

# Post Flood Health Hazards in Ernakulam District of Kerala: A Focus on Safe Water Supply and Control of Acute Diarrheal Disease

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## ABSTRACT

**Background:** Flooding is associated with an increased risk of infection, however this risk is low unless there is significant population displacement and /or water sources are compromised. In August 2018, Kerala state in India experienced a major flood after a heavy rain.

**Objectives:** Present study was conducted to examine the post flood status of safe water supply in flood affected areas of Ernakulam District of Kerala.

**Materials and Methods:** A mixed study design was used. The study was conducted during the period 15<sup>th</sup> to 30<sup>th</sup> September, 2018. During the study a total of 550 House Holds were surveyed from 11 purposively selected administrative areas. The Houses were selected by using Simple Random Sampling with 50 houses from each area. Data on safe water supply was collected by house to house survey by using a standardized pre-tested questionnaire and data on Acute Diarrheal Disease was collected from District Surveillance Unit (DSU). Data from DSU was collected for the year 2016, 2017 and 2018. At house hold level Orthotolidine (OT) Test was done to check the residual chlorine level and hence to assess the potability of the water. The presence of free chlorine in drinking water was correlated with the absence of most disease-causing organisms, and thus was taken as a measure of the potability of water. **Results:** out of 11 selected areas, 3 areas had water supply exclusively from well while another 3 areas had water supply exclusively through piped and in rest 5 areas the water supply was mixed i.e. both through well and pipe. In Mallapuram area 100% of the households had residual chlorine in potable water. In rest of the areas <50% of the households had residual chlorine in potable water. Cases of Acute Diarrhoeal Diseases (ADD) were more in year 2018 as compared to year 2016 and 2017 respectively.

**Conclusion:** During post flood period, though the reporting of ADD cases was increased however safe water supplied to the community was key to prevent any outbreak of ADD.

**Key words:** Acute Diarrhoeal Disease, Safe Water Supply, OT test, Post Flood Situation, Ernakulam, Kerala

## INTRODUCTION

Floods can potentially increase the transmission of water-borne diseases, such as typhoid fever, cholera, leptospirosis, hepatitis A and vector-borne diseases, such as malaria, dengue and dengue hemorrhagic

fever, yellow fever, West Nile Fever etc.<sup>[1,2]</sup>

Flooding is associated with an increased risk of infection, however this risk is low unless there is significant population displacement and/or water sources are compromised.<sup>[3]</sup> Of the 14 major floods which occurred globally

between 1970 and 1994, only one led to a major diarrheal disease outbreak - in Sudan, 1980. This was probably because the flood was complicated by population displacement. Floods in Mozambique in January-March 2000 led to an increase in the incidence of diarrhea and in 1998, floods in West Bengal led to a large cholera epidemic.<sup>[3,4]</sup>

Water supply and sanitation condition become severely disrupted during flood when it embraces various water borne diseases.<sup>[5]</sup> The major risk factor for outbreaks associated with flooding is the contamination of drinking-water facilities, and even when this happens, as in Iowa and Missouri in 1993, the risk of outbreaks can be minimized if the risk is well recognized and disaster-response addresses the provision of clean water as a priority.<sup>[5,6]</sup> Flooding has been shown to cause epidemics of water-borne and vector-borne disease.<sup>[7]</sup> Water-borne outbreaks of diarrhoeal disease after floods are thought to be primarily from contamination of water caused by disruption of water purification and sewage disposal system. However, it has been hypothesized that the secondary effects of flooding, including overcrowding and subsequent fecal-oral spread of gastrointestinal pathogens, may also contribute to spread of diarrhoeal disease.<sup>[8,9]</sup>

Flood related diarrhoeal epidemics cause significant morbidity and mortality throughout the world.<sup>[10]</sup> During the 1988 flood in Bangladesh, diarrhoeal disease was responsible for 35% of all flood-related illnesses and 27% of 154 flood-related deaths in population of more than 45,000 patients in rural Bangladesh.<sup>[11]</sup> During the 1998 flood, 25% of 3,109 people surveyed in two rural areas of Bangladesh reported diarrhoeal illness.<sup>[9]</sup>

Ensuring uninterrupted provision of safe drinking water is the most important preventive measure to be implemented following flooding, in order to reduce the risk of outbreaks of water-borne diseases.

Free chlorine is the most widely and easily used, and the most affordable of the drinking water disinfectants. It is also highly effective against nearly all waterborne pathogens. At doses of a few mg/liter and contact times of about 30 minutes, free chlorine generally inactivates >99.99% of enteric bacteria and viruses.<sup>[10]</sup>

Rainfall over Kerala during southwest monsoon season 2018 (1 June to 19 August, 2018) has been exceptionally high 2346.6 mm against normal of 1649.5 mm (above normal by 42%) resulting in flooding affecting all districts of the state. Present study was conducted to examine the post flood status of safe water supply in flood affected areas of Ernakulam district of Kerala.

#### **Objective:**

- To study the post flood status of safe water supply in flood affected areas of Ernakulam district.
- To study the sources of safe water supply of the flood affected community.

