Section: Research Paper

A study on bacteriological quality of drinking water and water related practices in village Kallhe of Raigad district Maharashtra

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Abstract

Background: Drinking water quality is an important determinant of health in the environment. Source protection, unhygienic public gatherings close to sources, and poor personal hygiene are all factors contributing to water contamination by faces. The most common cause of waterborne illness in the globe is biological deterioration in the drinking water supply. A lack of data on the point at which bacteriological quality of drinking water degrades (source or point of use) and associated factors in developing-country households is a problem, however. **Aim and Objectives:** The main objective of this study is to analyze and evaluate bacteriological effectiveness of water samples collected from source and point of consumption of drinking water and water related practices in village Kalhe. **Material and Methodology:** This study is a descriptive, Community based, cross sectional study conducted in village Kalhe in Raigad. **Result:** 115 water samples collected for bacteriological analysis including 26 from the sources and 89 from point of consumption.

Keywords: Bacteriological quality, drinking water, bacteriological effectiveness, quality.

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Introduction

Bacterial water quality is characterized by the presence or absence of indicator organisms. Infected people will not become sick if the water doesn't contain any indicator organisms. The right to clean drinking water is a basic human right that is important to one's health. A country's health and development are dependent on its citizens having access to safe drinking water at all times.

Water is essential to all living things, and it should be available to everybody in an adequate (suitable, safe, and easily accessible) quantity for everyone. When there is no clean water, infectious diseases like hepatitis and cholera may quickly spread, resulting in both suffering and death.

To be considered safe to drink, water must fulfill strict standards for physical, biological, and chemical purity. Access, quantity, quality, and reliability are often the primary considerations when planning a water supply during a disaster or other crisis. In spite of the fact that no one can exist without it, water contamination is the most widespread and omnipresent problem.[i]

Bacterial water quality is characterised by the presence or absence of indicator organisms. There is no infectious sickness if the water is free of indicator organisms. As a human right, access to clean drinking water is essential to one's health. Clean drinking water is essential for a country's citizens' health and growth.

Most people in the world, however, do not have access to safe drinking water in adequate quantities or in a clean environment. In the world, 884 million people do not have access to safe drinking water. Around two-thirds of the world's drinking water comes from surface water sources such lakes, rivers, and open wells. Thus, sewage discharge or human and animal waste bacteria may easily infect it. Diseases including cholera, dysentery and typhoid may be transmitted by contaminated water. It is because of this that aquatic diseases are still a major public health concern. Polluted drinking water is thought to be the primary cause of 80% of all illnesses inthe globe.

Approximately 1.8 million people die each year as a result of unsafe water sources and inadequate sanitation and hygiene. Pregnant women and infants are more at risk, as are those under five years old. On the other side, improvements in water supply may help reduce overall morbidity by 6 to 25 percent. A country's health and economic well-being are negatively impacted by a lack of access to basic water and sanitation services. Infectious diseases caused by pathogenic bacteria are the most common and widespread health concern associated with drinking water. Waterborne germs pose the greatest danger to public health when consumed from sources contaminated with human and animal waste. More people die each year from waterborne illnesses than from all other forms of violence combined, including war.

Around 250 million people are sickened and 10 to 20 million die each year as a consequence of waterborne illnesses. 80 percent of all health problems are caused by these disorders in developing countries.[ii]

Bacteria in water may cause serious and even fatal health problems. Having travelled a great distance in the water cycle and been contaminated at several places, water is very susceptible to diseases. Drinking water is a major cause of microbial diseases in developing countries across the world, along with poor sanitation and food tainted with gastrointestinal bacteria. Poor sanitation and hygiene are commonly associated with polluted water, which accounts for 88% of all diarrhoea cases. Ingestion of polluted water tainted with dung and urine from humans, animals, and birds is the primary cause of bacterial contamination. Pathogenic bacteria, viruses, protozoa, and helminths found in faeces may cause cholera, typhoid, bacillary dysentery, adenoviruses, and retroviruses, among other diseases.

