WATER QUALITY ANALYSIS

COMPARATIVE ANALYSIS OF POTABLE WATER QUALITY OF PAHARIA AND NON-PAHARIA VILLAGES OF SANTHAL PARGANA, JHARKHAND

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Key words : Paharias, Physico-Chemical, Potable water.

The comparative analysis of potable water quality of paharia and non-paharia villages of Santhal Pargana (Dumka), Jharkhand for drinking purpose was made from January, 2013 to December, 2013. Twenty different Physico-chemical parameters were taken into account. It has been found that certain standard permissible levels as suggested by Indian Standard Institution (ISI) and World Health Organization (WHO) have crossed the limits. Highest bacterial density was recorded in pond (1.376×10^7) and well (1.678×10^7) water while the lowest was recorded in river (0.145×10^7) and Govt. tube well (0.403×10^7) in paharia village in comparison to the highest bacterial density (1.356×10^7) in pond, 1.476×10^7 in well and lowest (145×10^7) in river and 0.398×10^7 in Govt. tube wells in non-paharia village. Similarly, higher MPN coliform was recorded in pond (898), in river (890) of paharia village while in pond 895, in river 890 of non-paharia villages and lowest was recorded in Govt. tube wells,156 and 150, in wells 565 and 560 in paharia and non-paharia villages respectively. Several different types of water borne diseases such as diarrhoea, gastritis and blood dysentery are quite common and prevalent in paharia due to contamination in comparison to non-paharia. Presence of bacteria such as *Escherichia coil, Salmonella typhii. Staphylococcus aureus, Acrobacter acrogens* and *Clostridium perfringens* (*C. welchi*) along with faecal matter proves the real pollution of potable water quality.

Comparative assessment data show that paharias are more prone to several diseases in comparison to non-paharias due to consumption and use of pond and well water for drinking and other purpose. Proper and adequate use *of* alum, bleaching powder and other disinfectants are necessary and unavoidable. Villagers specially paharias must be made fully aware of hygienic use or drinking water. The Govemment also must take care of ecologically uneducated paharias to improve their potable water quality.

INTRODUCTION

Dumka is the Headquarter of the Santhal Pargana Division which is located between 80°28' and 89° 57" east longitude and 23° 40' & 25° 18' north latitude in Jharkhand. The Bhagalpur Division and the river Ganges form its boundary on the nothern side while the districts of Dhanbad and Burdwan (W.B.) form its southern side. The districts of West Bengal, namely Birbhum, Murshidabad and Maldah form its boundary on the eastern side while districts of Giridih, Hazaribagh (Jharkhand) and Munger (Bihar) on the western side.

The Santhal Pargana Division has an area of 14129 sq.km. land out of the total area of 79714 sq. km. of the state of Jharkhand constituting about 17.72%. This is the second largest division of the Jharkhand State.

Dumka is a hilly terrain of Santhal Pargana Division of Jharkhand whose maximum population resides in the natural besettings. Villagers of Dumka get their water for drinking purposes from the river Mayurakshi, ponds, wells and Govt. tube wells. Two villages,namely, Chorkatta (Paharia) and Dhadhakia (Non-paharia) were selected for the present study.

The sources of drinking water contain both micro-and macro-nutrients in permissible limit but quality of drinking water changes due to human interference and gets contaminated and polluted through percolation and seepage, drain and domestic sewage. The quality of water used for drinking purposes gets deteriorated leading to several health hazards, namely, diarrohea, gastritis and blood dysentery. The present study is an attempt to make an assessment of the quality of drinking water made available through different water resources of the twin villages selected for this investigation.

MATERIALS AND METHODS

Drinking water samples were collected from different sources such as wells, Govt. tube wells, ponds and Mayurakshi river from the selected villages.

The pH of water was recorded by both the pH paper in the field and by the digital pH meter in the laboratory. Temperature was measured by the mercury centigrade thermometer. Dissolved oxygen (DO) was calculated by the Winkler's modified volumetric methods. Free CO_2 and HCO_3 alkalinity were determined by the standard methods of NEERI (1979). Other chemical constituents of water were estimated by the standard methods of APHA (1980) and WHO (1985).

