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BACTERIOLOGICAL QUALITY OF DRINKING WATER IN THE HOSPITALS OF CHIKHLI TOWN IN BULDANA DISTRICT

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Abstract: Water is one of the important substances on earth. Water is indispensable for life. Total 42 samples were collected from the study area. Six samples were from Government hospital and 36 drinking water samples were collected from six different Private hospitals of Chikhli town in Buldana district. The microbial quality of drinking water samples were assessed by making use of the Multiple Tube Fermentation Technique test (MPN/100 ml), presence of total coliform, faecal coliform and thermo tolerant coliform. Bacterial isolate is identified on the basis of cultural, morphological and biochemical characterization. From this water samples 21% have presumptive bacterial count MPN above the permissible limits for drinking water. Also *Salmonella typhi* was confirmed in total ten drinking water samples out of the forty two samples. Out of the total forty two samples three samples were thermo tolerant *Escherichia coli* positive. Totally there was only 5 water source with excellent type, 28 with acceptable, 7 unacceptable and 2 grossly polluted. Out of the total analyzed samples, only 33 had acceptable faecal coliform count (less than 10 MPN per 100 ml of water), 5 sample excellent range. All the excellent type of water samples were collected from private hospital. Environmental assessment of the sample locations revealed that some of the environments were dirty. The results of the bacteriological analysis of drinking water showed that most drinking. The contamination of drinking water sources should be because of the improper sanitation and hygiene, handling processes and leakages in the distribution system. So it increases the threats of the waterborne diseases in the people in that hospitalized area.

Key Words: Coliform, faecal coliform, Escherichia coli and Salmonella typhi

INTRODUCTION

Water is the second essential factor for life after oxygen. If this essential factor is not available some organism dies early, some from resistance stage, while some other dies late. Human beings are not excluded from this marvelous factor. Peoples obtain their drinking water from surface and ground water sources. However both surface and ground water sources could become contaminated by biological and chemical pollutants arising from point and non-point sources. Quality water is vital to the health, social and economic well-being of people. Harmful bacteria, parasites, and viruses are invisible to the naked eye, so water, which looks and taste good, may not necessarily be safe to drink. These microbes can exist in surface and ground water supplies, and can cause immediate sickness in humans if not properly treated. Poor water quality and bad sanitation are deadly; some fire million deaths a year are caused by polluted drinking water. Water is the basic element of social and economic infrastructure, which is essential for healthy society and sustainable development (Asati, 2012). World Health Organization (WHO) reports that approximately 36% of urban and 65% of rural India's were without access to safe drinking water (WHO, 2009; Sohani and Sanjeeda, 2012).

Microbiological indicators have been used to determine or indicate the safety of water for drinking. Bacteria of coliform group are considered the primary indicators of faecal contamination and most frequently applied. Estimation of coliforms helps in determining the faecal contamination of water and probably the presence of intestinal pathogens (Gugnani, 1999; Raina *et al.*, 1999; Jain *et al.*, 2012). A direct relationship exists between water, sanitation, health, nutrition, and human well-being. Consumption of contaminated drinking water, improper disposal of human excreta, lack of personal and food hygiene and improper disposal of solid and liquid waste have been the major causes of many diseases in India (Rajgire, 2013).

This study addresses some of the issues given above by bacterial analysis of the drinking water in hospital area in Chikhli town, District-Buldana (Maharashtra) collected during the time period 2012-2013. Attention is focused upon total coliforms, thermo tolerant coliforms, *Escherichia coli* and *salmonella typhi.* Forty two samples were analyzed which were collected from the tap water in government hospital as well as private hospitals in Chikhli town. The portability of water was determined and the results obtained were compared with the standard provided by APHA. It further determined the need for frequent bacterial analysis of drinking water and it also concerned about the current hygienic conditions of drinking water provided in the hospitals.

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MATERIAL AND METHODS

Water is indispensable for life. Total 42 samples were collected from the study area. Six samples were from Government hospital and 36 drinking water samples were collected from six different Private hospitals of Chikhli town in Buldana district.

Estimation and isolation of total coliforms

The bacteriological analysis of collected water samples were carried out for the presence of coliforms, faecal coliforms, thermotolerant coliforms by using methods as recommended by APHA, (1998). Total coliforms were estimated by using a set of nine tubes MPN method.

Isolation of the Salmonella typhi

For the isolation of the *Salmonella typhi* from the drinking water samples, the MPN positive tubes were inoculated on the Brilliant Green Agar (BGA) and Bismuth Sulphite Agar (BSA) plates. After the incubation, observe the colonial characteristics.