#### **MATERIALS & METHODS**

Present study was conducted in Ernakulam district of Kerala. A mixed study design was used. The study was conducted during the period 15<sup>th</sup> to 30<sup>th</sup> September, 2018. During the study period a total of 550 households were surveyed from 11 purposively selected administrative areas. The households were selected by using Simple Random Sampling method by using a random table numbers. Out of all listed households 50 houses were selected from each area.

Data on safe water supply was collected by house to house survey. Data was collected by using a standardized pre-tested questionnaire. Data was collected regarding source of drinking water, frequency of chlorination of wells, distribution of chlorine tablets and storage of water. Data on Acute Diarrheal Disease was collected from District Surveillance Unit (DSU). Data from DSU was collected for the year 2016, 2017 and 2018. At

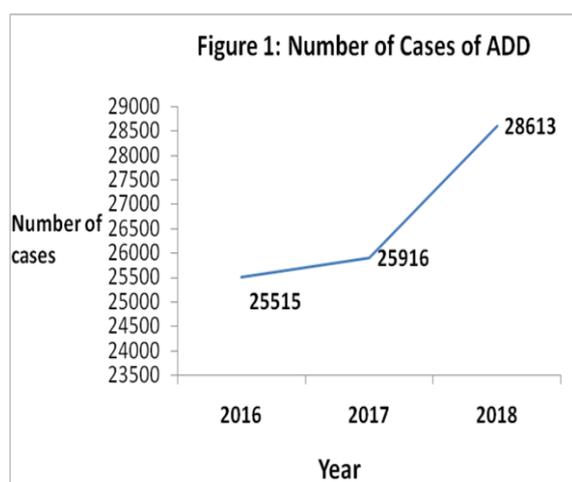
household level Orthotolidine (OT) Test was done to check the residual chlorine level and hence to assess the potability of the water. OT test was done by using OT testing kit supplied by the District Health Office. The presence of free chlorine in drinking water was correlated with the absence of most disease-causing organisms, and thus was taken as a measure of the potability of water.

**OT Test:** The test was carried out by adding 0.1 ml of the reagent to 1 ml of water and the reading was taken within 10 seconds. Colour change of water was matched against colour discs. The minimum recommended free chlorine was 0.5mg/liter.<sup>[11]</sup>

**Acute diarrhoeal disease:** Acute Diarrhoeal Disease was defined as “passage of 3 or more loose or watery stools in the past 24 hours with or without dehydration”.<sup>[12]</sup>

## RESULTS

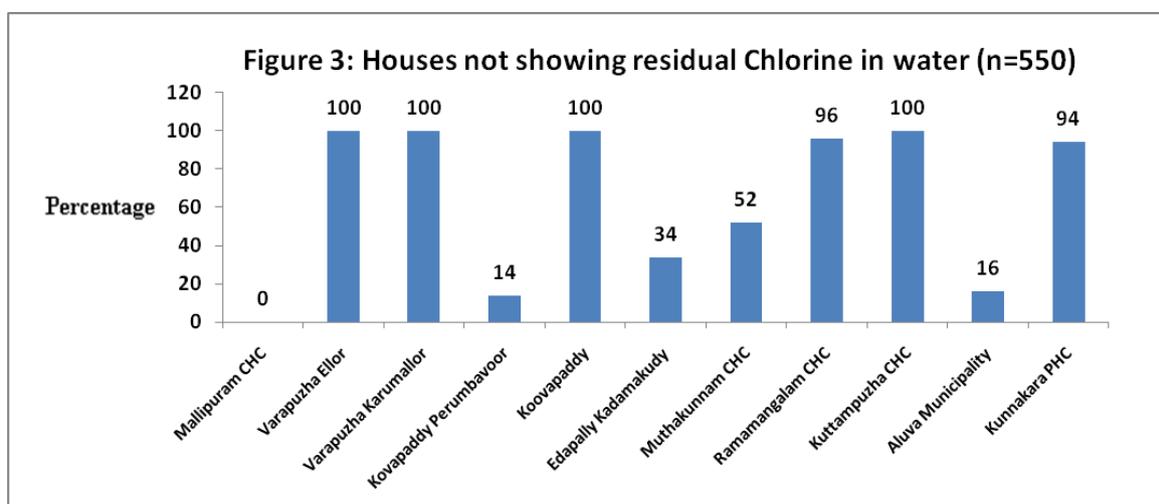
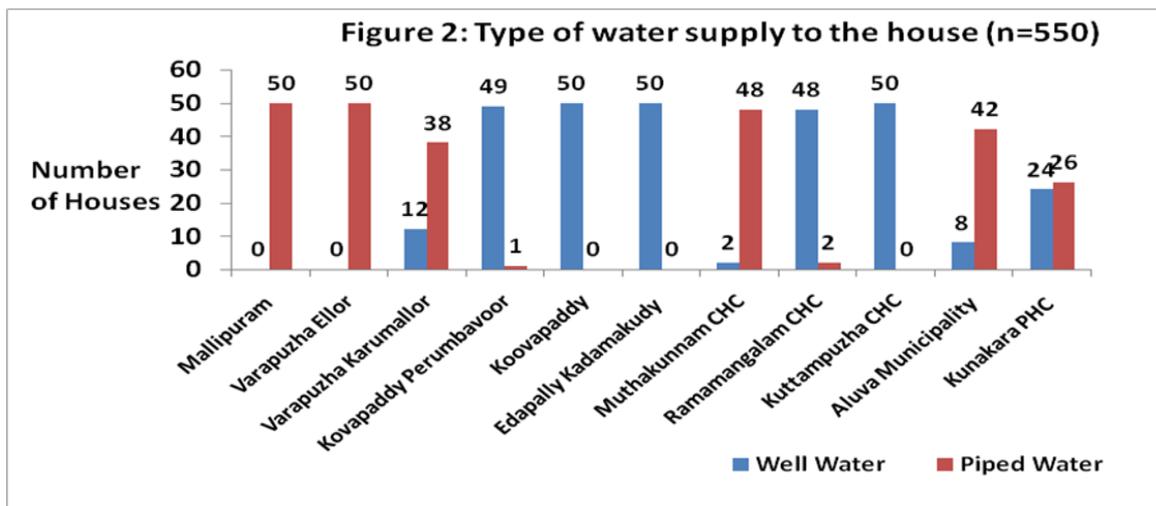
As per the IDSP record available in District Surveillance Unit (DSU) – Ernakulam, a total of 28613 cases of Acute Diarrheal Diseases (ADD) were reported from all blocks of Ernakulam district for the period January to September, 2018. During the year 2016 and 2017 number of reported cases of ADD was 25515 and 25916 respectively (**Figure 1**).