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TABLE - 1

Average physico-chemical and bacteriological quality of different potable water sources of Paharia village (Chorkatta)

Parameters	Well	Govt. tube-well	Pond	Mayurakshi River	Criteria of quality of potable water prescribed by	
					ISI	WHO
pH	7.3	7.1	7.4	6.8	6.5	6.5
Temp. (°C)	25.9	26.4	26.0	23.9		
Turbidity (NTU)	14.0 .	15.0	24.0	23.0	10.0	5.0
Total Solids (ppm)	650.0	400.0	680.0	670.0	500.0	1500.0
Dissolved O_2 (ppm)	2.0	1.8	5.9	5.6		
Free CO_2 (ppm)	18.0	13.00	3.0	2.6		
CO_3 - alk (ppm)	Nil	Nil	41.0	39.0		
HCO_3 - alk (ppm)	250.0	304.0	155.0	130.0		
Total Hardness (ppm)	105.0	326.5	96.0	95.0	300.0	500.00
Calcium (ppm)	65.8	101.8	60.0	59.1	75.0	200.0
Mg Hardness (ppm)	37.2	138.8	38.6	39.9	30.0	50.0
Conductivity (mho)	678.0	715.0	262.0	260.0	250.0	600.0
Chloride (ppm)	378.80	291.40	68.25	67.63		
Phosphate (ppm)	0.06	0.08	0.07	0.06		
Nitrate (ppm)	21.50	17.65	5.27	3.35	45.0	10.0
Silicate (ppm)	20.37	73.49	38.66	36.77		
Sodium (ppm)	48.18	96.27	28.39	26.48		
Potassium (ppm)	2.60	4.70	2.00	0.55		
Total Bacterial Density/L	1.678×10^7	0.403×10^7	1.376×10^7	0.145×10^7		
MPN Coliform/100 ml	565.0	156.0	898.0	890.0		

TABLE-2

Average physico-chemical and bacteriological quality of different potable water sources of Non-paharia village (Dhadhakia)

Parameters	Well	Govt. tube-well	Pond	Mayurakshi River
pH	7.4	7.2	7.0	6.8
Temp.(°C)	27.0	29.0	24.8	23.9
Turbidity (NTU)	15.8	16.4	23.8	23.0
Total Solids (ppm)	651.5	399.0	672.0	670.0
Dissolved O_2 (ppm)	3.2	2.6	6.5	5.6
Free CO_2(Ppm)	19.8	14.0	2.9	20.6
CO_3 - alk (ppm)	Nil	Nil	39.9	39.0
HCO_2- alk (ppm)	243.5	308.5	154.5	130.0
Total Hardness (ppm)	106.5	330.0	97.5	95.0
Calcium (ppm)	68.6	202.8	60.5	59.1
Mg Hardness (ppm)	38.2	140.0	39.5	39.9
Conductivity (mho)	658.0	705.0	261.0	260.0
Chloride (ppm)	430.63	320.15	69.0	67.63
Phosphate (ppm)	0.08	0.09	0.07	0.06
Nitrate (ppm)	22.70	18.55	6.10	33.50
Silicate (ppm)	20.85	74.50	75.50	36.77
Sodium (ppm)	47.55	97.27	27.29	26.48
Potassium (ppm)	2.85	4.10	1.85	0.55
Total Bacterial Density/L	1.476×10^7	0.398×10^7	1.356×10^7	0.145×10^7
MPN Coliform/100 ml	560.0	150.0	895.0	890.0

RESULTS AND DISCUSSION

The physico-chemical parameters of Paharia village (Chorkatta) and Non-Paharia village (Dhadhakia) have been summarized and presented in Tables 1 and 2 respectively.

From Table 1 and 2,it is quite clear that total solids values were maximum 680 ppm and 672 ppm in ponds of paharia and non-paharia villages respectively and 670 ppm in the river in both the cases while minimum values of total solids were recorded 400ppm and 399 ppm in Govt.tube wells in paharia and non-paharia villages respectively. Maximum values of turbidity 24.0 NTU and 23.8 NTU have been found in ponds while 15 NTU and 16.4 NTU were found in Govt. tube wells and minimum values of turbidity were 14.0 NTU in wells of paharia villages and 15.8 NTU in non-paharia village respectively. The criteria for upper limit of ISI and WHO are 10 NTU and 5 NTU in case of turbidity and 500 ppm for total solids by ISI. The higher values of total solids and turbidity of drinking water may cause colour, odour and taste problems. Ultimately it may also cause gastro-intestinal and throat problems as reported by ISI (1983) and WHO (1984a).

The pH values were recorded to be higher than 7.0 except in river which was found to be 6.8.

