

Post Flood Water pollution and its impact on rural health; A microbiological analysis on waterbodies of Alathur grampanchayat, Kerala, India - After Flood - 2018

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Abstract

There was a clear contamination of drinking water bodies of Alathur Block panchayat, Kerala, India. The Physico chemical changes were observed. There is a clear indication of microbiological contamination by total coliforms, with an indication of formation of gas in most of the MPN tubes but few non lactose fermenting non-pathogenic organisms like klebsiella sp. were detected from the well water and no fecal coliforms were observed in the completed test. Similarly when the well water samples were inoculated in specific media to detect the presence of other pathogenic Total coliforms such as Salmonella sp., shigella sp., cholera, etc., it was clear that no pathogenic organisms were isolated from the above mentioned samples. This clearly indicates that the Health department has taken proper preventive measures such as repeated chlorination of all the drinking water bodies immediately after the flood to prevent the outbreak of above mentioned threatening diseases, which is a good initiative.

Key words: Flood Water, microbial contamination, pollution, rural health, water quality.

INTRODUCTION

Kerala, India, is well known as GOD'S OWN COUNTRY for its Beauty of Greenery and rich water resources. The state has 44 rivers, 27 backwaters (mostly in the form of lakes and ocean inlets), 7 lagoons, 18681 ponds and over 30 lakh wells. Palakkad of Kerala is said to be the gateway to Kerala due to the presence of the Palakkad Gap, in the Western Ghats. It has many small and medium rivers, which are tributaries of the Bharathapuzha River. So there are many dams in Palakkad district, the largest one is Malampuzha dam (Qureshimatva and Maurya *et al.*, 2015)



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Gayathri River Basin, one among the major tributaries of river Bharathapuzha spread over 980.38 sqkm, 67 microwater sheds traversing the boundaries of 31 Gramapanchayaths, 5 Block panchayaths and 2 districts. It is one among the two tributaries sustaining the life of River Bharathapuzha with its origin from portions of Western Ghats, south of Palakkad gap, catchment of four major reservoirs Mangalam, Pothundy, Meenkara and Chulliyar serving the irrigation requirements of the extensive paddy tracts of Alathur, Nenmara and Kollengode blocks of Palakkad district, still rich in its traditional farming and water harvesting systems. The Climate of Palakkad is a tropical wet and dry. Temperatures remain moderate throughout the year, with exception in March and April being the hottest months. A very high amount of precipitation is received in Palakkad, mainly due to the South-West monsoon. July is the wettest month, and the total annual rainfall is around 83 inches (211 cm).

Rainfall over Kerala during southwest monsoon season 2018 (1 June to 19 August, 2018) has been exceptionally high. Kerala received more than 2346.6 mm against normal of 1649.5 mm (above normal by 42%). Studies indicate that the second highest excess rainfall is recorded in Palakkad district (72% above normal) just next to Idukki District (92% above normal) (Government of India 2018).

Well water is the main source of drinking water in many places of Alathur Grama Panchayat, Kerala, India. Many people depend on Grama Panchayat water supply for their drinking and domestic purpose. Since there was a sudden flood in these areas due to Monsoon change during August 2018, there was floods and contamination of the drinking water supplies as indicated by an observable change in the colour, taste and hardness of the water.

AIM AND OBJECTIVES OF THE STUDY

The aim of this study is to analyze the impacts of flood on the potable water bodies with respect to physico-

chemical and microbiological quality. The samples of drinking water were collected directly from various Wells, Grama Panchayat water supply and bore well water in and around Alathur Gramapanchayat in order to check the quality and potability of the drinking water just after the floods and to create the awareness for the people with respect to steps and precautions to be taken for maintaining cleanliness and hygiene conditions of drinking water. The water samples were collected from different areas of Alathur Gramapanchayat and analyzed for their physicochemical parameters, pH, Most Probable Number (MPN) for checking the portability, as well as prevalence of various water borne pathogens, indicators organisms of fecal contaminants using specific media.

OBJECTIVES

The objectives of the present study were analysis of water for physic-chemical changes and microbial contamination by Most Probable Number count and detection of pathogens.

METHODOLOGY:

Examination of Physico chemical parameters:

The collected water samples were taken in a clean glass beaker and viewed with naked eye for the detection of the physico chemical parameters such as Odour, taste, color and turbidity. Collected water samples were taken in a sterile beaker and checked for the pH using digital pH meter.

