Post Floods Bacteriological Quality of Drinking Water at District Nowshera (Pakistan) and its Health Impacts on Consumer

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Abstract – TPC were found in the range of range of $3 \times 10^8 - 1 \times 10^3$ CFU/ml. Seven samples have the highest TCB value >1600 MPN/100ml. The lowest TCB was 23MPN/100ml. All samples were contaminated with TFC. *Escherichia coli* was present in 90% samples, *Pseudomonas Aurogenosa* was present in 40%, *Vibreo Cholera* was present in 80%, Salmonella was present in 60%, Shigella was present in 90% samples. *Staphylococcus aureus* were present in the range of 1×10^7 CFU/ml, one samples have not found *staphylococcus aureus*.

Keywords – Bacteria, Diseases, Health Risk, Drinking water, WHO Standards.

1. Introduction

Water related diseases continue to be one of the major health problems globally. The high prevalence of diarrhea among children and infants can be traced to the use of unsafe water and unhygienic practices [1,2]. Water is one of the most essential needs for the continued existence of all living organisms on earth. The day-to-day activities of all living organisms required water in whatever form. It is effectively and efficiently put into use by plants, animals, microorganisms and man. In the microbial world, no single microorganism has been discovered to be active at the extreme lack of water for the singular reason that man cannot exist without water, it is of paramount importance to monitor domestic water supply [3]. Water pollution is the specific impairment of water quality by agricultural, domestic or industrial wastes to a degree that has an adverse effect upon any beneficial use of water yet that does not necessarily create an actual hazard to public health. Due to urbanization and industrialization, wastewater that is being discharged into natural water bodies results in serious ground water contamination [4]. The most serious pollutants in terms of human health worldwide are pathogenic organisms. Altogether, at least 25 million deaths each year are blamed on these water-related diseases, including nearly two-third of the moralities of children under five years old. The main source of these pathogens is from untreated or improperly treated human waste [5]. According to WHO guideline for bacteriological quality, potable water should be free from indicators of fecal pollution. Water to be used for drinking and cooking purposes must be free from turbidity, colour, odour and objectionable tastes as well as from disease causing organisms and organic and inorganic substances which may produce adverse physiological effects [1]. In Khyber Pakhtoonkhwa immediately after the disaster, the Pakistan Council of scientific and Industrial Research scientists visited affected coastal District Nowshera to take care of health related issues of the coastal area population afflicted by the flood. In this article, various drinking water sources were analyzed for bacteriological contamination due to flood along the affected coastal areas.

2. Materials and Methods

In order to reach out the most vulnerable affectees in disaster hit districts, PCSIR Laboratories Complex Peshawar selected most affected villages and made a three days field assessment survey.

2.1. Identification of Villages

The villages were identified on the bases that were completely inundated by floods.

2.2. Microbial Analysis

2.2.1. Total Plate Count (TPC)

Total plate count was determined by pour plate method. Serial dilutions (10-1 to 10-4) of the product were made and

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aliquots of 1ml were added to each duplicate Petri dish. Total Plate Count Agar was added to each Petri dish for total plate count and incubated at 35 ^{0}C for 48 hours ±2, after incubation colony was count by colony counter and result was expressed as cfu/ml (APHA 2001).

2.2.2. Total Coliform Bacteria (TCB)

The Most Probable Number (MPN) of total coliforms bacteria were determined by multiple tube fermentation technique. Total coliform were calculated from MPN tables as per 100 ml (APHA 2001).

2.2.3. Total Fecal Coliform Bacteria (TFC)

Tubes having 10ml E.C. broth with inverted Durham tubes was inoculated by means of 3mm loop from the presumptive fermentation tubes showing gas and incubated at 44.5°C for 24 hrs and examined for gas production. Fecal Coliform were calculated from MPN tables (APHA 2001).

