Journal of Advanced Zoology

ISSN: 0253-7214
*Volume **44** Issue **04 Year 2023** Page **682:688***

Assessment of Microbiological Quality of Potable Water in Rathinamangalam Village, Tamilnadu, India

Kannan I[1]*, Sukumar RG[2], Yogalakshmi T[3]

[1]*Associate Professor, Department of Microbiology, Tagore Medical College and Hospital, Rathinamangalam, Chennai, India*
[2]*Professor, Department of Microbiology, Tagore Medical College and Hospital, Rathinamangalam, Chennai, India*
[3]*UG Student, Tagore Medical College and Hospital, Rathinamangalam, Chennai, India*

**Corresponding author's E-mail: dr.ikannan@tagoremch.com*

Article History

Received: 06 June 2023
Revised: 05 Sept 2023
Accepted: 25 Nov 2023

Abstract

Water is an important constituent of all life forms and essential for its survival. Satisfactory supply of clean, safe, and hygienic drinking water is imperative for health. The current study has been designed to assess the microbial quality of drinking water in and around Rathinamangalam village, Tamilnadu. It is a cross sectional study. A total of 53 drinking water samples were collected and subjected to membrane filter techniques and MPN technique. Three sources of water were analyzed for the presence of faecal coliforms. Among the well water analyzed two wells showed the presence of faecal coliforms. All the 30 borewell samples showed the absence of coliforms. Among 14 water samples of public water supply, 2 showed the presence of coliforms. The present study concludes that the sources of drinking water in the Rathinamangalam village are microbiologically safe. However, the public water supply should be chlorinated.

Keywords: *Potable water, Microbiological analysis, faecal coliforms, membrane filter technique*

1. Introduction

India has 3% of fresh water resources. By 2025, half of the world's population will be living in water stressed areas. 21% of communicable diseases in India are related to unsafe water, with diarrhea alone causing more than one hundred thousand deaths annually.

As International Authority on Public Health and Water, WHO leads global efforts to prevent transmission of water borne diseases, advising government on the development of health-based targets and regulations.

WHO produces a series of water quality guidelines on drinkingwater, safe use of waste water etc., The water quality guidelines are based on managing risks and since 2004 the guidelines for drinking water induce the promotion of water safety plans to identify and prevent risks before water is contaminated.

The present study evaluated drinking water from localities in and around Rathinamangalam for faecal coliforms, vibrio cholerae and enterotoxigenic Escherichia coli. Drinking water samples were collected from bore well, public water supply and well water. Samples were tested for faecal coliforms and *E.coli* count by most probable technique and membrane filter technique.

2. Literature Review

Water is an important constituent of all life forms and essential for its survival [1]. Satisfactory supply of clean, safe, and hygienic drinking water is imperative for health [2]. Hence safe drinking water is vital for human living [3]. Rural India has more than 700 million people residing in about 1.42 million habitations spread over 15 diverse ecological regions. Meeting the drinking water needs of such a large population can be daunting task. An estimated 844 million people lack even a basic drinking water service, including 159 million people who are dependent on surface water. Water borne diseases continue to be one of major health problems globally. Contaminated water can transmit diseases such as diarrhea, cholera, dysentery, typhoid. Contaminated drinking water is estimated to cause 502,000

diarrheal deaths each year. The high prevalence of diarrhea among children and infants in the developing countries are due to the use of unsafe water and unhygienic practices [4]. This is mainly because of the unavailability of good quality of drinking water [5].

Consumption of contaminated drinking water was associated with 80% of diseases and one third of death in developing countries [6, 7]. Apart from that we also use water for domestic, recreational and industrial purposes which are washing, cooking, brewing, beverage bottling and for sporting activities [8]. Ground water constitutes 85% of the source of drinking water in India [9]. The contamination of water resources occurs due to poor water resources sanitation, animal manure and improper disposal of solid waste and domestic sewage [10]. The poor microbiological quality of ground water is likely to arise from variety of sources like leaking, infiltration and domestic sewage pipes. Infectious agents find their way into the drinking water by fecal contamination [11].

