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Research Article

STUDY ON BACTERIOLOGICAL QUALITY OF WATER USED FOR DRINKING PURPOSE FROM WESTERN REGION OF UTTAR PRADESH

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ABSTRACT

Objective: The objective of this study was to the bacteriological nature of drinking water from different dynamic sources of water used in the catchment region of a tertiary care teaching hospital.

Methods: Fifty water tests were performed for the review. Standard guidelines for drinking water quality appraisal were embraced. Culture and bacteriological trial of drinking water were preceded according to standard conventions. After assemblage of gathered information, examination was performed by statistical software.

Results: Out of 50 water tests gathered, 24 were viewed as inadmissible. *Escherichia coli* was viewed as liable for about a fourth of tests, while *Pseudomonas* in 1/5th of gathered examples. *E. coli* and *Klebsiella* tried positive with Methyl Red while *Pseudomonas* spp. what's more, *Klebsiella* tried positive with Citrate test reagent. *E. coli* showed positive outcome with Indole reagent though *Klebsiella* tried positive with Urease. With respect to populace life forms, *E. coli*, *Klebsiella* Spp., and *Pseudomonas* Spp. were viewed as certain in one sample though *Klebsiella* Spp. furthermore, *Pseudomonas* Spp. was viewed as certain another one sample.

Conclusion: The review featured unsafe nature of water sources in the study region with respect to drinking water which is not good for utilization of water. Reconnaissance of water sources and normal bacteriological evaluation of all water hotspots for drinking is suggested on regular basis.

Keywords: Drinking water, bacteriological quality, culture.

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INTRODUCTION

India has abundant water resources, including a network of streams and snow-covered mountains in the Himalayas, which can satisfy the nation's various water needs [1]. According to ongoing studies, there are alarmingly large concentrations of several disease-causing microbes in both drinking water and recreational water. Utilizing this water could result in several dangerous infections [2]. Releases from sewage treatment facilities and overflow from ad hoc settlements are the main factors affecting the microbial composition of surface waters. The microbiological makeup of surface waterways is often assessed using marker organisms, and fecal coliforms are the most frequently employed bacterial indicator of waste contamination [3].

It is highly important that many networks in developing countries deal with severe general medical concerns related to drinking water. To protect the well-being of the local population, a supply of clean water must be kept on hand. In some parts of India, people are seriously concerned about water shortages and contamination by microbes and chemicals [4]. Understanding of concerns relating to both quality and quantity of water becomes vital due to the unequal distribution of water and lack of local area control [5].

The presence of coliforms shows how hygienic the water is overall and indicates the likelihood of water-borne diseases. Coliforms that are present in water can cause diarrhea, fever, and other secondary problems [6]. The Yamuna River supplies the city of Mathura, which is located in western Uttar Pradesh. One of the key phases as rapid urbanization spreads along this river's flow is a focus on the type of water in this channel. Subsequently, this study was performed to assess bacteriological nature of drinking water from different sources of water used in the catchment region of a medical college.

METHODS

The department of microbiology, along with the departments of pharmacology and biochemistry, of a tertiary care teaching health facility situated in Mathura city, carried out and executed this investigation. The study area was defined as the medical college's catchment area. Families who drank water from government hand syphons, water coolers, and public faucets made up the study population. The study technique was shaped by bacterial testing on drinking water and culture.

Study design
This study was cross-sectional study.

Study period
This study was July 2021–December 2021.

Sampling technique
This study was purposive sampling.

Sample size
This study was 50 samples of drinking water.

Inclusion criteria
Any active water source which was being used for drinking purpose and a fairly good number of people using that water source for drinking purpose was included in the study.

Study strategy
A total of 50 drinking water samples were collected from active sources of drinking water according to National Environmental Engineering Research Institute (NEERI) guidelines [7] for drinking water quality assessment, for 1 year approximately.