The maximum values of DO were 5.9 ppm and 6.5 ppm in the ponds of paharia and non-paharia villages respectively while 5.6 ppm was found in the river. The minimum values 1.8 ppm and 2.6 ppm were found in Govt. tube-wells of paharia and non-paharia villages. Similarly 2.0 ppm and 3.2 ppm of DO were noted in the wells of paharia and non-paharia villages. The concentration of bicarbonate was found 304.0 ppm and 308.5 ppm in Govt. tube-wells of paharia and non-paharia villages respectively whereas minimum concentration 130.0 ppm was recorded in the river. The concentration of free CO_2 and HCO_3 alkalinity were directly related to each other and their concentration varies according to the depth.

Total hardness, calcium, magnesium, conductivity, chloride, phosphate, nitrate, silicate, sodium and potassium had their maximum values recorded in Govt. tube-wells and wells in both the cases while their minimum concentrations were recorded in pond and river. Even their minimum values had crossed the upper permissible limit fixed by ISI (1983) and WHO (1984a and 1984b).

Drinking water quality will be maintained only when it is free from pathogenic and non-pathogenic microbes. Maximum bacterial density 1.678 X10⁷ and 1.476 x 10⁷ in wells and 1.376x 10⁷ and 1.356 x 10⁷ in ponds were recorded from paharia and non-paharia villages respectively, while minimum density 0.403 x 10⁷ and 0.398 x 10⁷ recorded in Govt. tube wells. Due to such contamination of drinking water, a number of water borne diseases are very common in this area.

Further, presence of a number of microbes such as *Clostridium perfringens*, *Staphyloccus aureus*, *Salmonella typhi*, *Azotobacter aerogens* and *Escherichia coli* shows the real picture of pollution of drinking water with faecal matter. Similar observations have been reported by other investigators working on the quality of drinking water in their respective areas, such as Saha and Pandey (1987), Saba *et al.* (1987), Sinha *et al.* (1990) and Pandey and Kumar (1995).

After going through the data presented in Tables 1 and 2 it can be concluded that paharias are more prone to several water borne diseases in comparision to non-paharias due to consumption of pond and well water which they use for there drinking purposes.

If the villagers specially paharias are made fully aware about the hygenic use of drinking water, its quality and proper and adequate use of alum and other disinfectants,the water borne diseases may be well controlled. The Govt. also must take care of ecologically undetected, uneducated and ignorant paharias to improve their drinking water quality.

ACKNOWLEDGEMENTS

References

APHA, 1980. Standard methods for examination of water and waste water. 15th ed. American Public Health Association, New York, 1134.

ISI, 1983. Indian Standards: Specifications for drinking water. Indian Standard Institute, New Delhi, 22.

Kumar Sheo and N.C. Saha, 1989. Assessment of drinking water quality of Bhagalpur. Biol. Bul. of India. 11 : 9 - 13.

NEERI, 1979. A course mannual : Water and waste water analysis. National Environmental Engineering Research Institute, Nagpur, 134.

Pandey, Rajendra and Kumar, Arvind. 1995. Comparative evaluation of potable water quality of tribal and non-tribal villages of Santhal Pargana, Bihar. Ecol. Env. & Cons. 1-4 : 71-74.

Saha, L.C., and Pandey, B.K., 1987. Quality of hand pump waters at Bhagalpur. 1. Bacteriological quality. Acta Ecol. 9 : 44-48.

Saha, L.C., Pandit, B. and Pandey, B.K., 1987. Bhagalpur well water-Bacteriological quality. Nat.Acad. Sci. Letters. 10: 311-313.

Sinha, D. K., Roy, S.P. and Duttamunshi, J.S., 1990. Assessment of drinking water quality of Santhal Pargana, Bihar. Environment and Ecology. 8 : 937-941.

USEPA, 1977. National Interim primaty drinking water regualation. United States Environmental Protection Agency, USA. 159.

Welch, P.S., 1948. Limnological methods. Mc.Graw- Hill Book Company, Inc, New York 381.

WHO, 1984a. Guidelines for drinking water quality, (Recomendation) World Health Organisation, Geneva, 1 : 130.

WHO, 1984b. Guidelines for drinking water quality (Health Criteria and other supporting information) World Health Organisation, Geneva. 2. 335.

WHO, 1985. Guidelines for drinking water quality (Control in small community supplies) World Health Organisation. Geneva, 3: 121.