Most Probable Number count for the detection of water portability:

MPN test was performed in 3 steps: The presumptive test was a screening test to sample water for the

Table 1. Properties of Well water from Vezhumala location

Location- Vezhumala/ Ward 11	House no	Measured Parameters		
		Colour	Odor	Turbidity
Well-1	448	Colourless	No smell	Not turbid
Well-2	596	Colourless	No smell	Not turbid
Well-3	486	Colourless	No smell	Not turbid
Well-4	446	Colourless	No smell	Not turbid
Well-5	448	Colourless	Chlorine smell	Not turbid
Well-6	450	Colourless	No smell	Not turbid
Well-7	459	Colourless	No smell	Not turbid
Well-8	510	Colourless	No smell	Not turbid
Well-9	Public	Colourless	No smell	Not turbid
Well-10	445	Colourless	No smell	Not turbid
Well-11	444	Colourless	No smell	Not turbid
Well-12	439	Colourless	No smell	Not turbid

presence of coliform organisms. If the presumptive test was negative, no further testing was performed, and the water source was considered microbiologically safe. If, however, any tube in the series shows acid and gas, the water was considered to be unsafe and the confirmative test was performed on the tube displaying a positive reaction.

Preparation of the Medium

Lactose broth was prepared in single and double strength concentrations. Double strength medium was dispensed in 3 tubes (5ml in each tube) and single strength medium in 6 tubes (5 ml in each tube) and durham tubes were added into the tubes in inverted position. The tubes were examined that the inner vial is full of liquid with no air bubbles. It was sterilised by autoclaving at 15 lbs pressure (121°C) for 15 minutes (Cuppucino and Sherin 1998).

Detection Of Total And Fecal Coliforms on Selectie Media:

Collected water samples were inoculated into various selective media such as Macconkey agar, TCBS agar, *Salmonella shigella* agar for the isolation of Total and fecal Coliforms which can cause various threatening diseases such as cholera, typhoid, dysentery, etc (Cuppucino and Sherin, 1998).

RESULTS DISCUSSION

Physico chemical parameters of water sample

Colour

Most of the samples collected from the Well Water from Vezhumala were not having any color or they were colorless. well water from locations of Erattakulam, Kavasserry, Nalleppily, Vandazhi and the water samples collected from SN college did not show any change in color. However, the samples collected from Panchayat water connections showed shallow yellow color, this could be potentially due to the seepage of rain water, or the mixing of flood water into the well caused due to heavy rains.

ODOUR

Most of the samples collected from the Well water from Vezhumala were not having any Odor. Well water from locations of Erattakulam, Kavasserry, Nalleppily, Vandazhi and the water samples collected from SN college did not show any change in odour. However, the samples collected from Panchayat water connections showed Fecal smell in sample collected from connection No.4/193, and the other panchayat water connections showed muddy flavor. This could be potentially due to the seepage of rain water, or the mixing of flood water into the well caused due to heavy rains.

Table 2. Properties of Well water from other locations

Location	Well no	House no	Measured Parameters		
			Colour	Smell	Turbidity
Erattakulam	Well 13		Colourless	No smell	Not turbid
Kavassery	Well 14	5	Colourless	No smell	Not turbid
Nalleppily	Well 15	481	Colourless	No smell	Not turbid
Vandazhi	Well 16		Colourless	No smell	Not turbid
SN College	Tap water		Colourless	No smell	Not turbid
SN College	Filter water		Colourless	No smell	Not turbid

Table 3. Properties of Panchayat water connections

Location - Alathur	Measured Parameters		
	Colour	Odour	Turbidity
Connection - 1 / 320	Shallow yellow	Muddy flavor	Highly turbid
Connection - 2 / 782	Shallow yellow	Muddy flavor	Highly turbid
Connection - 3 / 547	Colourless	No odour	No turbid
Connection - 4 / 913	Shallow yellow	Feacal smell	Highly turbid
Connection - 5 / 780	Shallow yellow	Muddy flavor	Highly turbid
Connection - 6 / 430	Shallow yellow	Muddy flavor	Highly turbid
Connection - 7 / 321	Shallow yellow	Muddy flavor	Less turbid
Connection - 8 / 035	Shallow yellow	Muddy flavor	Highly turbid
Connection-9/public	Shallow yellow	Muddy flavor	Highly turbid