Based on WHO standards, drinking water must be without any fecal coliform's bacteria [14]. The routine microbiological analysis of potable water includes the identification of indicator organisms and finding the total viable count in the water, to assess the quality of water [15]. Escherichia coli inhabit the intestine of warm-blooded animals and are regarded as the best indication of fecal contamination of water.

In the present study, an attempt was made to assess the bacteriological quality of potable water of Ratinamangalam village situated in Kancheepuram district of Tamilnadu.

Aims And Objectives:

As the water borne diseases like diarrhea is common in villages, it is imperative to assess its microbial quality, thereby we can take several measures to improve its quality. The current study has been designed to assess the microbial quality of drinking water in and around Rathinamangalam.

3. Materials And Methods

Study design:

It is a cross sectional study. A total of 53 drinking water samples were collectedfor microbiological analysis in and around Rathinamangalam village. The Figure 1 shows the map of Rathinamanglam village and the places wherein different water samples were collected.

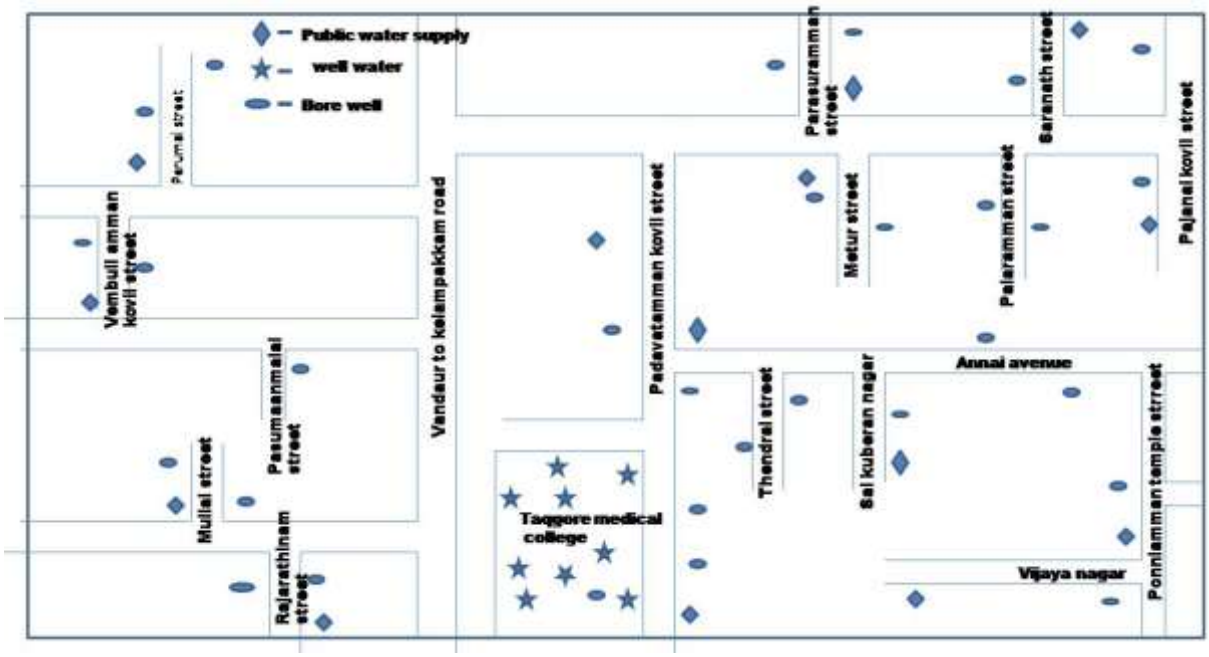

Figure 1: Rathinamangalam Map showing the places of collection of various water samples

Sample collection

From the tap:

First tap was opened for 2 to 3 minutes to run out the stagnant water. After flushing, tap was turned off and spout was sterilized by disinfectant. Following disinfection, the tap was opened. To get the gentle stream of water the flow of water has been adjusted. The water was filled up to the top leaving a sufficient gap to allow for mixing in the laboratory. The cap was replaced carefully.

