Assessment of Bacterial Quality of Different water sources in Pondicherry

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Abstract

An assessment of microbial load of different water sources in and around Pondicherry was conducted by testing a total of 123 water samples from wells, bore wells, taps, overhead tanks, rivers, ponds, lakes, bottles and sachets. The surface water sources included pond, lake and river samples with maximum microbial contamination found in pond samples with highest mean Total Viable Count (TVC) of 3.2 x10 6/ml and highest mean coliform count of 1.8 x 10 3/ 100 ml. Almost all (96%) pond, lake and river samples were contaminated with E.coli and faecal streptococci. The TVC of the surface water was 103 to 104 fold more when compared to that of ground water. The mean TVC of tap water was the lowest among the surface and ground water sources having 1 x10 2 / ml and mean coliform count of 5 organisms / 100 ml. Out of 22 tap water samples, three were contaminated either with E.coli or faecal streptococci. The study indicated presence of faecal coliforms in 2 bottled water samples (20%) and faecal coliforms, E. coli and faecal streptococci in four sachets (40%). A widespread microbial contamination of water sources was observed necessitating better sanitary measures.

Key words*: Water sources, bacterial quality, TVC, coliform, faecal streptococci.*

Introduction

Water-related diseases are a growing public health concern, killing more than 5 million people each year. About 2.3 billion people suffer from diseases linked to dirty water and 60% of infant mortality is mostly associated to water-related diseases. Safe and clean water supply can improve the health of the community and thus it is important for socio-economic development. Monitoring the water quality and rapid remedial action are important in controlling water borne diseases. In this context, an assessment of microbial load of different sources of water in and around Pondicherry has been carried out.

Materials and methods

A total of 123 water samples including well (20), bore well (29), tap (22), over head tank (10), river (5), pond (10), lake (7), bottled water (10) and water sachets (10) were collected from different regions in Pondicherry. Around 250 ml of sample from each source and packaged samples in closed condition were collected aseptically, transported to the laboratory in an icebox and processed within 3 h of their collection. To assess the bacterial quality, indicator parameters such as Total viable count (TVC), faecal coliform count, presence of E. coli and faecal streptococci were studied according to the standard methodologies recommended. (APHA, 1985; ISI, 1981). Ten-fold serial dilutions of each sample was made up to 10-6 ml with sterile normal saline and used for various bacteriological testing. One ml of each dilution was inoculated in to the plate count agar (Hi-media) using pour plate technique to estimate TVC. Total coliforms were estimated by using the 5- tube most probable number method (MPN), MacConkey agar and eosin methylene blue agar (EMB) agar (Hi-media) were used for isolation of E. coli and KF Streptococcal agar (Hi-media) was used for isolation of fecal streptococci.

Results and Discussion

Microbial evaluation of water samples revealed the bacterial quality of different water sources in and around Pondicherry. Out of 123 samples belonging to nine different sources, the surface water sources; pond, lake and river samples had maximum microbial contamination. Among them, pond samples

had the highest mean TVC of 3.2 x10 6/ml and highest mean coliform count of 1.8 x 10 ^{3}/ 100 ml (Table 1). Almost all (96%) pond, lake and river samples were contaminated with E. coli and faecal streptococci. (Table 2).

Table 1: TVC and CC of water from different sources

S. No	Source of water	No of samples	Mean TVC/ ml	Mean CC/100 ml
1	Bottled water	10	0.2 x 101	0.005 x 102
2	Sachets	10	1.1 x 102	1.9 x102
3	Well	20	3.5 x 103	2.6 x 102
4	Bore well	29	1.7 x102	0.9 x102
5	Tap	22	1.0 x 102	0.05 x 102
6	Overhead tank	10	1.8 x102	0.8 x102
7	Lake	7	6.9 x105	1.6 x103
8	Pond	10	3.2 x106	>1.8 x103
9	River	5	8.1 x104	1.5 x103

Table 2: Bacterial quality of water from different sources

S. No	Source of Water	No of samples	Frequency of sample with high bacterial count			Total no. of unsatisfactory samples (%)
			Faecal coliforms (%)	E. coli (%)	Faecal streptococci (%)	
1	Bottled water	10	2 (20)	Absent	Absent	Packaged water
2	Sachets	10	4 (40)	2 (20)	2 (20)	6/20 (30)
3	Well	20	10 (50)	6 (30)	5 (25)	Common drinking
4	Bore well	29	13 (45)	6 (21)	9 (31)	water sources
5	Tap	22	3 (14)	1 (4.5)	2 (9)	30/81 (37)
6	Overhead tank	10	4 (40)	2 (20)	2 (20)	
7	Lake	7	7(100)	6 (86)	7 (100)	Rarely used surface
8	Pond	10	10 (100)	10 (100)	10 (100)	drinking water sources
9	River	5	4 (80)	3 (60)	4 (80)	21/22 (96)

In the present study, the TVC, coliform count, E. coli and faecal streptococci of the surface water samples were very high as reported by Sinha,(1991), Ramteke *et al*., (1992) and Sharma *et al*.(2003) supporting the levels of gross surface water contamination. High percentage of bacterial contamination in ponds may be due to stagnation of water and these places are used by animals and human beings for bathing, defecation etc.

Surface water was found to be 103 to 104 fold more in TVC than ground water. Among the surface and ground water sources the mean TVC of tap water was the lowest i.e. 1 x10 ^{2} / ml and the mean coliform count was 5 organisms / 100 ml. Out of 22 tap water samples 3 (three) were contaminated either with E. coli or faecal streptococci. Well water had high coliform count when compared to bore well, overhead tank and tap water. Well water is usually contaminated by surface waters especially during monsoon and due to inadequate attention paid to environmental sanitary qualities of their walls. The present study clearly indicates that even bore-well water is not free of contamination and degradation in groundwater quality may be due to improper disposal of industrial waste and domestic sewage; similar observations were made by Sharma et al.(1991), Patel, (1991) and Gupta et.al.(1991). However, the study conducted by Kaza et.al. (1991) in Andra Pradesh indicates that bore well water

was free from bacterial contamination. Most of the tap water samples were found to be devoid of E.coli and faecal streptococci. The coliform counts were comparatively low in tap water. The better quality of tap water may be due to the pretreatment of water by the authorities. But it is interesting to note that storing the same domestic water in overhead tanks increases the bacterial load. This underlines the importance of proper maintenance of sumps, overhead tanks and tackling post disinfection contamination of water. However, presence of E. coli and faecal streptococci in three tap water samples is of great concern.

The microbiological analysis of bottled and sachet water sold in and around Pondicherry revealed the presence of faecal coliforms, E. coli and faecal streptococci in four (40%) sachets and faecal coliforms alone in 2 bottled water samples (20%) (Table 2). Similar study on packaged bottled water sold at Jaipur city revealed unsatisfactory samples ranged between 20-50% based on TVC, psychrophilic, coliform and E. coli count (Gangil et. al., 2013). A high demand of packaged drinking water for various occasions has led to sudden increase of small scale entrepreneurs engaging in this business without due regard to hygienic practices may be a reason of concern.

In general, drinking water samples were positive for faecal streptococci and E.coli showing a widespread bacterial contamination. Hence cleaning, disinfecting and monitoring the sources of drinking water are important in maintaining water quality. Efforts have to be intensified in monitoring of activities of water industry in order to provide safe water to public.

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