As a consequence of the absence of adequate drinking water and sanitary facilities in underdeveloped countries, people may suffer severely. Most developing countries are now obliged to use unsafe water sources due to a lack of freshwater. More individuals being sick or dying from sickness puts a greater pressure on a country's ability to develop. A large number of people are suffering from water- borne diseases and poor water quality as a consequence.[iii]

Global scenario

The global demand for water has been increasing at a rate of about 1% per year as a function of population growth, economic development and changing consumption patterns, among other factors, and it will continue to grow significantly over the next two decades. Industrial and domestic demand for water will increase much faster than agricultural demand, although agriculture will remain the largest overall user. The vast majority of the growing demand for water will occur in countries with developing or emerging economies.[iv]

The achievement of sustainable development very much depends up on achievement of the goal 6 i.e. safe water and sanitation for all. Goal 6 of SDG not only addresses the issues

relating to drinking water, sanitation and hygiene, but also the quality and sustainability of water resources worldwide.[v] SDG 6 is connected to the targets of five other SDGs. The first connection exists with Target 1.4, which calls for ensuring that all men and women have access to basic services, including water and sanitation. Target 3.3 is about combating water borne diseases and Target
3.9 concerns the reduction of the number of deaths and illnesses from hazardous chemicals, and air, water, and soil pollution (see also Target 11.5). Access to safe and affordable drinking water is a precondition of sufficient nutrition (6.1 and 6.2). Target 12.4 approaches water issues from the perspective of the environmentally sound management of water resources, which aligns with Target 15.1 on the conservation, restoration, and sustainable use of terrestrial and inland freshwater ecosystems and their services. From the inter linkages it is clear that access to sustainable sanitation and potable drinking water are central to achieving the SDGs as a whole. The SDG 6 is, thus, central to achieving most of the other goals as water and sanitation have important bearings on various aspects of sustainable human development.[vi]

In developing countries water resources are greatly burdened by urbanization, fast industrial development and increasing pollution. Hence although large resources are being made available for water and sanitation, the demand for good quality water and supply of the same shows a major disparity. Since 2000, 1.4 billion people have gained access to basic drinking water services, such as piped water into the home or a protected dug well. In 2015, 844 million people still lack a basic water service and among them almost 159 million people stillcollected drinking water directly from rivers, lakes and other surface water sources. The datareveal pronounced disparities, with the poorest and those living in rural areas least likely to use a basic service.[vii]

Globally, at least 2 billion people use a drinking water source contaminated with faeces. 4 Contaminated water can transmit diseases such diarrhoea, cholera, dysentery, typhoid, and polio. Contaminated drinking water is estimated to cause 502000 diarrhoeal deaths each year. By 2025, half of the world's population will be living in water-stressed areas. In low- and middle-income countries, 38% of health care facilities lack an improved water source.[viii]

Indian Scenario

India has 3% of world's fresh water with 20 % of its population. 700 million people in more than 1.5 million villages has been the biggest challenge for us to provide safe drinking water. In 1972, the government began to improve rural water supply, and in the mid-1980s the issue was declared a national priority. As a result, by 2011, 95 percent of India's rural population had access to some form of water supply infrastructure.[ix]

Although drinking water has become more accessible, the ill effects of unsafewater on health has not decreased. It is estimated that about 21% of communicable diseases in India is water related.[x]

Scenario in Maharashtra

In Maharashtra, the geography is challenging for provision of sustainable and safe water source. Two projects decentralized water supply services to local communities even in remote hillside villages and on drought-prone plains. Between 2003 and 2009, Jalswarajya I brought clean drinking water into 1.2 million homes, more than half of whom were below the poverty line. Introducing the culture of paying for services has created the basis for future sustainability. Jalswarajya 2 (2014-2020) is helping the state to address systemic challenges across the sector, including the challenges of providing services to peri-urban areas, improving waterquality, and bringing services to water-scarce areas.[xi]

The water and sanitation sector in Maharashtra has, during the last ten years, witnessed positive growth. Nearly 67.9 per cent households in Maharashtra have access to tap as a

source of drinking water, which is higher than the national average (43.5 per cent). Of these, 56.3 per cent gets treated water, 14.4 per cent is dependent on wells and 9.9 per cent of hand pumps, while, 59.4 per cent of the state population gets water on their house premises, 27.6 per cent gets has it outside their premises. Nearly 18 per cent of state population has to walk to access basic water supply. 80% of waterborne disease cases are of diarrhoea, others being cholera, gastro, viral hepatitis and typhoid fever. This trend of waterborne diseases has not changed over time. 90.5 % households in Maharashtra use improved drinking water sources which is slightly lower than the national average (91.9%). There is a rural and urban disparity in usage of various drinking water sources. While in rural areas only 56.9% households are using taps, in urban areas the proportion is 88.9%. One-tenth of rural households still using unprotected wells. While in urban areas 55.4% households usedrinking water source exclusively for their own selves, in rural areas 69% households share with others. Disparities between rural and urban areas are more in Maharashtra compared to the national average. One-fourth of the rural population is still dependent on multiple sources of water for drinking.[xii]

