Physicochemical and Bacteriological Study of Lake Water

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Abstract

Physicochemical and bacteriological analyses like *E.Coli* ,*Pseudomonas*, Sulphate reducing bacteria and Total bacteria count were carried out on lake water, open well and river water used for drinking in Bijapur district Karnataka. The results obtained were compared with WHO and EPA standards for drinking and recreational water. The presence of pathogens in water for drinking and swimming purposes is of public health significance considering the possibility of the presence of other bacteria, protozoa and enteric viruses that are implicated in gastro-intestinal water borne diseases and the low infectious dose for these water borne pathogens.

KEYWORDS : Lake water, , bacterial analysis, *E.Coli*, *Total bacteria* count etc.

INTRODUCTION

Drinking water is indispensable for human existence."Lack of access to water – for drinking, hygiene and food security - inflicts enormous hardship on more than a billion members of the human family", said United Nations Secretary-General Kofi Annan. "Water is likely to become a growing source of tension and fierce competition between nations, if present trends continue, but it can also be a catalyst for cooperation.“ The public health significance of water quality cannot be over emphasized. Many infectious diseases are transmitted by water through the fecal-oral route. Diseases contacted through drinking water kill about 5 million children annually and make 1/6th of the world population sick (WHO, 2004). Water is vital to our existence in life and its importance in our daily life makes it imperative that thorough microbiological and physio-chemical examinations be conducted on water. Potable water is the water that is free from disease producing microorganisms and chemical substances that are dangerous to health (Lamikanra, 1999).

Water borne infections still ravage the global community and are responsible for millions of deaths per year. Water that looks clear and pure may be sufficiently contaminated with pathogenic microorganisms to be a health hazard. A prime public health consideration is the continuous supply of drinking water which is free of pathogens and significant levels of toxic chemicals. Protection of drinking water from contamination by human or other animal excrement in sewage, food processing wastes and storm water runoff is of paramount importance. It is well established that unsatisfactory water supplies are related

to ill health. Water contamination occurs generally due to seepage of sewage or surface contaminated water in aquifers and improperly protected wells, or is due to inadequately treated or distributed drinking water. Person to person contact has been documented in the transmission of Legionella to humans. Legionella is a common inhabitant of natural waters. The direct way of transmission is the inhalation of contaminated aerosolized contaminated water. Water systems should be monitored at a frequency that is sufficient to ensure that the system is under control and continues to produce water of an acceptable quality. Samples should be taken from representative locations within the processing and distribution system. Established sampling frequencies should be based on system validation data and cover critical areas. All natural waters contain bacteria. The aerobic gram negative rods of the genera. *Pseudomonas*, *Alcalignes* and *Flavobacterium* as well as others are common in water. Many of these bacteria are capable of growing on a wide variety of single carbon sources. That is, they are able to grow on a medium containing only mineral salts and one carbon source as the sole organic nutrient supply. In such a medium all other nutrients are inorganic. Some members of the genus Pseudomonas can grow on as many as 90 different sole carbon sources: the epitome of nutritional versatility. Also, Pseudomonas contains species that produce fluorescent pigments that are water soluble and diffuse into the medium. The property of producing water soluble fluorescent pigments and the ability to grow on single carbon sources can be takes advantage of to enumerate (titer) the number of fluorescent *Pseudomonads* by the multiple tube technique (see below).All natural waters can also be populated by transient bacteria. Among these are the human pathogens that gain entry to water from fecal contamination. Thus contaminated water is a potential transmitter of any of a number of intestinal diseases. The direct isolation of intestinal pathogens is impractical; instead public health inspectors determine the number of indicator bacteria. Escherichia coli which is in the large intestine of virtually all people has been used as the indicator of human fecal contamination of water and food. Tests for the presence of this organism (and closely related types generally known as coli forms) utilize either a multiple tube technique or direct plating onto differential media. The quality of water for drinking has deteriorated because of the inadequacy of treatment plants, direct discharge of untreated sewage into rivers and inefficient management of the piped water distribution system (UNEP, 2001). Probably the most important pathogenic bacteria transmitted by the water route are Salmonella typhoid, the organism causing typhoid fever, and
Vibrato cholera, the organism causing cholera [4].

MATERIALS AND METHODS

Water sampling- samples for microbiological examination from different lakes was collected in sterile containers. The samples were collected in ice packs to keep the sample cold during transportation and tested within 24 hours. Drinking water samples from different lake sources in Bijapur district were collected and transported by standard methods as mentioned in APHA, 1998 [5]. Random sampling was adopted for the study. Microbiological analysis of water samples was conducted in our laboratory using standard test kits purchased from Rakiro Biotech Systems pvt.ltd Navi Mumbai. Testing were carried out according to the instructions of Rakiro Biotech System. Test kits serve a number of useful purposes and may be used to good effect in conjunction with full laboratory methods to strengthen the analytical capabilities of the laboratory. Test kits are

useful for the following purposes. The procedure for analysis was followed as per standard methods of analysis of water and wastewater [6].

