

BACTERIOLOGICAL ANALYSIS OF POST MONSOON WATER SAMPLES FROM SELECTED AREAS OF RANCHI (JHARKHAND)

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ABSTRACT

The present study presents a regional picture of water contamination. It lays emphasis on access of poor quality water by the people from open wells due to absence of proper infrastructure of ground water management. Presence of coliforms was detected in 39 water samples revealing the presence of coliform in 40.62% of the samples. Out of 5 well water samples tested for specific pathogens the species isolated were *Aeromonas hydrophila*, *Pseudomonas putrefaciens*, *Salmonella paratyphi B*, *E.coli*, *Vibrio NAG*, *Streptococcus faecalis*, *Shigella*.

INTRODUCTION

Contamination is the most common and widespread health risk associated with drinking water (Szewzyk *et al.*, 2000). Drinking such water, or using it in food preparation, may then result in new cases of infection. The pathogenic agents involved include bacteria, viruses, and protozoa that cause diseases with varying severity from mild gastroenteritis to severe and sometimes fatal diarrhea, dysentery, hepatitis, or typhoid fever, some of them are widely distributed throughout the world (Ballester and Sunyer, 2000). Faecal contamination of drinking water is only one of several faeco-oral mechanisms by which they can be transmitted from one person to another or, in some cases, from animals to people. Other pathogen causes infection when water containing them is used for bathing or for recreation involving water contact, rather than by the oral route. The proportion of waterborne disease outbreaks associated with the distribution system failures has been increasing over the years (WHO/UNICEF, 2004). Some may also cause infection by inhalation when they are present in large numbers in water droplets, such as those produced by showers and some air-conditioning systems or in the irrigation of agricultural land. The World Health Organization in its "Guidelines for drinking water quality" publication highlighted at least seventeen different and major genus of bacteria that may be found in tap water which are capable of seriously affecting human health (WHO, 2006).

The biggest challenge of the Municipal Corporation of Ranchi district during peak monsoon period from middle of June to mid August is directed towards sustaining disease surveillance to prevent epidemics. The district of Ranchi is situated on the

Chotanagpur Plateau located at 23' 23"N L and 85' 23"E L. The population of the district is more than 10 lakhs. The summer temperature ranges from 20 to 41°C. Recent epidemic broke out in Nonihathwari locality during 6-9 Oct2009. At present there are interconnections between existing sewer lines and natural drains. The district has emerged as an area harbouring a huge floating population along with a pool of people displaced due to rural unemployment.

Basic services such as clean water and sanitation are severely affected. The damaged water and sanitation system in the capital puts an immediate risk of water borne diseases like cholera, typhoid fever, shigellosis and hepatitis. There are immediate risk of water-borne diseases like cholera, typhoid and hepatitis which are all related to unsafe drinking water and inadequate sanitation. At present there is no integrated sewerage system except for the area occupied by MECON and HEC. The present study gives a regional picture of contamination of surface water in the crowded localities of the district.

MATERIALS AND METHODS

Sampling sites

Ninety-six water samples from various locations of the District were collected in sterile plastic containers from July15-Aug30 2007 and again from July20-Aug31 2008, for overall analysis of coliform count. In addition 5 well water samples from different localities of Kantatoli, Bariatu, Doranda, Tharpakna and Karamtoli were transported in dry ice to the department of Biotechnology, Ranchi Women's College and One Point Diagnostic centre, Ratu for specific bacteriological analysis.

Materials

Isolation and detection of various pathogens was done by commercial PA Coli form test kit, Hi-Media lab, Mumbai, Hi-Selective *E.coli* test kit, Hi-Media lab. Rapid Hi-Water Test kits, Hi-Media lab, nutrient agar, MaConkey's agar, blood agar, Trypticase soy agar and Phenylethyl alcohol agar.

Microbiological analysis

Coli form test: The presence or absence of coli form bacteria (Leclere *et al.*, 2001) in the samples were detected using the commercially available PA Coli form test kit, Hi-Media lab, Mumbai (Greenberg *et al.*, 1965). A positive coli form test indicates faecal contamination in water sample.