From open well

The closed bottle was held near its base and it was plunged below the surface. The top/cap was removed and the bottle was turned until its neck pointed slightly upward and mouth was directed toward the current.

Microbiological analysis of water

Most Probable Number (MPN) technique

This method is also called as multiple tube fermentation technique. It is a statistical method based on the random dispersion of microorganisms per volume in a given sample. It is used to detect the total coliforms. The test was performed sequentially in three stages namely the presumptive, confirmed, completed tests.

Presumptive test

Materials required

1. Fifteen tubes of double-strength lactose.
2. 10, 1.0 and 0.1 ml pipettes.
3. Water samples, to be tested.

Test

1) the water sample is taken and inoculated in five tubes of lactose broth with 10 ml, five tubes with 1.0 ml each and five tubes with 0.1 ml each.
2) All tubes were incubated at 37oC for 24 hours.
3) The number of tubes at each dilution which show gas production in 24 hrs was observed.
4) The results have been recorded from the standard chart.
5) Re-incubated the negative tubes for an additional 24 hours at 37°C and observed.

Confirmed test

Material required

1. EMB agar plates.

Test

1)Inoculated an EMB plate with material from a tube containing gas.
2)Inverted and incubated the plate at 37°C for **24 hours**.
3) Observed EMB agar plates.
4)A positive [confirmed] test is indicated by small colonies with dark centers and a green metallic sheen (*E. coli*).
5) The results were recorded.

Completed test

Materials required:

1. Lactose broth tubes.
2. Nutrient agar slants.

Test

1) Inoculated a lactose broth tube and a nutrient agar slant with organisms from the EMB plate.
2) Incubated the broth tube and agar slant at 37°C for **24 hours**.
3) Checked for gas production in the lactose broth tube.
4)Gram stain was made from the organisms on the nutrient agar slant.
5) The results were recorded.

Membrane filter technique

Principle:

The Membrane Filter (MF) Technique was introduced in the late 1950s as an alternative to the Most Probable Number (MPN) procedure for microbiological analysis of water samples. The MF Technique offers the advantage of isolating discrete colonies of bacteria, whereas the MPN procedure only indicates the presence or absence of an approximate number or organisms (indicated by turbidity in test tubes). The MF technique has been accepted and recommended both by Bureau of Indian Standards and International Organization for Standardization (ISO).

The following is the general steps of membrane filter technique:

1) 100 mL of water sample was passed through the membrane of 0.45 µm pore size, utilizing a Membrane filtration unit (Figure 2) and vacuum system.