Table 4. pH of Well water from Vezhumala location

Location	Measured pH		
	Test-1	Test-2	Average
Well-1	7	7	7
Well-2	7	7	7
Well-3	7	7	7
Well-4	7	7	7
Well-5	8	8	8
Well-6	7	7	7
Well-7	8	8	8
Well-8	8	8	8
Well-9	7	7	7
Well-10	8	8	8
Well-11	8	8	8
Well -12	7	7	7

Turbidity:

Turbidity is a measure of the intensity of light scattered by suspended particles. Clay, silt, organic matter, phytoplankton, and other microscopic organisms cause turbidity in water. The extent of turbidity in an

Table 5. pH of Well water from other locations

Location	Well no	Measured pH		
		Test-1	Test-2	Average
Erattakulam	Well-13	7	7	7
Kavassery	Well-14	8	8	8
Nalleppily	Well-15	7	7	7
Vandazhi	Well-16	7	7	7
SN College	Tap water	7	7	7
SN College	Filter water	7	7	7

Table 6. pH of Panchayat water connections

Location - Alathur	House No	Measured pH		
		Test-1	Test-2	Average
Connection - 1	320	7	7	7
Connection - 2	782	7	7	7
Connection - 3	547	7	7	7
Connection - 4	913	7	7	7
Connection - 5	780	7	7	7
Connection -6	430	7	7	7
Connection -7	321	7	7	7
Connection -8	35	7	7	7
Connection -9	Public	7	7	7

aquatic system is generally taken as a measure of pollution intensity. Least value of turbidity were observed in Well water from Vezhumala and well water from locations of Erattakulam, Kavassery, Nalleppily, Vandazhi and the water samples collected from SN college.

pH:

The pH values of the water samples taken from water bodies showed alkaline trend. The pH values ranged from 7 to 8. As per BIS desirable limit of pH is 6.5-8.5 in drinking water. The study showed there were not much acidic changes in the water and is in the permissible standard limits set by BIS. pH of the collected samples were tabulated below (Tables 4,5 and 6):

The coliform bacteria identified included the genera *Escherichia*, *Citrobacter*, *Enterobacter*, and *Klebsella*. Coliform bacteria may not cause disease, but they are used as one of the indicators of pathogenic contamination that can cause different diseases like dysentery, intestinal infections, typhoid fever, hepatitis, cholera, and other illness. According to BIS for drinking water quality, the drinking water should be devoid of coliforms. In this study the total coliforms levels ranged from 1 to 1100.

Detection of Fecal coliforms and Total coliforms:

Escherichia coli was detected from the water samples of Alathur Gramapanchayat water supply, and other pathogenic coliforms were absent in the samples.

Table 7. MPN Analysis report of Well Water

S. No.	Location	House No	Presumptive Test	MPN	Confirmatory Test	MPN	Completed Test
1	Veezhumala	484	2,2,1	28	2,1,1	20	Large, Mucooid Pink colonies
2	Veezhumala	596	2,2,1	28	2,2,0	21	Large, Mucooid Pink colonies
3	Veezhumala	486	2,2,1	28	2,1,0	15	Large, Mucooid Pink colonies
4	Veezhumala	446	2,1,1	20	2,1,0	15	Large, Mucooid Pink colonies
5	Veezhumala	448	2,2,1	28	2,2,0	21	Large, Mucooid Pink colonies
6	Veezhumala	450	2,1,1	20	2,1,0	15	Large, Mucooid Pink colonies
7	Veezhumala	459	2,1,1	20	2,1,0	15	Large, Mucooid Pink colonies
8	Veezhumala	510	2,2,1	28	2,1,1	20	Large, Mucooid Pink colonies
9	Veezhumala	445	2,1,1	20	2,1,0	15	Large, Mucooid Pink colonies
10	Veezhumala	444	2,2,1	28	2,1,1	20	Large, Mucooid Pink colonies
11	Veezhumala	439	2,1,1	20	2,1,0	15	Large, Mucooid Pink colonies
12	Erattakulam		2,2,1	28	2,1,1	20	Large, Mucooid Pink colonies
13	Kaveserry	5	2,1,1	20	2,1,0	15	Large, Mucooid Pink colonies
14	Nallepilly	481	2,2,1	28	2,1,1	20	Large, Mucooid Pink colonies
15	Vandazhi	901	2,1,1	20	2,1,0	15	Large, Mucooid Pink colonies

Table 8. MPN Analysis report of Panchayat Water:

