Bacteriological Quallity of Potable Water in Davangere City

Water borne infections are common in our country. Any source of water; be it ground water or water held in reservoirs is bound to get contaminated in various ways. We wanted to verify the general opinion that bore well water is generally safe. We undertook a study to determine the quality of ground water as well as municipal supplied water in Davangere city between October 2003 and 2004 with four-months gap during monsoons. The quality of water was assessed by estimating presumptive coliform count, confirmed coliform count, confirmed *E. coli* count and entercoccal count by multiple tube technique.

Total of 30 samples of water, 24 from bore well, 5 from municipal supply and one from hand pump were collected in sterile containers after letting the water run waste for 10 minutes. The municipal water samples were collected in container with sodium thiosulphate to counter any residual chlorine. Presumptive coliform count was obtained by inoculating 50 ml., 10 ml and 1 ml water into 50 ml double-strength, 10 ml double-strength and 5 ml single-strength Lauryl Tryptose Broth (LTB) respectively and incubated at 37°C for up to 48 hours. Number of tubes showing gas production were counted and the presumptive coliform count was deduced from McCrady's table[1]. A drop of sample each that showed gas production was sub-cultured into two sets of

Brilliant Green Bile Lactose Broth (BGBLB) and one set of Tryptone Water (TW). The set incubated at 37°C was used to deduce confirmed coliform count while the set incubated at 44°C was used to deduce confirmed *E. coli* count. Tryptone water tubes were incubated at 44°C. All the tubes were incubated overnight in separate water baths. The number of BGBLB tubes that produced gas at 37°C were counted and MPN of confirmed coliform count obtained from McCrady's table. Samples that produced gas in BGBLB and were indole positive (positive Eijkman's test) were counted and MPN of confirmed *E. coli* count obtained from McCrady's table. The positive tubes were not sub-cultured on any plating media as recommended.[1] One drop of water sample from each of 11 LTB tubes were inoculated into Azide Dextrose Broth and incubated overnight at 44°C. Those tubes that indicated acid production were confirmed for enterococci by sub-culturing into Bile Esculin Agar that were again incubated at 44°C overnight. The number of tubes that were positive for enterococci gave the the MPN of enterococci per ml of water. Enumeration of clostridia was left out.

Our study (Table 1) revealed that 80% of bore well samples contained MPN (presumptive coliform count) of ≥1/100 ml. Of the 24 samples, 17 were unsatisfactory, 2 were suspicious, 1 was satisfactory and 4

Quality of water was graded in the following ways[2]. (MPN/100 ml)

Excellent	0/100 ml in presumptive coliform
Satisfactory	1-3/100 ml in presumptive colifiom
Suspicious.	4-10/100 ml in presumptive coliform
Unsatisfactory	>10/100 ml in presumptive coliform

were excellent. Seven bore well samples had enterococcal count of ≥1/100 ml while 17 had levels <1/100 ml. All the five municipal supplied water had excessively high (presumptive coliform count) MPN levels and were all unsatisfactory. Except for one sample all the remaining samples had enterococcal count of ≥1/100 ml. The only sample of hand pump water had presumptive coliform count of 1/100 ml and had enterococcal count < 1/100 ml. Our study indicated that even though the confirmed coliform counts were either equal to or slightly less than the presumptive coliform counts, there is no actual benefit of conducting confirmed coliform tests. Our study also indicated that of all samples where

the presumptive coliform counts were >1/100 ml, only 36% of samples had confirmed E.coli count <1/100 ml.

Even though the E. coli counts were in the acceptable limits, high levels of presumptive coliform counts rendered them less than satisfactory. This raises the question whether it is necesasary to perform Eijkman's test whenever presumptive coliform counts are at unsatisfactory levels. Our interpretation has limitations due to smaller sample size. A much larger sample size would have given more meaningful results. Several studies across the country have similar findings showing large number of potable water sources having coliforms in unacceptable counts [3, 4, 5, 6] even though the use of total coliforms as indicator bacteria has itself been the subject of debate.[7] Our conclusion that even gound water is heavily contaminated with bacteria and is not safe contrary to general perception is generally agreed with.[5] A recent study in U.S. confirmed that the analyses of only a few samples per year do not give a correct picture of the water quality and that continuous surveillance of the microbiological quality of drinking water could help to improve control of water quality.[8]

Table 1. Coliform count in different water samples

Presumptive coliform count MPN per 100 ml	Confirmed Coliform count MPN per 100 ml	Confirmed *E. coli* count MPN per 100 ml	Enterococcal count MPN per 100ml
A. Bore Water Well Samples			
161	5	5	5
2	2	<1	<1
22	22	1	1
35	11	<1	<1
5	5	<1	<1
54	14	<1	5
54	1	1	<1
54	54	<1	<1
7	1	<1	<1
92	92	7	5
110	70	<1	<1
>180	>180	<1	<1
>180	>180	<1	<1
>180	>180	5	<1
>180	>180	<1	<1
>180	>180	7	1
>180	>180	<1	<1
>180	>180	>180	< 1
>180	>180	10	4
>180	>180	>180	5
B. Municipal supply			
14	11	7	<1
24	24	8	2
92	92	1	<1
>180	>180	3	8
>180	161	13	11
C. Hand Pump			
1	<1	<1	<1

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