The Biobrio ISSN : 2393-9508
An International Quarterly Journal of Life Sciences
Website : www.thebiobrio.in
2 (1&2): 73 - 77, 2015

INVESTIGATION ON DRINKING WATER QUALITY WITH REFERENCE TO GENERAL HEALTH IN CERTAIN TRIBAL AREA OF GODDA DISTRICT (JHARKHAND)

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ABSTRACT

Drinking water in terms of physico-chemical and biological properties of groundwater (dugwell and tubewell) and surface water sources (hill stream) located in Boarijor tribal belt of Godda district under Santal Pargana, Jharkhand were analysed to assess the quality of these water sources and its comparision with the set standards of drinking water. The parameters such as pH, Total Dissolved Solids , Dissolved O_2, free Co_2 , alkalinity, total hardness, chloride, nitrate, fluoride, phosphate and total coliform (MPN) were undertaken for investigation. The investigation revealed that medium of both groundwater and surface water samples varied between slightly acidic to slightly alkaline range of pH (pH 6.4-7.3). All the physico-chemical parameters were within the permissible limit except higher value of TDS and fluoride of dugwell sampling stations.11 MPN of total coliform estimated in groundwater and stream exceeded the permissible standard limits and appeared to be bacterially contaminated and not at all suitable for drinking purpose without proper and conventional treatment. General health status of the tribals appeared to be very weak with poor body built, lazy habits, suffering from several water-borne diseases. Lack of awareness, poor sanitation, open defaecation, improper waste disposal, mishandling of drinking water are the factors responsible for their poor general health.

Keywords – Drinking water quality, Physico-chemical parameters, Coliform, General health.

INTRODUCTION

The quality of drinking water is a powerful environmental determinant of health and the assurance of its safety is a foundation for the prevention and control of water borne diseases. In the last decade, awareness about the importance of safe potable water has grown tremendously due to the alarming level of hazardous dissolved impurities like rust, salt, chemicals, organic matters leading to bacterial contamination found in our drinking water sources including groundwater and surface water.

Drinking water quality is a combined expression of physical, chemical and biological properties of water. Water to be used for drinking purpose should specify the prescribed set standards. Investigation conducted and the findings reported by Jha and Verma (2000), Ramakrishnaiah (2009), Mumtazuddin et al., (2009), Subin and Aneesha (2011) are of special relevance to the present study. Study on physico-chemical properties of water is required to determine the extent of pollution and to monitor the hazardous impact on human health.

AREA UNDER INVESTIGATION

Godda district is situated under Santhal

Pargana of Jharkhand state between latitude of $24^0$25' – $25^0$10' North and longitude of $87^0$10'-$87^0$28' East with an altitude of 400-600m. The district is an upland hilly tract with backbone of Rajmahal hill range. Total geographical area of the district is 2110 sqkm. The area under investigation is located in Boarijor block about 55 km north east of the district headquarter including tribal villages namely Anamo, Beldiha, Chotaboarijor and Babuchuri situated at different situations of Rajmahal hill. The availability of drinking water is anadequate in these villages with acute scarcity of pure and safe water, few dugwell and tubewell are the common sources of drinking water.. The tribals of these villages are mostly dependent on seasonal and perennial hill streams.

MATERIALS AND METHODS

Water samples of dugwell, tubewell and hill stream was collected from identified sampling stations. The location and source of water samples are given in Table -1.Water samples were collected in clean polythene container of one litre capacity with necessary precautions. Storage and preservation of samples were done following standard procedure of APHA, (1996). The pH, dissolved oxygen, free carbondioxide and alkalinity were measured at the sampling points. The other parameters were analysed in the laboratory within 36 hrs. of collection by using standard methods (APHA, 1996, Trivedy and Goel, 1986). Bacterial density and MPN was done by serial dilution count method (APHA, 1996) using MacConkey's broth and durham's tube.

Physico-chemical parameters and total coliform of water samples analysed and measured were compared with WHO and BIS set standards for drinking water. Data provided in Table-2 is the range value of water samples collected from each sampling stations during January 2012-December 2012.

RESULT AND DISCUSSION

The result of all water sample range values of physio-chemical and bacteriological properties along with set standard are given inTable-2.

The pH of water is an important indication of its medium and provides significant information on acid-base buffer system and geo-chemical equilibrium. The pH value of groundwater (tubewell and dugwell) varied from 6.1-7.3 and surface water (stream) indicated acidic medium in the range of 6.1-6.7. The maximum values were only within the prescribed limit of 6.5-8.5 which is biotolerable for drinking water. The acidic pH value may be due to the presence of free Co_2 generated by bacterial oxidation. Leaching of organic acids from decaying vegetations may be responsible for lower pH value in the stream.

