap water samples where *Citrobacter* was the major enteric bacteria. In bore well water (hand pump) *Klebsiella* was detected.

The main object of our study was to evaluate the potability of water at different stages starting from the source till the storage in houses of Mysore city. People often collect and store water in large containers, increasing contamination events. Majority of diseases in developing countries are infectious diseases in nature caused by bacteria, viruses and other microbes, which are shed in human faeces and pollute water supplies which people use for drinking and washing purposes. Microbial contamination of water between source and point-of-use is widespread and often significant. Increased faecal and total coliform counts in household

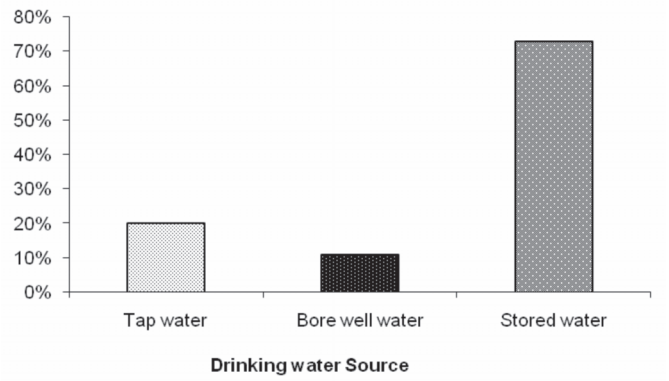

Figure 1: Percent contamination of different sources of drinking water.

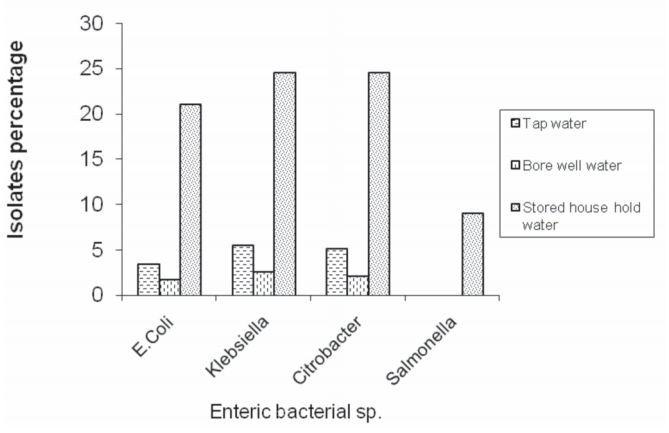

Figure 2: Percent occurrence of enteric bacterial sp. of different sources.

stored water container are generally high even when the source water is of good quality suggesting that contamination is widespread during collection, transport, storage and drawing of water (Write et al., 2004).

The present study shows contamination of majority of stored household water samples than the tap and bore well water. This indicates that lack of proper hygienic practices and types of container play an important role in the quality of drinking water. The contamination may be due to large handling of the same storage water and withdrawing utensils as there are chances of water contamination with fingers or dirty dipper or glass while withdrawing the water. Other studies have also found a similar deterioration in water quality between the source of drinking water and point of consumptions/use (Lindskog and Lindskog, 1988; Genthe and Strauss, 1997).

The present data suggests that the water leaving the treatment plant meets bacteriological standards; the presence of coliforms indicator bacteria in some of the tap water samples and the stored household water samples suggests that the water is becoming contaminated in the journey through the distribution, plumbing systems (Cristobal et al., 2008) and the poor hygienic storage practices. The periodical faecal pollution of container-stored water can be associated with poor personal hygiene practices as well as unhygienic domestic environments (Mintz et al., 1995). It is important to keep the source point clean so as to avoid the storage contamination and improvement in behavioural and water hygiene practices can improve the household water quality. Since the water samples were collected mainly from regions of water stress and areas of low income tap water samples; they were also shown to be contaminated. The reason may be corroded and damaged pipe lines. Hence there is urgent need to replace the old pipe lines. Contamination of bore well (hand pumps) could be attributed to the percolations of drainage water to the underground. People can protect themselves from diarrheal diseases and other infections if they are provided with the appropriate information and if they are encouraged to change their behaviour. This may reduce the prevalence of diarrheal disease and promote the health of people.

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