Test for Escherichia coli: Rapid detection of *E.coli* based on enzyme-substrate reaction was performed using the commercially available Hi Selective *E.coli* test kit, HiMedia lab, Mumbai (Hansen and Yoorassawsky, 1984).

Test for Salmonella and Vibrio: species were tested by commercially available Rapid Hi Water Test kits, Hi Media lab. Mumbai (Manja *et al.*, 1982). This test also detects *E.coli* and *Citrobacter* species.

Test for culture and isolation: All nine samples received on dry ice were tested for coliforms and cultured on nutrient agar, MaConkey's agar, blood agar, Trypticase soy agar and Phenylethyl alcohol agar for isolation and identification of specific pathogens and the bacterial isolates were confirmed by biochemical tests.

RESULTS

Out of 96 surface water samples collected the test results showed presence of coliforms in 39 samples (40.6%). The bacteriological analysis given in Table 1, shows 18 out of 34(52.94%) of overhead tanks, 4 out of 12(33.3%) of bore wells, 5 out of 8(62.5%) of public wells and 2 out of 4 of sumps were contaminated with coliforms.

Note: Out of 5 well water samples tested for specific pathogens the species isolated were *Aeromonas hydrophila*, *Pseudomonas putrefaciens*, *Salmonella paratyphi B*, *E.coli*, *Vibrio* NAG *Streptococcus faecalis*, *Shigella*. Interestingly the MPN value of all well water samples were beyond permissible levels ranging from 17 to 180/ 100 mL.

DISCUSSION

An initial survey of bacteriological profile of some surface

Table 2: Bacterial isolates from post-monsoon well water samples (2007-08)

S. No	Location	Organism	MPN Result			MPN Index/100mL
			10mL	1mL	0.1mL	
1.	Kantatoli	<i>Aeromonas hydrophila</i>	3	3	0	17
2.	Bariatu	<i>Pseudomonas petrificiens/</i> <i>Salmonella paratyphi B</i>	5	3	2	140
3.	Doranda	<i>Aeromonas hydrophila/</i> <i>Pseudomonas petrificiens/</i>	5	3	0	79
4.	Tharpakna	<i>E.coli, Vibrio</i> NAG	5	3	3	180
5.	Karamtoli	<i>Streptococcus faecalis/</i> <i>Shigella</i>	5	4	1	170

Note: Out of 5 well water samples tested for specific pathogens the species isolated were *Aeromonas hydrophila*, *Pseudomonas putrefaciens*, *Salmonella paratyphi B*, *E.coli*, *Vibrio* NAG *Streptococcus faecalis*, *Shigella*. Interestingly the MPN value of all well water samples were beyond permissible levels ranging from 17 to 180/ 100 mL.

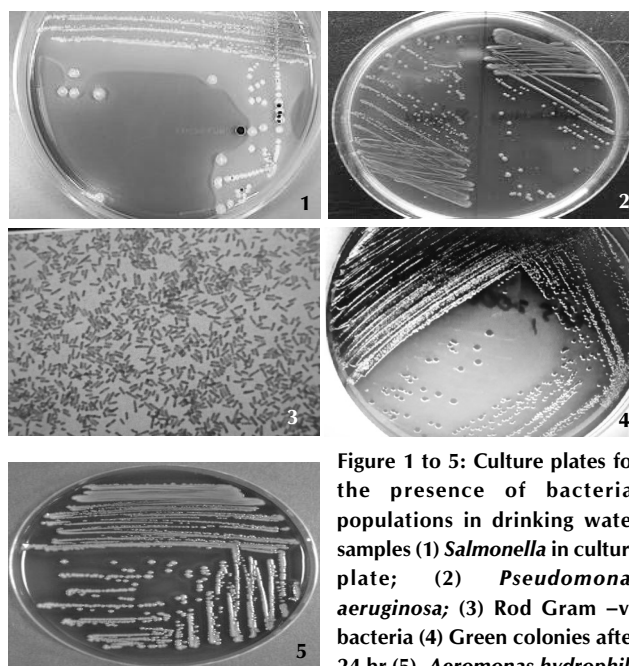


Figure 1 to 5: Culture plates for the presence of bacterial populations in drinking water samples (1) *Salmonella* in culture plate; (2) *Pseudomonas aeruginosa*; (3) Rod Gram -ve bacteria (4) Green colonies after 24 hr (5) *Aeromonas hydrophila*