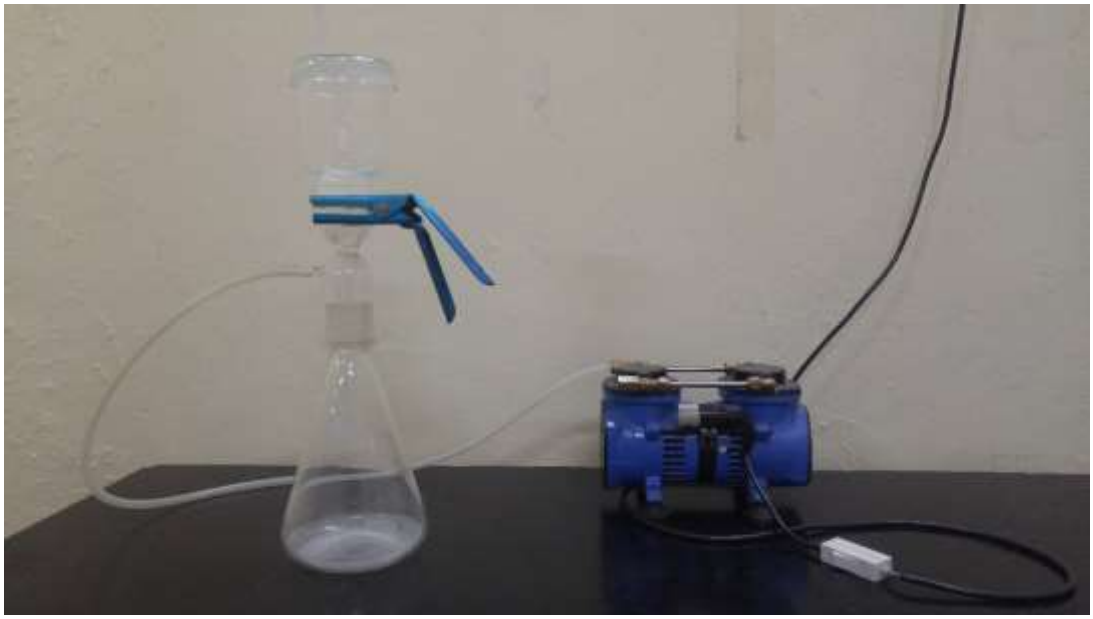

Figure 2: Membrane filter unit

2) The bacteria were present in the sample were concentrated on the surface of the membrane.

3)Next, the membrane was placed without inverting it into a Petri dish containing the EMB agar medium.

4) The passage of nutrients through the filter would facilitate the growth of organisms on the upper surface of the membrane (Figure 3).

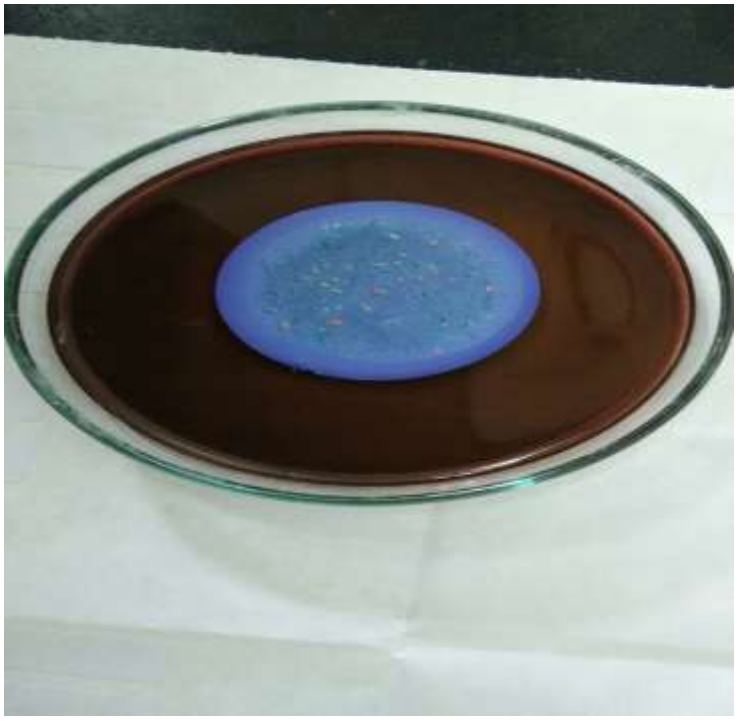

Figure 3: Membrane filter in EMB agar showing the growth of bacteria.

3. Results and Discussion

Observation

Three sources of water were analyzed for the presence of faecal coliforms. The result of the well water is depicted in Table 1. Only 9 wells are present with water. Remaining wells are either abandoned or

dry without any water. Among the well water analyzed two wells showed the presence of faecal coliforms (Figure 4).