Safe drinking water is essential for healthy community and thereby uninterrupted overall growth of a nation. Goal 6 of sustainable development goals isexclusively dedicated to clean water and sanitation. But even today globally 785 million people do not have access to clean water close to home. In India alone about

37.7 million people are affected and 1.5 million children die of waterborne diseases. Drinking water can get contaminated at any stage in the distribution system in spite of having an improved source due to various reasons resulting in deterioration in thequality of water at the point of consumption. Bacteriological quality of water can be determined by presence of E. coli, the bacteria that indicate contamination of waterby fecal matter.[xiii]

Objectives

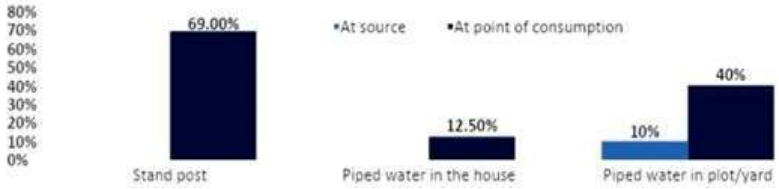
- To asses bacteriological quality of water samples collected from source andpoint of consumption of drinking water.
- To study water related practices in village Kalhe.
- To assess the relationship between drinking water quality, water related practices in village Kalhe.

Methods and Materials

- This study is a Community based, descriptive, cross sectional study conductedin village Kalhe in Raigad.
- 115 water samples collected for bacteriological analysis including 26 from the sources and 89 from point of consumption.
- Bacteriological quality of water was assessed at Public Health Laboratory,Navi Mumbai using MPN method.
- A predesigned, pretested questionnaire to assess water related practices was administered to 234 households in the community.
- Statistical analysis was performed to assess relationship Between bacteriological water quality and water related practices.

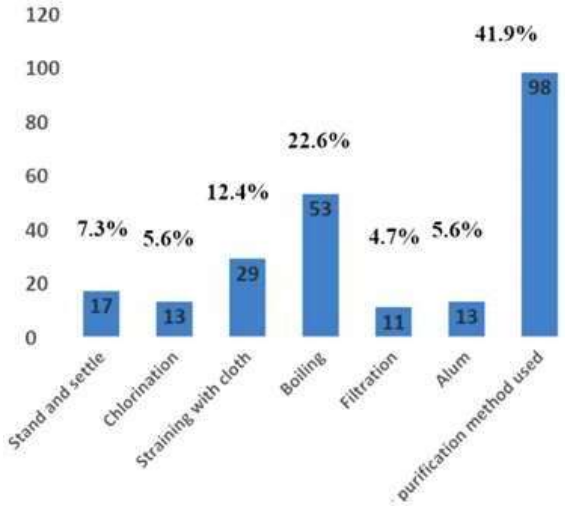
Results

- Out of total 26 water samples drawn at the source of water, 1 (3.8%) sample showed presence of E Coli. From 89 water samples collected from the point of consumption, 54(60.7%) samples showed presence of E coli.

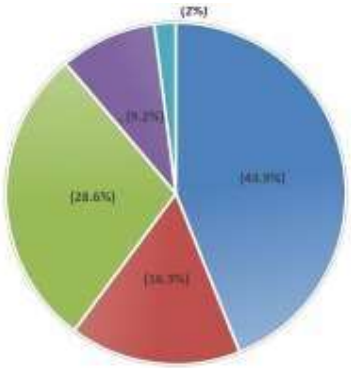


Graph I: Presence of E. Coil at the source and point of Consumption

- Maximum i.e. 147 (62.8%) households consume 20 – 50 litres of water per capita per day.
- Return trip to a water source i.e. going to water source, collecting water and returning home typically takes less than 30 minutes of time for maximum i.e. 98 (41.9%) households
- 81 (34.6%) of total households were at a distance less than 20 meters from asource of drinking water
- Maximum i.e. 189 (80.8%) of households receive drinking water supply for1-3 hours per day



Graph II: Distribution of households according to water purification methods used(N=234)



Pie Chart: Reasons for not using any methods of water purification (N=98)

Association between water related practices and bacteriological quality of water.

