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Increasing ratio of coliform and hemolytic bacteria to total bacterial load of Bhojtal – A serious concern

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Abstract

Water temperature has great influence on bacterial population. Seasonal change in temperature and other anthropogenic activities greatly influences the bacterial population. The ratio of counts of fecal coliform to total coliform has been proposed as mean to differentiating between contamination from human and animal sources. Bhojtal (Bhopal MP India) is main source of potable water to Bhopal city. Average water temperatures of upper lake were 29^0-30^0 C, 24^0-25^0 C and 17^0-18^0 C during summer, monsoon and winter respectively. Study was performed during the three seasons of the year 2010 to 2012, on three different media. Coliform and haemolytic bacterial loads were statistically analyzed for the influence of season and sampling sites. Significantly high CFU values were observed at all three sites during summer season. Significant variation was observed only between the Hammidia hospital site and other two sites (Bairagarh and Prempura), as compared to that of Prempura and Bairagarh sites. The ratio of coliform and hemolytic bacteria to total bacterial population was around 0.43 – 0.51 and 0.25 – 0.42 respectively during 2010-11 and this ratio was increased during 2011-12, as 0.45 – 0.55 and 0.31 – 0.47 respectively. Total coliform count and hemolytic bacteria were comparatively higher in 2011-12 than 2010-11, specifically at the site receiving sewage from densely populated area and also due to the interference of high human induced activities. It can be concluded that variation in coliform and hemolytic bacterial population is significantly influenced by seasonal temperature variation and mainly due to anthropogenic activities and sewage with high load of fecal coliform.

Keywords: Coliform, Hemolytic bacteria, bacterial diversity, freshwater ecosystem**.**

INTRODUCTION

Water is essential to life but due to human over interference has made it unsafe because of bacterial pathogens (WHO, 2008). A sewage effluent contains a wide range of human enteric pathogens, which may create a health hazard to the exposed human population when they are discharged into natural waters (Dionisio *et al.*, 2002). A clean and treated water supply to each house may be the norms in Europe and North America but in the developing countries access to both plain waters and sanitation are not rule and water born infection are common. Two and half billion peoples have no access to improve sanitation and more than 1.5 million children die each year from diarrhea (Fenwick, 2006). The greatest microbial risks are associated with drinking of water contaminated with human and animal feces. Wastewater or sewage discharged in freshwater are the major source of fecal microorganisms including pathogens (Grabow, 1996). In Asian and African countries children are most affected by microbial diseases transmitted through water (Seas *et al.*, 2000). The main bacterial disease transmitted through drinking water are cholera, gastroenteritis, typhoid fever and other Salmonellosis, Bacillary dysentery or Shigellosis and acute diarrheas caused due to bacteria such as *Vibrio cholerae*, *V. parahaemolyticus*, *Salmonella enteric*, *Shigella sp.* and *E. coli*. Another emerging waterborne bacterial pathogen group consists of *Mycobacterium Avium Complex* (Mac), *Helicobacter pylori*, *Aromonas hydrophila*. Many studies have illustrated the usefulness of indicator bacteria in predicting the presence of pathogens (Wilkes *et al.* 2009). Microbiological analysis of the human feces was important in order to structure and validate the use of fecal indicator bacteria in environmental water. The fecal bacteria are derived from microbiota of the human gastroentistinal tract. Fecal coliform are the coliform that ferment lactose in a medium with bile salt. The ratio of count of feal coliform to fecal Streptococci has been proposed as a mean to differentiate between contamination from human and animal source.

Bhopal, a Lake city, is a capital of Madhya Pradesh state of India. The upper lake was created in 11th century AD and lower lake in 18th century AD, are by far the most important. Upper lake is one of the main sources of potable water to Bhopal city. Upper Lake is heavily receiving pollutants by domestic sewage from surrounding habitation, agricultural waste, industrial waste and hospital effluents. Present study was performed to observe the ratio of total coliform and haemolytic bacteria to total bacterial load of Bhojatl (Upper lake), Bhopal MP India.