Out of total 550 houses surveyed in 11 areas all houses has either well water supply or piped water supplied for drinking purpose. Out of 11 areas, in 3 areas drinking water supply was exclusively through well. In these 3 areas namely Koovapaddy, Edapally Kadamakudy and Kuttampuzha CHC 100% of the houses had water supply through well. In 2 areas namely Mallipuram and Varapuzha Ellor 100% of the houses had water supply through piped water i.e. public water distribution system. In areas of Mallipuram CHC, Varapuzha Ellor and Edapally Kadamakudy public water supply was available. In Kunnakara PHC area and varapuzha karumallor, Aluva municipality water supply was of mixed type i.e. both from well and public water supply (**Figure 2**).

Only in the area of Mallipuram CHC residual chlorine was found by OT test in 100% of the houses. In six areas residual chlorine was not detected in more than 90% of the houses. In kovapaddy perumbavoor and Aluva municipality residual chlorine was not detected in less than 20% of the houses. In Edapally & Muthakunnam CHC area residual chlorine was not found between 20 to 60 percent of the houses (**Figure 3**).

Out of 11 areas, only households of four area received chlorine tablets. In Mallipuram CHC nearly 90% of the houses received chlorine tablets followed by Aluva Municipality, Karumallor and Ellor. It was also found that in more than 90% of the houses people used boiled water for drinking purpose as per their food habit. After the flood many a persons, had to stay in relief camps for nearly 7 to 10 days. In relief camps facilities for safe water and proper excreta disposal were available. Moreover chlorine tablets were also distributed.



## DISCUSSION

There was a heavy rainfall between 15.8.2018 to 22.8.2018 giving rise to flood. The water level was nearly 10 ft high and it flooded all the wells. Acute Diarrhoeal Diseases has increased in comparison to earlier years but there was no outbreak. Major source of drinking water was well water. On testing the water for residual chlorine, majority of the places did not show any residual chlorine. In majority of the places chlorine tablets were not distributed. The communities have little knowledge regarding the dose of chlorine tablets. As per the information obtained from the community, it was found that chlorination of well was done only on one or two occasions in the first and second week after the flood. In the relief camps water safety was stringently maintained.

On interviewing the health workers, it was observed that they have little idea regarding OT testing and dose of chlorine tablets. Probably as for the first time they had faced such a huge disaster, they have little knowledge about safe water supply. In contrast, a very good health 'habit of drinking boiled water' was observed in majority of the population. Majority of the population also practices hand washing. Probably this could have been the cause of not having any outbreak of diarrhoeal diseases.

## CONCLUSION

A long continued health education campaign by the State Health Department has established a positive health habit in the population. A simple health habit of 'Boiling water for twenty minutes' could be the reason for preventing the occurrence of

any post flood outbreak of Acute Diarrhoeal Disease.

### Recommendations

Periodic training and retraining of Peripheral Health Workers on chlorination of the wells and OT testing for residual chlorine shall be taken by the State Public Health Department.

Community shall be trained on how to use chlorine tablets for water purification. Adequate supply of Chlorine tablets should be ensured at community level.

Well water supply need to be replaced with public potable water supply.

**Conflict of Interest: Nil**

### ACKNOWLEDGEMENT

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**Ethical Clearance:** Study was conducted after taking permission from the appropriate authorities. Informed consent was taken from the study participants.

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