Table 1

Variable	E. Coil present (N=55)	E. Coil present (N=52)	Chi Square	P Value
Quantity of water used per capita per day				
<20 litres(52)	38(73.0%)	14(27.0%)	19.41	0.0002
20-50 litres (54)	17(31.5%)	37(68.5%)		
50-80 litres(1)	0(0)	1(100%)		
Timw required for reaching the nearest water source, collecting water and returning home				
<30 minutes(44)	10(22.7%)	34(77%)	26.86	0.000006
30 minutes-60 minutes(31)	20(64.5%)	11(35.5%)		
60 minutes-90 minutes (21)	15(71.4%)	6(28.6%)		
90 minutes<(11)	10(90.9%)	1(9.1%)		
Distance of the household from the nearest drinking water source				
Zero distance(16)	3(18.8%)	13(81.3%)	12.07	0.01
20 metres>(20)	8(40.0%)	12(60.0%)		
20 metres-50 metres(39)	25(64.1%)	14(35.9%)		
50 metres-100 metres(18)	12(66.7%)	6(33.3%)		
100 metres<(14)	7(50%)	7(50%)		
Duration of dinking water supply per day				
1 hour<(12)	6(50.0%)	6(50.0%)	1.33	0.51
1 hour- 3hour(86)	46(53.5%)	40(46.5%)		
3 hours – 5 hours(9)	3(33.3%)	6(66.7%)		
5 hours<(0)	0	0		
Water Purification method used				
Any Publication method used (64)	18(28.1%)	46(71.9%)	34.54	0.000000004
No Purification method used (43)	37(86.0%)	6(14.0%)		
Cover the water storage container				
Yes(65)	26(40.0%)	39(60.0%)	8.61	0.003
No(42)	29(69.0%)	13(31.0%)		
Method of drawing water from water storage container				
Attached tap(21)	1(4.8%)	20(95.2%)	29.85	0.000001
Long handled ladle (9)	2(22.2%)	7(77.8%)		
Sinking a dedicated utensil without ling handle (26)	19(73.1%)	7(26.9%)		
Directly by dipping any utensil and hand in water (51)	33(64.7%)	18(35.3%)		

Store drinking water separately				
Yes (91)	48(52.7%)	43(47.3%)	0.44	0.50
No (16)	7(43,8%)	9(56.3%)		

Discussion

The World Health Organization recommends that water used for human consumption be free of microbiological contamination since the presence of Escherichia coli signifies a probable health hazard for consumers.

A study by Jayasheel Eshcol et al in slum area located in Hyderabad showed that out of 51 source samples, 1 had presence of E. Coli while out of the 50 household storage samples, 10 (20%) had presence of E Coli. The finding is much lesser than our study findings, reasons for which could be greater awareness in the urban area regarding water handling practices than that in rural area.

Our findings are almost similar to a study carried out by Ramnath Subbaraman et al in a Mumbai slum where 81- 95% households did not meet the WHO recommendation of 50 litres per capita per day. In a study carried out by Shraddha Mishra and Sunil Nandeshwar in Jhangi village of rural field practice area of Banda subdivision of Sagar district in Madhya Pradesh, 39.5% households took up to 60 minutes while 36.8% household reported spending more than an hour in fetching water.

A study carried out by Ashish Joshi et al in urban slum settings of south Delhi showed that 75% respondents used no methods to make the water safer before consumption.15% used filters and 10% used boiling. The reason for not treating water was given as water already clean by 73% followed by 20 % finding the methods expensive and 7% not knowing any methods of cleaning. The finding waslike our study findings.

In our study we found a significant association between covering the water storage container and presence of E.coli. According to a study by Jim Write et al, the percentage of point of use samples contaminated with faecal coliforms was lower where households covered their water containers.

Conclusion & Recommendation

This study revealed that despite improved water source availability at the village level, the bacteriological quality of drinking water at the point of consumption is affected due to water related practices in the households. Many bacterial contaminations were found in homes with a greater number of plastic pipes connected to the pipe. Most people don't bother to filter their water before drinking it. Pipelines and water storage tanks aren't maintained on a regular basis, which means bacteria may build up over time. Educating the public about the hazards of polluted drinking water and water-borne illnesses is a top priority for water development and public health organisations, according to the authors. At the very least, water should be cleaned at home before consumption to eliminate the normal waterborne pathogenic bacteria that are transmitted into the drinking water through the pipeline at certain locations. Behavioral change communication is needed as much as public health engineering for achieving the comprehensive goal of 'Safe drinking water for all'.

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