water samples raises an important objective of providing potable water to the citizens (Szewzyk *et al.*, 2000). Among the diseases associated with poor microbial quality, those causing dehydrating diarrhoea are of critical importance, as they lead to death within 48 hr after the initial symptoms, specially in infants. Pathogen levels in water and predisposition of the person exposed play important roles in disease. Impact of exposure to water borne pathogens tends to be a greater

Table 1: The bacteriological analysis of water samples

Types of water samples	Total No. Tested	+ve for Coliform	Percentage (%)
1. Overhead Tank	34	18	52.94
2. Sintex Plastic Tank	18	7	38.8
3. Public Fountain	4	2	50
4. Borewell	12	4	33.3
5. Filter House	2	-	-
6. Sump	4	2	50
7. Packed drinking Water	10	-	-
8. Reservoir	2	1	50
9. Public Well	8	5	62.5
10. Aquaguard	2	-	-
TOTAL	96	39	40.6

problem for immuno-compromised and immuno-suppressed people like infants and the aging (WHO, 2003).

In the present study, coliform counts ranged from 17 to 180/100mL in well water samples, which are all beyond permissible limit of 10/100mL (Flood and Communicable disease fact sheet, 2007). The water samples collected from tanks, bore wells, public wells, sumps had about 40.6% of positive coliform count. The water at almost all the sites showed trends of medium to high MPN values. The presence of *Salmonella* and *Vibrio* NAG shows the deteriorating surface water quality after the onset of monsoon. Other bacterial species isolated were *Aeromonas hydrophila*, *Pseudomonas putrefaciens*, *E.coli*, *Shigella*, and *Streptococcus faecalis*. The presence of these bacteria in wells poses threats to dysentery, diarrhoea and typhoid (Manja *et al.*, 1982). The absence of good infrastructure of sewerage system has led to heavy pollution of surface water as 33.3% of bore wells and 62.5% of public wells showed positive result for coliforms. Thus the immediate concern is that there is contamination of the existing surface water. The disposal of pollutants and wastes to the surface water sources have added to the problem (Consumer Information water quality index, NSF, 2007). The study emphasises the urgent need for development of a Replicable Model for surface water through improved ground water recharge, along with an additional requirement of tackling pollutants and wastes.

Isolation of pathogenic and potentially pathogenic microorganisms such as *Aeromonas hydrophila*, *Pseudomonas putrefaciens*, *E.coli*, *Shigella* sp., *Vibrio* NAG and *Streptococcus faecalis* is of immense importance and indicated that potable waters are unsafe due to water quality deterioration and that immuno-compromise people are at risk and suggested that there may be connection between the high cases of reported diarrhoea and the isolated organisms in Ranchi (Yagoub and Ahmed, 2010). *Staphylococcus aureus* produce enterotoxins while *Pseudomonas* sp. are very common in water systems due to their ease of colonization and they form thick biofilms which consequently has an effect on turbidity, taste and odour of drinking water (Aquachem, 2009). As the district of Ranchi is becoming increasingly crowded, the hygienic conditions of people residing in low areas are also deteriorating. *Shigella* epidemics have been known to break out in settlements of crowded human localities under poor hygienic conditions (Bennish and Wojtyniak, 1991). Invasive bacteria like *Aeromonas* cause blood

dysentery and the cornerstone of diagnosis is bacteriological analysis (Gadewar and Fasano, 2005). Thus the importance of microbiological analysis becomes completely justified.

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