Table.1
Physicochemical and Microbiological analysis of Lake Water

S.NO	Source	pH	EC in µS/cm	TDS	E.Coli	Pseudomonas	Sulphate reducing bacteria	Total Bacteria Count(Yeast and Fungi)
1	Lohagaon	7.4	26	103	10^2	$\geq 10^2$	10^3	10^2
2	Dhandaragi	7.2	18	114	$\leq 10^5$	10^4	10^1	10^2
3	Baratagi	6.7	39	209	10^2	10^3	10^1	NIL
4	Bhutanal	6.2	199	919	10^3	NIL	10^1	NIL
5	Kumatagi	6.9	64	335	10^4	10^4	10^1	10^2
6	Katral	7.3	12	62	10^4	10^4	10^1	10^2
7	Arjunagi (OW)	6.2	145	813	10^3	10^4	Nil	10^2
8	Tikota	6.7	20	103	10^4	10^4	10^1	10^3
9	Babaleshwar	6.7	8.0	46	10^5	10^4	Nil	10^3
10	Yakkundi	7.0	23	124	10^5	10^5	Nil	10^4

RESULTS AND DISCUSSION-

pH is affected not only by the reaction of carbon dioxide but also by organic and inorganic solutes present in water. Any alteration in water pH is accompanied by the change in other physic-chemical parameters [7]. pH maintenance (buffering capacity) is one of the most important attributes of any aquatic system since all the biochemical activities depend on pH of the surrounding water. It was concluded that the pH of water were from 6.2 to 7.3**4** and were within the maximum limit set for domestic use as per APHA. High value of pH may results due to waste discharge, microbial decomposition of organic matter in the water body [8]. The high pH in this case may be attributed to sewage discharge by surrounding human population. Electrical conductivity is a measure of water capability to transmit electric current and also it is a tool to assess the purity of water. Electrical conductivity found in the range 8 to 199 µS/cm. One of the reason of salinity is the high concentration of cations such as sodium, calcium and magnesium whereas chloride, phosphate and nitrate as anions[9]. The TDS of all the samples were in range of 46- 919 mg / lit. While the maximum permissible limiting value of TDS for potable water is 500 mg/ lit., according to WHO. High level of TDS in water used for drinking purposes leads to many diseases which are not water-borne but due to excess salts[10].

The microbiological observations reflect the presence of E.coli varied from 10^2 to 10^5 high concentration of *E.Coli* in Dhandaragi and Babaleshwar (10^5) respectively. The coliform bacterium is the primary bacterial indicator for fecal pollution in water [11,12]. Most pseudomonas do not have any effects on human health, but one species *pseudomonas aeruginosa* under the right conditions can cause infections. It is therefore

desirable to remove the pseudomonas to minimize risks to personnel such as maintenance engineers who may come into contact with contaminated water.

Pseudomonas aeruginosa were found to be in the range of 10^2 to 10^5 and in Yakkundi the *Pseudomonas* was in high range i.e. 10^5. This study demonstrated a high percentage of positive *Pseudomonas aeruginosa* lake samples that may pose a health risk to bathers[13]. These bacteria may cause minor problems associated with color, taste, odor, and turbidity of the water. The main concern is related to the biological slime they form. These slimes, which protect the *Pseudomonas aeruginosa*, also have the ability to harbor other disease-causing bacteria such as coliforms and *E. coli*. Common illnesses associated with *Pseudomonas* include skin rashes, swimmers ear, infection of the blood and urinary and respiratory tract infections. Other infections may also be caused and, in rare cases, even pneumonia. In most cases of infection the individual's skin or mucous membranes is damaged or an underlying immune deficiency is present.

Sulphate reducing bacteria was varied from 10^1 to 10^3 and highest reducing bacteria was detected in Lohagaon i.e. 10^3-.Sulphate reducing bacteria these bacteria use sulphate ions as acceptor of electrons in the process of organic matter oxidation. SRB are considered the oldest organisms detected in this environment [14]. The production of H_2S often indicates the activity and presence of sulphate-reducing microorganisms in natural habitats. Since hydrogen sulphide is a by-product of their metabolism, SRB can also cause the pH level of the water system to fall to as low as pH 5.0. Sulfate-Reducing Bacteria (SRB) are types of bacteria that use sulfate instead of oxygen for respiration. They survive and multiply in low oxygen environments such as dead legs, off line chillers, and under slime (biofilm) or sludge deposits. Many investigations into cooling system corrosion focus on SRB, which are one of the main causes of Microbiologically Influenced Corrosion (MIC).

Yeast and fungi ranged from 10^2 to 10^3 and high content of yeast and fungi was detected in Babaleshwar lake. Indirect health impacts may arise from association with other pathogens. For example, colonization of the respiratory tract with Candida spp. increases the risk of ventilator associated pneumonia from *Pseudomonas aeruginosa*. Biocorrosion of pipes by fungal species may represent a second indirect health impact. This process can lead to increased metal concentrations in drinking water and corrosion tubercles also provide habitat for fungi. There are over 70,000 species of fungi. Fewer than 300 have been implicated in human diseases, and fewer than a dozen cause about 90% of all fungus infections. They are involved in different forms of diseases, including allergies to fungal antigens, production of toxins, or direct invasion of hosts[15]. *Candida Albicans* is a fungus/yeast and a common microorganism that lives in the gut of a humans and dogs. But when there is an "overgrowth" of this fungus/yeast in the gut, it is called a Systemic Yeast Infection, and it affects the health and well-being of the whole animal or human. The inside of his ears will appear red and irritated; he will shake his head and scratch at his ears almost constantly, sometimes to the point of bleeding; a foul odor will emanate from the inside of his ears; and he may whine, pace, or even stop eating because of the pain and irritation.
Serious injury or permanent damage may occur to the ears if an ear infection is left untreated.

CONCLUSION

The water quality results suggested that the hospitalization of Bijapur district residents reported was due to their drinking contaminated water from existing lakes. Regular monitoring of drinking water quality and the promotion of hygienic household behavior during an emergency response is highly recommended. Also, the water samples were showing microbial content beyond the potability range, which needs to be disinfected before consumption to avoid water-borne diseases. Although, the present investigation is essentially a primary work and needs to be further investigated to arrive at specified conclusion with respect to clinical implications.

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