S. No.	Location	House No	Presumptive Test	MPN	Confirmatory Test	MPN	Completed Test
1	Alathur	College drinking water	1,1,1	1	1,1,1	1	No growth
2	Alathur	College Tap	3,2,2,	210	3,2,2,	210	Green MetallicScheen
3	Alathur	320	3,2,2,	210	3,2,1	150	Green MetallicScheen
4	Alathur	782	3,3,2	1100	3,3,1	460	Green MetallicScheen
5	Alathur	547	3,3,2	1100	3,3,2	1100	Green MetallicScheen
6	Alathur	913	3,3,2	1100	3,3,2	1100	Green MetallicScheen
7	Alathur	780	3,2,2	210	3,1,0	43	Green MetallicScheen
8	Alathur	430	3,3,2	1100	3,3,2	1100	Green MetallicScheen
9	Alathur	321	2,2,0	21	2,2,0	21	Green MetallicScheen
10	Alathur	35	3,3,2	1100	3,3,2	1100	Green MetallicScheen
11	Alathur	Public Pipe	3,2,2	210	3,2,1	150	Green MetallicScheen

The present study showed there was a clear contamination of drinking water bodies of Alathur Block panchayat. The Physico chemical changes were observed, like change in color and odour in certain areas of the Alathur Grama Panchayat, as mentioned above in results. Water quality indicates the relation of all hydrological properties including physical, chemical and biological properties of the water body (Suryalekshmi Prasad and K. Mophin Kani, 2017). Hence, water quality assessment involves analysis of physico-chemical, biological and microbiological parameters that reflects the biotic and abiotic status of ecosystem. Similar results was observed and reported

by Pesce and Wunderlin, (2000). pH is one of the important parameters for water quality assessment (Simeonov *et al.*, 2002). It is considered as an ecological factor and is the result of interaction of various substances in water and also influences numerous biological phenomena (Athira, and Jaya (2014). In our finding the pH was ranging from 7 to 8 in almost all the samples.

There is a clear indication of microbiological contamination by Total coliforms, with an indication of formation of gas in most of the MPN tubes but few non lactosefermenting non pathogenic organisms like *Klebsiella* sp. were detected from the well water and no

fecal coliforms were observed in the completed test. Similarly when the well water samples were inoculated in specific media to detect the presence of other pathogens, total coliforms such as *Salmonella* sp., *Shigella* sp., etc., which causes severe health damage with the harmful diseases such as Typhoid, dysentery, cholera etc. But from the results it was clear that no pathogenic organisms were isolated from the above mentioned samples. This clearly indicates that the Health department has taken proper preventive measures such as repeated chlorination of all the drinking water bodies immediately after the flood to prevent the outbreak of above mentioned threatening diseases, which is a good initiative.

Similarly when the Grama Panchayat water sample collected from the taps showed the formation of gas in all the samples and *E.coli* growth was also observed in almost all the samples. Fecal coliform and *Enterococcus* species, exist in the intestines of both human and animal populations. Their presence in the water has a relationship to public health risk (e.g. skin rashes, respiratory infections, gastro-intestinal illness and other diseases) This clearly indicates the fecal contamination of the water, which might be due to either mixing of sewage with the drinking water bodies due to flash floods, insufficient chlorination or, any leakage in the drainage pipe line which may be present adjacent to the drinking water pipeline of Alathur grama Panchayat. The results also raised a potential concern of spread of water borne diseases like diarrhea and dysentery. So it is recommended for regular water quality monitoring and proper sanitary measures with the highest priorities to control and minimize the incidence of potential outbreak of water born diseases. There is a closer link between pollution and health damages. Five million people die each year around the world because of polluted drinking water, poor sanitation and unhygienic domestic environment (WHO, 1996). In India alone, nearly 1 million people die annually because of waterborne diseases (World Bank 2001). Dirty water and poor sanitation cause more than 5,00,000 infant deaths a year in the Asia pacific region (Economic Review 2005). In this modern world, it is no longer safe to use water from natural resources. The quality of surface water is unpredictable because the water continually moves and pollutants can be introduced at any time. In other words, an area of the lakes or streams that is fine one day may be contaminated on next day.

Water quality evaluation is considered as a critical issue in recent years, especially when fresh water is becoming a scarce resource in the future (Chang-An Yan *et al.* 2015). Water quality monitoring has a high priority for the determination of current conditions and

long term trends for effective managements. The supply of safe water has a significant impact on the anticipation of water transmissible diseases [Muhammad Balal *et al.* 2008].

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