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WATER-BORNE PATHOGENS FROM DIFFERENT SOURCES OF JABALPUR REGION

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ABSTRACT

Water-borne diseases constitute one of the major public health hazards in developing countries (WHO, 1996). In India, more than 70% of the epidemic emergencies are either water – borne or are water related (Khera et. al. 1996). The pathogens most frequently transmitted through water are those which cause infection of the intestinal tract namely Typhoid and Paratyphoid bacteria, Dysentery (Bacillary and amoebic) and Cholera bacteria and enteric viruses. Among the microorganisms, 61% bacteria are water – borne pathogens.

Samples of surface, ground and drinking water were collected from Jabalpur region. Surface water samples were collected from the River Narmada and Bargi Reservoir. Ground and drinking water samples were collected from well, Hand-pump and Municipal water supply. Samples were collected in sterilized Borosil glass bolltes (Cap. 300 ml). These samples were brought in ice bags where the temperature was maintained at 4°C to freeze the activity of microbes present in water. To assess the presence of water borne pathogens, indicator parameters, viz. Heterotophic plate count (HPC), Total coliform count (TCC), Feacal coliform count (FCC), Faecal streptococci count (FSC),

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presence of Pseudomonas and Aeromonas and Total count of yeast and mould were studied by standard methodologies recommended by American Public Health Association (APHA, 1995) and Bureau of Indian standards.

In comparison to ground and drinking water (collected from well, hand-pump and corporation water supply), the surface water (collected from river Narmada and impounded water sample from upstream of Bargi Reservoir) showed a higher numbers (i.e. 2 to 10 times increase in all the indicator parameters). All indicator parameters indicate that there was sharp decline between Mandla and Bargi Reservoir largely due to the dilution of the point load of sewage from Mandla (River Narmada) and absence of any point source of sewage up to Bargi Reservoir. All ground water and drinking water sample showed the presence of Coliforms, Faecal coliforms, Faecal streptococci, Pseudomonas, Aeromonas, Yeast and Mould. However, except for some indicator microorganisms, most water samples were found to be contaminated with water – borne pathogens.

Introduction

Water – borne diseases constitute one of the major public health hazards in developing countries (WHO, 1996). In India, more than 70% of the epidemic emergencies are either water – borne or are water related (*Khera et. al. 1996*). Natural water supplies such as rivers, lakes etc. contain sufficient nutrients to support growth of various organisms. Microorganisms enter the water supply in different ways. In congested countries water supply get polluted by domestic and industrial waste. As a potential carrier of pathogenic microorganisms, water can endanger health and life.

The pathogens most frequently transmitted through water are those which cause infection of the intestinal tract namely Typhoid and Paratyphoid bacteria, Dysentery (Bacillary and amoebic) and Cholera bacteria and enteric viruses. Among the microorganisms, 61% bacteria are water – borne pathogens. There are three groups of bacteria in the intestinal tract of man and animals in abundance, namely, the coliform, the anaerobic lactose fermenting spore formers and the *Faecal streptococci*. Other bacteria that cause diarrhea are *Salmonella, Campylobacter, Yersinia, Aeromonas* and *Pseudomonas* sps. The mode of transmission of these diseases are mainly through contaminated water.

Materials and Methods

Samples of surface, ground and drinking water were collected from Jabalpur region. Jabalpur occupies almost a central position in India. It is surrounded by Vindiya ranges in the North west and Satpura in the south. Geologically it is very important city. The city has a good number of ponds, lakes and rivers. The water from these are used by local people for drinking, washing and fishing purposes.

Surface water samples were collected from the River Narmada and Bargi Reservoir. Ground and drinking water samples were collected from well, Hand-pump and Municipal water supply. Samples were collected in sterilized Borosil glass bolltes (Cap. 300 ml). These samples were brought in ice bags where the temperature was maintained at 4°C to freeze the activity of microbes present in water. Surface water samples were collected during the months of summer.

All media used for enumeration, isolation and identification of indicator pathogens were obtained from Hi – media Laboratories Limited, Mumbai.

Heterotrophic plate count (HPC) aerobic count were made in Tryptone glucose yeast extract (TGYE) agar medium by standard plate method. Appropriate dilutions of the water samples were spread over the agar surface and incubated at 20°C and 37°C for 48 hours.

Total Coliform count (TCC) were made by Most – probable number (MPN) technique. TCC made at 35°C of incubation and were recorded as presumptive test. Count were made on Lauryl Tryptone broth, inoculated with 10 ml, 1 ml, and 0.1 ml of sample. Fermentation tubes were examined for positive gas production. All primary fermentation tubes showing gas production within 24 hours of incubation were submitted to the confirmed test. A loopful of culture from presumptive tubes were inoculated to a fermentation tube containing Brilliant green lactore bile broth to ensure cultural purity.

For enumeration Faecal coliform count (FCC), positive tests of Lauryl tryptose broth was inoculated into EC broth. Positive results of EC broth indicated the presence of faecal coliforms.

Enumeration of Faecal streptococci (FSC) made on Azide dextrose broth and these were inoculated with a series of 10 ml, 1 ml and 0.1 ml of each sample for the examination of turbidity at 35°C for 24 hours. All positive tubes were subjected to the confirmatory test. They were streaked on a petridish containing Pfizer selective enterococcus agar medium. Brownish black colonies with brown halos confirmed the presence of Faecal streptococci.