Table 1: Identification of micro-organisms in the water samples

Water sample obtained from	Sample collected, *n* (%)	Unsatisfactory sample, *n* (%)	Organism grown		
			E. coli	***Pseudomonas* Sp.**	***Klebsiella* Sp.**
Municipal tap water	25 (50)	16 (66.67)	12	3	5
Government hand pump	14 (28)	1 (4.16)	-	1	-
Water cooler	11 (22)	7 (19.16)	1	6	2
Total (%)	50	24	13 (26)	10 (20)	7 (14)

E. coli: Escherichia coli

Table 2:Species identification with biochemical tests in water samples

Organism	MR	VP	Indole	Urease	Citrate
E. coli	+	−	+	−	−
Klebsiella	+	−	−	+	+
Pseudomonas spp.	−	−	−	−	+

MR: Methyl red, VP: Voges-Proskauer, *E. coli: Escherichia coli,* + means present, − means absent

Table 3: Distribution of mix population organisms with reference to sample numbers of drinking water

Number of sample	Organisms			
	E. coli, Klebsiella* Sp., *Pseudomonas Sp.	***E. coli, Klebsiella* Sp.**	***E. coli, Pseudomonas* Sp.**	***Klebsiella* Sp., *Pseudomonas* Sp.**
1	+	−	−	−
3	−	−	+	−
2	−	+	−	−
1	−	−	−	+

E. coli: Escherichia coli, + means present, − means absent

Around 200 mL water tests from Government hand pump, water cooler and Municipal tap water were gathered, named, and shipped to the laboratory for bacteriological examination. Bacteriological investigation was done for indicator organisms, for example, all total and fecal coliform (*E. coli*) [8].

Five tubes of MacConkeys broth (Hi media Pvt. Ltd Mumbai) organized in two columns with a 100 mL blood culture bottle. First, column containing 10 mL two-fold strength MacConkeys broth was inoculated with 10 mL of water test and 50 mL two-fold strength MacConky broth was inoculated with 50 mL of water test. Second, column containing 1 mL single strength MacConkeys broth medium was inoculated with 1 mL water test separately. They were brooded at 44°C for 24 h. Post-incubation, the quantity of bottles in which lactose fermentation with acid and gas creation has happened was counted. The MPN of coliform in 100 ml water test was been assessed by alluding to probability table. Culture and biochemical tests were likewise performed.

RESULTS

Out of the 50 samples of water collected, 25, 14, and 11 samples of water from government hand pumps, water coolers, and municipal tap water, respectively, were collected. The majority of the cases were deemed to be unreliable. Twenty-six percentages of tests were thought to be *Escherichia coli's* fault, and 5% of the examples that were gathered involved *Pseudomonas* (Table 1).

For species, distinguishing proof the biochemical tests was performed. *E. coli* and *Klebsiella* tried positive with Methyl Red while *Pseudomonas* spp. Furthermore, *Klebsiella* tried positive with Citrate test reagent. *E. coli* showed positive outcome with Indole reagent, while *Klebsiella* tried positive with Urease (Table 2).

Regarding mix population organisms, *E. coli*, *Klebsiella* Spp., and *Pseudomonas* Spp. were found to be positive in one sample, whereas *Klebsiella* Spp. and *Pseudomonas* Spp. were found to be positive only in one sample (Table 3).

DISCUSSION

This review's bacteriological testing of the water's quality is not to be seen as a technological intermediary, but rather as a way to collaborate with the community's stronger systems of health administration and health promotion. It is possible to trace a significant portion of humanity's frailty, particularly in developing countries, to the lack of protected and clean water. Positive health cannot exist without access to clean water. We expect water should be safeguarded since it is essential to our survival. In fact, even water that appears clear may not actually be safe or appropriate [9].

The bacteriological examination of water decides the potability of water. As per Indian norm (BIS, 1981) all through the year 95% of tests should not contain any coliform creatures or ought not be recognizable in that frame of mind of any two back to back examples and no example contains *E. coli* in 100 mL. The right limit of coliform in water is 10 MPN/100 mL [10].

Since water is the primary anticipated source of infectious diseases, it is necessary that the water used for human consumption be free from pathogenic and substance specialists, delicious to drink, and suitable for domestic uses. The primary option for ensuring general well-being is water sanitization. The study report also revealed that water-borne illnesses regularly caused a few deaths, particularly among children. In fact, in non-industrial countries like India, access to pure water and disinfection offices continues to be a strict test even after more than 60 years of freedom [11].

Twenty-five samples of water from public tap water, government hand pumps, and water coolers, respectively, were collected for this review. Nearly half of the samples were thought to be inappropriate. A quarter of tests were thought to be answerable for *E. coli*, while a fifth of the samples were thought to be answerable for *Pseudomonas*. In the event that a water test was conducted on municipal ordinary water, the MPN of coliform was determined to be extremely high (180), and in the case of water from a water cooler, it was 90, not adaptable, and no coliform was identified in the government hand pump supply for drinking.