Table 1. Bacteriological analysis of bore water of District Nowshera (Akora Khattak)

Name of village	^{1}TPC	^{2}TCB	^{3}TFC	^{4}EC	^{5}PA	^{6}VB	^{7}S	^{8}S	^{9}SA
1. Masjid Mala Khan	2. 1 X 10^7	3. 2 40	+	+	+	+	-	+	06
4. Chowk Bazar Sajid Khan	1 X 10^3	5. 2 3	+	-	-	+	-	+	48
6. Chowk Bazar Kamil Shezad	1 X 10^8	7. > 1600	+	+	+	+	+	+	1 X 10^3
8. Mohallah New Farid Khan	1 X 10^4	9. > 1600	+	+	-	+	+	+	1 X 10^5
10. Masjid Darbar (Sheikhan)	1 X 10^5	11. > 1600	+	+	+	-	+	+	1 X 10^6
12. Mohallah Khana Din	7 X 10^3	13. > 1600	+	+	-	+	+	+	1 X 10^7
14. Mohallah Hasan Khel	3 X 10^8	15. > 1600	+	+	-	+	-	+	04
16. Hasan Khel(Nawaz House)	4 X 10^3	17. > 1600	+	+	-	+	+	+	8 X 10^6
18. Qazi Abad Tube well	8 X 10^5	19. > 1600	+	+	-	+	+	+	1.1 X 10^7
20. Sheikhan (A.Raziq House)	8 X 10^3	21. 2 40	+	+	+	-	-	-	Nil

+ = Detected, - = Not Detected, ^{1}**TPC**= Total Plate Count, ^{2}**TCB**= Total Coliform Bacteria, ^{3}**TFC**= Total Fecal Coliform Bacteria, ^{4}**EC**= Escherichia Coli

^{5}**PA**= Pseudomonas aeruginosa, ^{6}**VB**= Vibrio cholera**,** ^{7}**S**=   Salmonella Spp / 25 ml, ^{8}**S**=   Shigella**,** ^{9}**SA**= Staphylococcus aureus

Table.2.WHO Standards of Drinking Water.

S#	Bacteriological parameters	WHO Standards
1	Total Plate Count (CFU/ml)	<100
2	Total Coliform Bacteria (MPN/100ml)	<1.1
3	Total Fecal Coliform Bacteria	<1.1
4	*Escherichia Coli* (O157: H7)	Nil
5	*Pseudomonas aeruginosa*	Nil
6	*Vibrio cholera*	Nil
7	*Salmonella Spp* / 25 ml	Nil
8	*Shigella*	Nil
9	*Staphylococcus aureous*	Nil

E. Coli

EMB Agar was used for the enumeration of *E. Coli*. All the tubes of E.C. broth showing gas were subculture by streaking on EMB agar plates and incubated at 35 °C for 18-24 hrs. Positive plates contained typical colonies with green metallic sheen were inoculated on PCA slants (plate count agar) and incubated at 35 °C for 18 – 24 hrs. After 24 hrs incubation the typical colonies were confirmed by biochemical tests and also by kits *E.ColiO157:H7* latex test reagent kit Pro Lab. Canada (APHA 2001).

Pseudomonas aeruginosa (PA)

Take a 250 mL sample and filtered through a 0.45 μm cellulose membrane filter, placed on Pseudomonas CN agar and plates were incubated at 37°C for 48 hours, blue/green colonies were isolated on Plate Count agar at 37°C for 24 hours, and after the oxydase test, the species identification was conducted using standardized identification Biochemicals tests (APHA 2001).

Vibrio cholerae

Vibrio cholerae (VB) was done by enriching the samples in 1% alkaline peptone water for 6 to 8 hours followed by isolation on Thiosulphate Citrate Bile salt sucrose (TCBS) agar medium [6].

All colonies with different characteristics on M-Endo agar, Xylose Lysine Deoxycholate Agar (XLD) agar and Thiosulphate Citrate Bile salt sucrose Agar (TCBS) were sub cultured onto Nutrient agar (NA) for purification. Enteric bacteria isolated on respective selective or differential media were identified on the basis of their colonial, morphological and Biochemical properties following Bergey's Manual of Determinative Bacteriology, 1994.