Test for the Thermo tolerant coliforms

The presence of thermo tolerant coliforms in the drinking water sample was detected by performing Eijkman test (Rajgire, 2013). The biochemical Characterization of bacteria was determined by using IMViC test (Cappucino, 2002).

Antibiotic Resistance Analysis

Antibiotic susceptibility testing of the isolates was performed on Muller Hinton agar plates by disk diffusion method. A single disc contained different antibiotics namely Cifrofloxacin, Colistin, Co-trimoxazole, Gentomicin, Nitrofurontoin, Streptomycin, Tetracycline, Ampicillin and observed the results.

RESULT AND DISCUSSION

Environmental assessment of the sampling locations revealed that some of the environments were dirty during the collection of the samples. All the samples were shown presence of coliforms. Total samples were analyzed for the isolation and identification of pathogenic bacteria such as *Escherichia coli*, Thermo tolerant coliform and *Salmonella typhi.* The Most Probable Number for the presumptive coliform count of water sample ranges from 0-920 MPN/100 ml. Total 42 samples were collected from the study area. Six samples were from Government hospital and 36 drinking water samples were collected from six different Private hospitals of Chikhli town in Buldana district.

All the excellent type of water samples were collected from private hospitals. The isolates were initially differentiated on the basis of cultural study. After which they were subjected to morphological and biochemical tests. In the morphological study both the isolates were subjected to Gram staining and motility. After the morphological studies the isolates were subjected to the biochemical test analysis. Total of the forty two samples, sample GHSP2 and PHSP6 showed Thermo tolerant *Escherichia coli*. It showed the water contaminated by the faecal materials. It could be from the human or animal origins. The isolates screened were identified by using the cultural, morphological and biochemical characteristics. So identification of the screened isolates was confirmed as *Escherichia coli*, thermo tolerant *Escherichia coli* and *Salmonella typhi*.

Table 1 shows the percentage of presence of *Escherichia coli* and *Salmonella typhi* in drinking water samples of different hospitals i.e. one Government hospital and six different Private hospitals in the Chikhli town in the Buldana district. The percentage of *Escherichia coli* ranges from 16% to 50% and the percentage of *Salmonella typhi* ranges from 0% to 50%. The results of the coliform count obtained from the water samples. It showed that $PHSP_6$ recorded the least *Escherichia coli* percentage and GHSP, $PHSP_1$ and $PHSP_2$ recorded the highest *Escherichia coli* percentage. Figure 1 showed the percentage of presence of *Escherichia coli* and *Salmonella typhi* in drinking water samples of different hospitals. Water samples from Government hospital has a significantly higher percentage of *Escherichia coli* and *Salmonella typhi* compared to those collected from the Private hospitals.

Table 1: Percentage of presence of *Escherichia coli* and *Salmonella typhi* in drinking water samples in different hospitals

S.No.	Sources	Total Samples	*Escherichia coli*		*Salmonella typhi*	
			Positive	%	Positive	%
1	GHSP	6	3	50%	3	50%
2	$PHSP_1$	6	3	50%	2	33%
3	$PHSP_2$	6	2	33%	2	33%
4	$PHSP_3$	6	2	33%	1	16%
5	$PHSP_4$	6	1	16%	1	16%
6	$PHSP_5$	6	1	16%	1	16%
7	$PHSP_6$	6	1	16%	0	0%

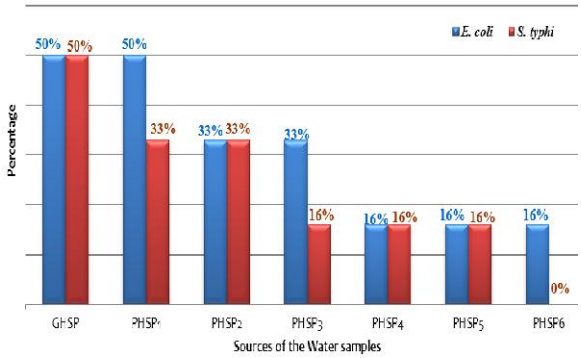

Figure 1: Shows percentage of presence of *Escherichia coli* and *Salmonella typhi* in drinking water samples in different hospitals

Table 2 shows the antibiotic sensitivity of the isolates of *Escherichia coli* and *Salmonella typhi*. It is used to study the susceptibility of the different pathogenic microorganisms against different antibiotics. The antibiotic Ciprofloxacin (Cf) was shown maximum activity against pathogenic bacteria. This study measures only microbial quality by using *Escherichia coli* as an indicator for faecal pollution and *Salmonella typhi*. However, we believe that the information about contamination of the water sources in the hospitals in the Chikhli town is the first in its kind and revealed the hygienic conditions of water sources which are used by the people who would came in the hospitals for treatment, visitors, hospital staff members etc.