E. coli and *Klebsiella* tried positive with Methyl Red though *Pseudomonas* spp. Furthermore, *Klebsiella* tried positive with Citrate test reagent. *E. coli* showed positive outcome with Indole reagent, while *Klebsiella* tried positive with Urease. As per Focal Contamination Control Board India, complete coliform creature MPN/100 mL will be 50 or less in drinking water source. The utilization of drinking water tainted with pathogenic microorganisms of waste beginning is a critical gamble to human health [12].

This review has a few strengths. We evaluated the bacteriological composition of drinking water from several dynamic water sources, which is a crucial focus study. Microbial science organizations and experts in the subject have not conducted a thorough investigation of this viewpoint. There are also some limitations on the review. Some

would argue that the results might not matter to the general audience. In view of the fact that, these findings are dependent on a single site study from western Uttar Pradesh, I agree. There should be more multicentric concentrations.

CONCLUSION

The review featured unsafe nature of water sources in the study region with respect to drinking water which is not good for utilization of water. Reconnaissance of water sources and normal bacteriological evaluation of all water hotspots for drinking is suggested on regular basis.

AUTHORS' CONTRIBUTION

All the authors have contributed equally.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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REFERENCES

1. Murcott S, Keegan M, Hanson A, Jain A, Knutson J, Liu S, *et al*. Evaluation of microbial water quality tests for humanitarian emergency and development settings. Procedia Eng 2015;107:237-46. doi: 10.1016/j.proeng.2015.06.078
2. Abebe L, Karon AJ, Koltun AJ, Cronk RD, Bain RE, Bartram J. Microbial contamination of non-household drinking water sources: A systematic review. J Water Sanit Hyg Dev 2018;8:374-85. doi: 10.2166/washdev.2018.080
3. Bhardwaj A, Surana A, Mithra P, Singh A, Panesar S, Chikkara P. A community based cross sectional study on use of sanitary latrines in a rural setup in Maharashtra. Healthline 2013;4:89-93.
4. Clasen TF, Menon S. Microbiological performance of common water treatment devices for household use in India. Int J Environ Health Res 2007;17:83-93. doi: 10.1080/09603120701217695, PMID 17616864
5. Bain R, Cronk R, Wright J, Yang H, Slaymaker T, Bartram J. Fecal contamination of drinking-water in low-and middle-income countries: A systematic review and meta-analysis. PLoS Med 2014;11:e1001644. doi: 10.1371/journal.pmed.1001644, PMID 24800926
6. Rainey RC, Harding AK. Acceptability of solar disinfection of drinking water treatment in Kathmandu Valley, Nepal. Int J Environ Health Res 2005;15:361-72. doi: 10.1080/09603120500289168, PMID 16416753
7. National Environmental Engineering Research Institute (NEERI). Guidance Manual for Drinking Water Quality Monitoring and Assessment. 2007. Available from: https://eprints.neeri.res.in/id/eprint/180 [Last accessed on 2022 Jun 15].
8. Britton LJ, Greeson PE. Methods for Collection and Analysis of Aquatic Biological and Microbiological Samples. United States: US Geological Survey Techniques of Water-Resources Investigations; 1987.
9. Faúndez G, Troncoso M, Navarrete P, Figueroa G. Antimicrobial activity of copper surfaces against suspensions of *Salmonella enterica* and *Campylobacter jejuni*. BMC Microbiol 2004;4:19. doi: 10.1186/1471-2180-4-19, PMID 15119960
10. Bureau of Indian Standards. Drinking Water Specification. 1st rev. New Delhi: Bureau of Indian Standards; 1991. p. 1-8.
11. Anstiss RG, Ahmed M. A conceptual model to be used for community-based drinking water improvements. J Health Popul Nutr 2006;24:262-6. PMID 17366766
12. Singh A, Goel S, Singh AA, Goel AK, Chhoker VK, Goel S, *et al*. Rapid appraisal of the drinking water management practices among residents of urban field practice area of a tertiary care teaching centre in Northern India. J Integr Health Sci 2014;2:12-6. doi: 10.4103/2347-6486.239541