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Materials and Method

Samples were taken from three sites of Upper Lake of Bhopal (M.P.) viz. Bairagarh, Hamidia and Prempura during 3 seasons of two years 2010-12. The bacterial isolation was done by the methods of Collins and Lyne (1985). For the isolation of total bacteria, total Coliform and total heamolytic bacteria the three different media were used as Nutrient Agar media, McConkey agar media and Blood agar respectively. The inoculation was done by serial dilution (x10^4, x10^5, x10^6) spread plate methods. Colony count was measured in terms of CFU (Colony Forming Unit) values.

RESULT AND DISCUSSION

Bhopal always experiences a pleasant atmosphere with an average air-temperature in the range 17^0 – 40^0 C. The average water temperatures of upper lake were 29^0-30^0 C, 24^0-25^0 C and 17^0-18^0 C during summer, monsoon and winter of study period respectively, at all three sites. Bacterial populations were analyzed. Significant ($P<0.01$) variation was observed in total bacterial count (TBC), total coliform count (TC) and total haemolytic bacteria count (HB) during all three seasons of study periods. High bacteria count during summer season may be due to evaporation of water of Lake and reduced water level. Sitewise, site-1 showed high load of total bacteria, total coliform and total haemolytic bacteria. Bacterial counts of all three categories were higher during 2011-12 than 20910-11.

Table -1 indicates the average CFU of total bacterial load, total coliform and total haemolytic bacteria, as well as the ratios of total coliform and total haemolytic bacteria to total bacterial load during all three seasons of the study period. The ratios of total coliform to total bacterial count (TC/TBC) and total haemolytic bacteria (HB/TBC) were higher during 2011-12 than 2010-11. The TC count are always higher than Fecal Count (FC) and Haemolytic counts since total coliform can originate from known fecal sources such as plants and soils (Goyal, *et al.*, 1977). Coliforms are generally accepted as an indicator for sewage pollution. The coliform and haemolytic bacteria were higher at the sites close to densely populated area and under urbanization. The ratios of total coliform (TC/TBC) and total haemolytic (HB/TBC) to total bacterial count were in the range as 0.43 – 0.51 and 0.25 – 0.42 respectively during 2010-11 and 0.45 – 0.55 and 0.31 – 0.47 respectively during 2011-12. According to Sinton *et al.* (1998) in urban sewage, fecal streptococci and other pathogenic coliform tend to present in concentration 10-100 times less than fecal coliform.

Table 1. Variation in total Bacterial (TBC) load, total coliform (TC) and total Haemolytic bacteria (HB).Values are given in mean CFU values and standard deviation. Ratios of Total coliform and Haemolytic bacteria to Total bacterial load are mentioned as TC/TBC and HB/TBC.