Table 2: multiple drug resistance pattern of isolates against different antibiotics

Antibiotics	Concentration in mcg	Zone of inhibition in mm	
		Escherichia coli	*Salmonella typhi*
Ciprofloxacin (Cf)	10 mcg	33 mm	15 mm
Colistin (Cl)	10 mcg	Resistant	Resistant
Co-Trimoxazole (Co)	25 mcg	Resistant	19 mm
Gentamicin (G)	10 mcg	Resistant	11 mm
Nitrofurontoin (Nf)	300 mcg	Resistant	10mm
Streptomycin (S)	10 mcg	Resistant	11 mm
Tetracycline (T)	30 mcg	Resistant	Resistant
Ampicilin (A)	10 mcg	Resistant	10 mm

In this study 21% of water samples have MPN count of total coliforms above the allowable limit. This indicates that majority of the water source of the hospitals were faecally polluted. Thermo tolerant coliforms were found in 7% of the samples. Also, *Salmonella typhi* was found in 23 % of the samples, so it was life threatening conditions. This indicates that the majority of the water sources of the hospitals of the Chikhli town were faecally contaminated.

In comparison with the study conducted by Sapokta *et al.*, (2012) showed that the most probable number of presumptive coliform count of water sample ranges from 2-240 MPN/100 ml. This was little bit lower than the present study that showed presumptive coliform count of water sample ranges from 0-920 MPN/100 ml. Rajgire (2013) showed that drinking water in open defecation free villages was 17% faecally contamination whereas open defecation not free villages 48%. In both open defecation free (ODF) and open defecation not free (ODNF) villages faecally contaminated drinking water samples was also showed poor water quality index (WQI) also TTC positive and *Escherichia coli* detected by antibiotic resistance analysis. As compared to this result in the present study out of the 42 samples collected 9 water samples exceeding the WHO standards and out of these only 13 samples confirmed presence of *Escherichia coli* and 10 samples confirmed the presence of *Salmonella typhi.*

CONCLUSIONS

Consuming unsafe drinking water may lead to several water bone diseases, and other long and chronic health problems. Therefore, provision of safe drinking water to each and every individual living in this planet is required. On this note, a routine water treatment should be employed to avoid any health hazard that could erupt through drinking of contaminated water. Environmental assessment of the sample locations revealed that some of the environments were dirty. The results of the bacteriological analysis of drinking water showed that most drinking water sources were contaminated with coliforms and pathogenic bacteria. The pathogens like *Salmonella typhi* and *E. coli* were identified by using selective and differential media. Thermo tolerant coliforms were also isolated for the drinking water samples it concluded that water samples might be contaminated by the faecal matter of the humans or animals in origin. The contamination of the water sources should be because of the improper sterilization of the water, handling processes, leakages in the distribution system, unhygienic processes doing there. So it increases the threats of the waterborne diseases in the people in that area. The people likely to be at risk would be the very old or very young as well as patients undergoing immunosuppressive therapy.

REFERENCES

1. APHA. Standard methods for the examination of water and wastewater. 1998, 20th edition, APHA, Washington, D.C.

2. Asati SR. Water quality analysis of source Wainganga River for Tirora town. *International journal of life sciences biotechnology and pharma research*, 2012, 1(2):244-252.

3. Cappucino JG and N Sherman. Microbiology: Laboratory Manual. 2002, Benjamin Cumming.

4. Gugnani HC. Some emerging food and water borne pathogens. *Journal commun. Dis.* 1999, 31: 65-72.

5. Jain, Udit, Basanti Bist and DD Lalawani. Assessment of microbiological quality by coliform estimation in drinking water sources of Mathura region. *IOSR journal of pharmacy*, 2012, 2: 500-503.

6. Raina PS, Pollaria FL, Teare GF, Goss MJ, Berry DAJ and Wilson JB. The relationship between E. coli indicator bacteria in well water and gastrointestinal illness in rural families. *Canadia Journal Pub. Health*, 1999, 90: 172-175.

7. Rajgire AV. Open defecation: a prominent source of pollution in drinking water in villages. *International journal of life sciences biotechnology and pharma research*, 2013, 2(1):238-246.

8. Sapkota Rajendra, Dasgupta Rubin, Malik Abhishek. Microbiological quality of potable water in Dehradun city. *International research journal of pharmacy*, 2012, 3(6):130-137.

9. Sohani S and J Sanjeeda. Microbiological analysis of surface water in Indore, India. *Research journal of recent sciences*, 2012, 1:323-325.

10. WHO. Guidelines for drinking water quality. 2009, Geneva, 1:3rd edition.

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