Table 1: The results of well water

S.NO	PLACE	RESULTS
1.	Girls hostel – TMCH	No faecal coliforms
2.	Temple opposite	No faecal coliforms
3.	CRRI front	Faecal coliforms
4.	Dental college middle	No faecal coliforms
5.	Ground side left	No faecal coliforms
6.	Boys hostel back	No faecal coliforms
7.	Hospital back	Faecal coliforms
8.	Ground side right	No faecal coliforms
9.	Dental hostel front	No faecal coliforms

Figure 4: The results of well water

Thirty borewell water were checked for the presence of the faecal coliform. The results are shown on the Table 2. From the table it is evident that none of the borewell showed the presence of faecal coliforms.

TABLE 2: The results of bore well water

S.NO	PLACE	RESULTS
1.	Girls hostel TMCH	No faecal coliforms
2.	College opposite1st house - in padavattamman kovil street	No faecal coliforms
3.	College opposite 2nd house – in padavattamman kovil street	No faecal coliforms
4.	In Padavattamman kovil street, annai avenue st opposite	No faecal coliforms
5.	Annai avenue st entrance, left side house	No faecal coliforms
6.	Sai kuberan nagar,1st houseleft side	No faecal coliforms
7.	Sai kuberan nagar ,5th house right side	No faecal coliforms
8.	Sai kuberan nagar ,2nd house left side	No faecal coliforms
9.	Sai kuberan nagar ,6th houseright side	No faecal coliforms
10.	Annai avenue ,3rd house Left side	No faecal coliforms
11.	Annai avenue ,4th house left side	No faecal coliforms
12.	Annai avenue , house 6	No faecal coliforms
13.	Annai avenue street, walk 1m, left side house	No faecal coliforms
14.	Annai avenue street , walk 1m right side house	No faecal coliforms
15.	Ponni amman street , right side 1st house	No faecal coliforms
16.	Ponni amman street , left side 1st house	No faecal coliforms
17.	Ponni amman street , left side 2nd house	No faecal coliforms
18.	Vijaya nagar , left cut 1st house	No faecal coliforms
19.	Vijaya nagar , right cut 2nd house	No faecal coliforms
20.	Metur street , right side 1st house	No faecal coliforms
21.	Metur street , left side 2nd house	No faecal coliforms

22.	Metur street , right side 4th house	No faecal coliforms
23.	Parasuramman street , right side house 5th	No faecal coliforms
24.	Parasuramman street , left side 3rd house	No faecal coliforms
25.	Palaramman street , right side 2nd house	No faecal coliforms
26.	Palaramman street , left side 1st house	No faecal coliforms
27.	Pajainai kovil street , right cut 4th house	No faecal coliforms
28.	Pajainai kovil street , left cut 2nd house	No faecal coliforms
29.	Palaramman street , right side 7th house	No faecal coliforms
30.	Parasuramman street , left side 8th house	No faecal coliforms

The village Rathinamangalam had a total of 14 taps in the streets that supplies the drinking water. The Table 3 shows the results of the presence of faecal coliforms. Two water sources showed the presence of the faecal coliforms (Figure 5).

Table 3: showing results of public water supply

S.no	Place	Results
1.	Padavatamman street temple ,left cut right side 1st house	No faecal coliforms
2.	Annai avenue street entrance left side 1st house	No faecal coliforms
3.	Perumal street left side	No faecal coliforms
4.	Saranath street right side	Faecal coliforms
5.	Sai kubaerannagar left side	No faecal coliforms
6.	Pajanaikovil street right side	No faecal coliforms
7.	Metur street right side	No faecal coliforms
8.	Parasuramman street right side	No faecal coliforms
9.	Ponniamman street right side	No faecal coliforms
10.	Perumal street	No faecal coliforms
11.	Vembullammankovil street	No faecal coliforms
12.	Mullal street	Faecal coliforms
13.	Rajarathinam street	No faecal coliforms
14.	Padavattammankovil street end	No faecal coliforms

Figure 5: The results of the public water supply

Water is an important source of transmission of various diseases like typhoid, cholera, amoebiasis, etc. The important source of contamination in drinking water is the sewage. The water is important for every living being. The safety of the drinking water is the need for the human kind. In India, safe drinking water in villages are a big concern. In the present study, an attempt was made to do microbiological analysis of drinking water in the Rathinamangalam village, Kancheepuram District, Tamilnadu.