Presence of *Psuedomonas* and *Aeromonas* were carried out by using Glutamate – starch – phenol red agar medium (differential medium) by standard plate count method. Appropriate dilutions were spread over the surface of differential media and incubated at 37°C for 24 hours.

Yeast and Mould count were made on Yeast and mould count agar medium (Special medium). Appropriate dilution were spread over the surface of special medium and incubated at 27°C for 4 to 7 days.

Physico-chemical parameters like, water temperature, conductivity, pH, total dissolved solids were measured by electronic analyzer and other parameters like alkalinity, chloride, hardness, nitrate – N, nitrite – N, total iron, phosphate etc. were analysed as per the method given by APHA (1995) and Bureau of Indian standards.

Results and Discussion

Water is said to be contaminated when it contains infective and parasitic agents, poisonous chemical substances, industrial or other wastes or sewage. Water intended for human consumption must be free from concentration of chemical substances and disease causing microorganisms that may be hazard to health. Some countries have established national standards of quality of drinking water and have achieved a certain degree of uniformity in methods of analysis and in the expression of results of such analysis (WHO, 1971).

During the course of present investigation important observations for water borne pathogens have been recorded with supportive analysis of few selected physico-chemical parameters and these were compared with Bureau of Indian standards and WHO standard for their potability.

Table I summarizes water borne pathogens from different sources and assessed by the indicator parameters and Table II summarizes some physico-chemical data as supportive parameter for water borne pathogens.

In comparison to ground and drinking water (collected from well, hand-pump and corporation water supply), the surface water (collected from river Narmada and impounded water sample from upstream of Bargi Reservoir) showed a higher numbers (i.e. 2 to 10 times increase in all the indicator parameters). All indicator parameters indicate that there was sharp decline between Mandla and Bargi Reservoir largely due to the dilution of the point load of sewage from Mandla (River Narmada)

and absence of any point source of sewage up to Bargi Reservoir. All ground water and drinking water sample showed the presence of *Total coliforms, Faecal coliforms,* and presence of *Pseudomonas.* However, some water samples indicate absence of other indicator bacteria like *Faecal streptococci, Aeromonas, and Yeast* and *Mould count.*

The preliminary analysis of water samples from different sources of Jabalpur region, indicated that most water samples were found to be contaminated with water borne pathogens. Analysis of these indicator microorganisms along with the supportive physico-chemical parameters indicated that, according to Bureau of Indian standard norms and standards given by World Health Organization, most of the parameters highly exceeded the permissible limits, thus, the water samples collected from Jabalpur region is not safe for drinking purpose.

TABLE I: WATER BORNE PATHOGENS FROM DIFFERENT SOURCES (GEOMETRIC MEAN)

Water borne pathogens	River surface water (Mandla)	Bargi Reservoir	Well water	Hand pump	corporation water supply (Tap Water)
Heterotrophic count CFU/ml at 37°C	9.5×10^5	1.4×10^2	3.7×10^4	3.6×10^4	5.3×10^4
Heterotrophic count CFU/ml at 20°C	3.4×10^4	0.6×10^2	11×10^3	5×10^3	5.2×10^4
Total coliform count (MPN/100ml)	1600	350	2400	23	93
Faecal coliform count (MPN/100ml	900	350	900	439	7.3
Faecal streptococci count (MPN/100ml	240	-nt	189.8	-nt	-nt
Pseudomonas (CFU/ml)	$0.5X\ 10^2$	0.1×10^1	0.15×10^1	$0.02X10^2$	$0.13X\ 10^2$
Aeromonas (CFU/ml)	$0.02X\ 10^2$	-nt	-nt	-nt	$2.4X\ 10^2$
Yeast and mould count (CFU/ml)	10	06	$2.3X10^2$	-nt	$1.75X10^2$

TABLE II PHYSICO CHEMICAL DATA FOR WATER SAMPLES FROM DIFFERENT WATER SOURCES (GEOMETRIC MEAN).

Paromenters	Narmada river water (Mandla)	Bargi Reservoir	Well water	Hand pump	Corporation water supply
Odour	Non-agreeable	Agreeable	Agreeable	Agreeable	Agreeable
Taste	Non Agreeable	Agreeable	Agreeable	Non Agreeable	Non Agreeable
Temperature (°C)	28.8	27	30	31	30
PH (Units)	7.5	8.0	6.0	6.65	7.57
Conductivity (Mmhos/cm)	0.27	0.18	1.09	0.38	0.56
TDS (mg/L)	252	168	122	600	1240
Free CO_2 (mg/L)	15.2	16	3.48	11.75	47.6
Total alkalinity (mg/L as $CaCO_3$)	157	932	40	129.2	204
Chloride (mg/L)	12	13.2	217.9	46	47.7
Total hardness (mg/L as $CaCO_3$)	151	100	360	360	155
Ca hardness (mg/L as $CaCO_3$)	74	54	200	49.2	100
Mg hardness (mg/L as $CaCO_3$)	77	96	160	310.8	55
Nitrate (mg/L)	0.14	0.12	0.17	0.20	0.11
Nitrite (µg/L)	1.6	1.1	12	37.6	2.9
Total Iron (mg/L)	0.42	0.47	0.01	0.19	0.015
Phosphate (mg/L)	0.037	0.013	1.7	0.07	0.098

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