Salmonella and Shigella

Detection of *Salmonella* (SA) and *Shigella* species were done by the enrichment of water samples on Selenite F broth, followed by isolation of the typical organism on selective medium, Xylose Lysine Deoxycholate Agar (XLD) [7].

Staphylococcus aureus

The membrane Filtration Technique was employed for the enumeration of Staphylococcus aureus was applied using 100ml drinking water sample by using Baird Parker agar as selective medium. After incubation the Baird Parker agar plates containing filter for 25-48 h at 37°C, circular bright gray to black colonies were picked, purified and sub-cultured on nutrient agar. The confirmed colonies were subjected to Gram-positive cocci in cluster, positive reaction catalase and coagulase test were considered as Staphylococcus aureus [8].

3.   Results and Discussion

Bacteriological analysis of bore water of District Nowshera (Akora Khattak) shown in Table 2. The results of location Masjid Mala Khan showed that its TPC was 1 X 10^7 CFU/ml, *Pseudomonas aeruginosa* was absent but TFC, *E. Coli*, *Vibrio cholerae*, Salmonella and Shigella were present in the analyzed samples. Mohallah Hasan Khel TPC was 3 X10^8 CFU/ml which was the highest

count in all the analysed samples of Akora Khattak. TCB was >1600 MPN/100ml, *Staphylococcus Aureus* was 04CFU/ml, PA and Salmonella was absent but TFC, *E.Coli*, *Vibrio cholerae* and Shigella were present. Hassan Khel TPC was 4 X 10^3 CFU/ml, TCB >1600 MPN/100ml, and *Staphylococcus Aureus* was 8 X 10^6 CFU/ml. PA was -ve while TFC, EC, *Vibrio cholerae*, Salmonella and Shigella was present. Qazi Abad Tube Well TPC was 8 X10^5 CFU/ml, TCB was >1600 MPN/100ml and *Staphylococcus Aureus* 1.1 X 10^7 CFU/ml, this value was the highest among all the analysed samples of Akora Khattak. A leading cause of gastroenteritis is staphylococcal food poisoning, an intoxication caused by ingesting an enterotoxin produced by *Staphylococcus Aureus*. staphycocci are comparatively resistant to environmental stress. They also have a fairly high resistance to heat; vegetative cells can tolerate 60°C for half an hour. Their resistance to drying and radiation helps them survive on skin surfaces. These bacteria are often an inhabitant of the nasal passages, from which it contaminates the hands. It is also a frequent cause of skin lesions on the hands. From these sources it can readily enter in food. If the microbes are allowed incubate in the food, a situation called temperature called temperature abuse, they produced and released the enterotoxin into the foods. S. aureus produces several toxins that damage tissues or increase the microorganism's virulence. The production of the toxin of serological type A (which is responsible for most cases) is often correlated with the production of an enzyme of that coagulates blood plasma. Such bacteria called coagulase positive. The toxin quickly triggers the brain's vomiting reflex center; abdominal cramps and usually diarrhea then ensue [8].

The water supplies in different areas of Peshawar, Nowshera and Charsadda was studied by Misal Khan *et al* 2000, [9] revealed that before flood these sites (Jalozai, Akora Khattak, Pabbi, Charsadda) were highly contaminated with TPC, TCB and *E. Coli*. After flood in these areas drinking water were more highly contaminated at the results of these highly contamination the diseases like Malaria, Cholera, Typhoid, Hepatitis, dysentery, skin diseases and Eye disease are common in the visited areas [10]. The village Sheikhan results were reported that TPC was 8 X10^3 CFU/ml, TCB 240 MPN/100ml, the *Vibrio cholerae*, Salmonella, Shigella and *Staphylococcus Aureus* were absent while TFC, *E. Coli* and *Pseudomonas aeruginosa* was present. Drinking water quality forecast of Peshawar valley on the basis of sample data were studied by Salim and Fazlullah 2001,[11] calculated that water all sources are well in the WHO recommended standards and fit for supply to consumer. While moving within the distribution system the same water becomes unfit for human consumption due to gradual fall in quality due to mixing of wastewater entering the distribution line through leakage [12-14].

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