Three important sources of water viz., well water, borewell water and public water were subjected to the analysis. The results showed that the various water sources are not contaminated with sewage. In the present study, two open wells showed the presence of faecal coliforms indicating the sewage contamination. The contaminated wells are not used by the public as drinking water source.

All the borewells are microbiologically safe/good and hence potable. The village has public water supply in different streets. A total of 14 water sources were analyzed and two water sources were found

to have faecal contamination. It was found that the public water is not chlorinated. Hence, it has the possibility of contamination if there is any breakage somewhere in the pipeline.

4. Conclusion

The present study concludes that the sources of drinking water in the Rathinamangalam village are microbiologically safe. However, the public water supply should be chlorinated. The pipelines should be checked periodically and should be maintained. At present, the public water is not used for the drinking purpose by the people of the village because of the fear of its contamination. Only way to make the people to make of use of public water for drinking is of proper chlorination.

References:

1. UN General Assembly United Nations Millennium Declaration, 2000.
2. http://www.un.org/millennium/declaration/ares552e.htmg. assessed on 18/01/2017
3. Khatoon A, Pirzada ZA. Bacteriological quality of bottled water brands in Karachi, Pakistan. Biologia (Pakistan) 2010;56:137-43.
4. Khaniki GRJ, ZareiA ,Kamkar A, Fazlzadehdavil M , Ghaderpoori , Marei A. Bacteriological evaluation of bottled water from domestic brands in Tehran markets, Iran. World Applied Sciences Journal 2010; 8:274-8.
5. Onifade AK, Ilori RM. Microbiological analysis of sachet water vended in Ondo state , Nigeria. Environmental Research Journal 2008; 2:107-10.
6. Onweluzo JC, Akuagbazie CA. Assessment of the quality of bottled and sachet water sold in Nsukka town. Agro Science Journal of Tropical Agriculture, Food, Environment and Extension 2010;9:104-10.
7. Mellor J, Smith J, Samie A, Dillingham R; Coliform Sources and Mechanisms for Regrowth in Household Drinking Water in Limpopo, South Africa. Journal of Environmental Engineering, 2013; 139:1152–1161.
8. Echoru I, Ayikobua ET, Emorut SP; A Study to Investigate Major Community Health Challenges and Their Predisposing Factors in Bushenyi District of South Western Uganda. OJEPI, 5(May),2015.
9. Oesterholt F, Medema G, van der Kooij D, Martijnse G; Health risk assessment of non-potable Domestic water supplies in the Netherlands. Journal of Water Supply: Research and Technology— AQUA, 2007; 56:171.
10. Pahuja, S. 2010. Deep wells and prudence: towards pragmatic action for addressing groundwater overexploitation in India. The International Bank for Reconstruction and Development. The World Bank Report. The World Bank, Washington, DC.
11. Grabow, W.O.K. 1996. Waterborne diseases: update on water quality assessment and control. Water SA, 22: 193 202
12. WHO; WHO | Guidelines for Drinking-Water Quality, 2nd edition. WHO Chronicle, 2011; 38:104–8. (81-88).
13. Bartram, J., Cotruvo, J., Exner, M., Fricker, C., Glas-macher, A. 2003. Heterotrophic plate counts and Drinking water safety : the significance of HPCs for water quality and human health. IWA Publishing, London.
14. Guidelines for Drinking-water Quality, Vol. 1, World Health Organization, Geneva, 1985. 15.
15. Standard Methods for the Examination of Water and Wastewater; 19th Edition; American Public Health Assn., American Water Works Assn., and Water Pollution Control Federation, Washington D.C., 1995.