Year 2010-11						
Season	**Sites**	**TBC**	**TC**	**TC/TBC**	**HB**	**HB/TBC**
Summer	**Site-1**	58.07 ±9.51	28.93 ±3.52	0.50	20.07 ±3.63	0.35
	Site-2	43.07 ±9.03	20.2 ±3.72	0.47	14.33 ±0.91	0.33
	Site-3	48.07 ±6.92	21.53 ±3.14	0.45	13.47 ±1.37	0.28
Monsoon	**Site-1**	38.60 ±4.87	16.6 ±3.14	0.43	13.80 ±1.76	0.36
	Site-2	25.33 ±4.73	11.73 ±3.2	0.46	10.60 ±1.14	0.42
	Site-3	31.87 ±4.28	14.6 ±2.02	0.46	10.27 ±0.86	0.32
Winter	**Site-1**	42.93 ±0.77	19.13 ±2.72	0.45	12.47 ±1.07	0.29
	Site-2	25.80 ±5.66	13.07 ±2.8	0.51	8.87 ±0.90	0.34
	Site-3	34.00 ±4.47	15.6 ±1.71	0.46	8.47 ±1.04	0.25
Year 2011-12						
Season	**Sites**	**TBC**	**TC**	**TC/TBC**	**HB**	**HB/TBC**
Summer	**Site-1**	65.87 ±11.50	31.87 ±4.42	0.48	26.53 ±4.43	0.40
	Site-2	43.20 ±7.46	22.80 ±4.13	0.53	18.53 ±1.97	0.43
	Site-3	47.67 ±3.92	21.67 ±1.11	0.45	15.20 ±1.54	0.32
Monsoon	**Site-1**	38.33 ±11.47	17.40 ±4.47	0.45	18.00 ±2.22	0.47
	Site-2	27.07 ±8.07	14.73 ±3.36	0.54	12.80 ±0.90	0.47
	Site-3	32.93 ±8.39	15.87 ±1.19	0.48	11.73 ±0.60	0.36
Winter	**Site-1**	47.27 ±7.77	22.87 ±3.55	0.48	14.80 ±1.59	0.31
	Site-2	29.53 ±5.91	16.20 ±3.40	0.55	11.27 ±0.72	0.38
	Site-3	33.73 ±5.81	16.60 ±3.35	0.49	10.53 ±0.51	0.31
*Site-1: Hamidia & Gandhi Hospital, Site-2: Sub-urban area Bairagarh & Village Bhaiskhedi, Site-3: Prempura ghat area						

CONCLUSIONS

Indicator microorganisms such as coliform, fecal coliform, haemolytic bacteria etc. have been used as models for the potential presence of pathogenic microorganisms in water samples. Total coliform and haemolytic bacteria showed significant positive relation with the seasonal temperature and regions of lake. It can be concluded that variation in coliform and hemolytic bacterial population is significantly influenced by seasonal temperature variation and mainly due to anthropogenic activities and sewage with high load of fecal coliform and also pathogenic haemolytic bacteria. It is serious concern that the fecal coliform and haemolytic (pathogenic) bacterial concentration in Bhojtal (Upper Lake) has been increased during 2010-12.

REFERENCES

[1] Colins C.M, Lyne P.M. 1984. Microbiological Methods 5th Ed. Butterworth and Co. Publ. Ltd. London. Pp:331-345.

[2] Dionisio L.P.C., Rosado E.G., Lopez-cortes L., Castro D., Barrego J.J. 2002. Microbiological and sanitary quality of recreational seawaters of southern Portugal. Water, *J. Air and Soil Pol.* 138:319-334.

[3] Fenwick A. 2006. Waterborn disease – Could they be consigned to history? *Science.* 313:1077-1081.

[4] Goyal S.M., Gerba C.P., Melnick. 1977. Occurrence and Distribution of bacterial indicators and pathogens in canal communities along the texas coast. *Appl. Environ. Microbiol.* 34:139-149

[5] Grabow W.O.K. 1996. Waterborne disease: update on water quality assessment and control. Water SA, 22:193-202

[6] Seas C., Alarcon M., Aragon J.C., Beneit S. Quinonez M., Guerra H., Gotuzzo E. 2000. Survilalnce of bacterial pathogens associated with acute diarrhea in Lima, Peru. *Int. J. Infect. Dis.* 4:96-99.

[7] Sinton L.W., Finlay, R.K., Hannah D.J. 1998. Distinguishing human from Faecal contamination in water: A Review. *New Zealand J. Marine Freshwater Res*. 32:323-348.

[8] WHO (World Health Organization). 2008. Guidelines for Drinking water qualities, incorporating first and second agenda, Vol-I, recommendation, 3rd Ed.; WHO: Geneva, Switzerland.

[9] Wilkes G., Edge T., Gannon V., Jokinen C., Lyautey E., Medeirous D., Neumann N., Ruecker N., Topp E., Lapena D.R. 2009. Seasonal relationship among indicator bacteria, Pathogenic bacteria *Cryptosporidium* oocysts, *Giardia* Cysts and hydrological indices for surface water within an agricultural landscape. *Water Res.* 43:2209-2223.