The TDS value in groundwater samples and stream water varied from 310-590 mg/L and 270-400 mg/L respectively. Increase in total dissolved concentration of major ions normally occur when groundwater moves and stay for a longer time in its flow path. Higher TDS in groundwater showed longer storage period of water with regular stirring and handling activities in well and tubewell. The ion contributing to TDS are bicarbonate, chloride, nitrate, calcium and magnesium. The maximum TDS value were found to be above the minimum permissible limit in dugwell and tubewell water but quite below the standard limit in stream water. TDS with respect to drinking water quality is its effect on taste. TDS value more than 500 mg/L in water is not undesirable and can cause excessive scaling on water surface containers and household appliances (Tihansky, 1974).

Dissolved oxygen is an important parameter for water quality. Its content varied from 3.6-5.8 mg/L and 6.5-8.5 mg/l in groundwater and stream water sources respectively. Swift water current and photosynthetic activities might have influenced the higher value of dissolved oxygen in stream water. The fluctuation in its value indicates its dependence on water temperature, besides the influence of sources due to different chemical and biological processes. Dissolved oxygen content imparts a good taste to water and is an absolute requirement for the metabolism of aerobic organisms in water bodies. Free Co_2 varied from 3.6-6.6 mg/L with lower value (3.4-4.8 mg/L) in stream water and higher value (3.6-6.6 mg/L) in groundwater samples. Higher value in ground water was probably

Table-1 : Location of Sampling stations

Sampling station	Name of location (Tribal village)	Sampling points
I	Anamo (Tubewell)	1
II	Beldiha (Dugwell)	2
III	Chota Boarijor (Dugwell)	3
IV	Babuchuri (Hill stream)	4

Table 2. Physico-chemical parameters and Total coliform (MPN) in groundwater and surface water samples (Range value- January 2012 – December 2012)

Parameters	S I Max-Min	S II Max-Min	S III Max - Min	S IV Max- Min	Standard WHO	sets BIS
Water Temp 0C	16.0-23.0	16.5-23.0	16.0-25.5	16.0-28.0	-	-
pH	6.3-6.9	6.1-6.5	6.4-7.3	in6.1-6.7	6.5-8.5	6.5-8.5
TDS	380-550	310-590	330-480	270-400	500	500
DO2	3.8-5.4	4.3-5.5	3.6-5.8	6.5-8.5	6.5	6.4-7.6
Free Co2	4.0-6.6	4.1-5.4	3.6-4.5	3.4-4.8	6.0	-
Bicarbonate alkalinity	140-168	230-360	150-174	45.0-89.0	200	200
Total Hardness	13.0-22.0	15.0-30.0	16.0-34.0	34.0-62.0	300	100
Chloride	41.0-50.0	35.0-68.0	71.0-84.0	40.0-57.0	200	250
Nitrate	0.51-0.58	0.51-0.75	0.50-0.69	0.36-0.59	45	45
Fluoride	0.41-0.56	0.40-1.40	0.10-0.60	0.30-0.53	1.0-1.5	0.6-1.5
Phosphate	0.50-0.68	0.50-0.64	0.51-0.66	0.35-0.47	-	-
Total coliform (MPN/100 ml)	08-20	130-260	85-200	700-1480	10-50	50
All values are in ppm except pH.						

derived from chemical nature of underlying rocks, influencing ground water and activities of micro organisms. Availability of free Co_2 is responsible for lower pH value.

Bicarbonate alkalinity varied from 140-360 mg/L and 45-89 mg/L in groundwater and stream water respectively. Bicarbonate represent the major factor since it is formed from the action of carbonate upon basic materials in the soil. The value are within the permissible limit of 200 mg/L. Chemical weathering of rocky bed might be a factor for higher biocarbonate in ground water.

Total hardness of water sample varied from 13-34 mg/L (ground water) and 34-62 mg/L (Surface water) that is within the desirable limit. Hardness is primarily due to interaction between water and geological strata in weathering process. Values of hardness in ground water might be due to considerable accumulation of bicarbonate, chloride and nitrate in well water and tube well water. It is an important index in classifying the quality of water. Total hardness of 50ppm ($CaCO_3$) is the dividing line between soft and mild water (Swingle, 1967). Thus water of ground water and stream water appeared to be of soft to mild nature.

Chloride concentration in water is important to consider water quality as its higher concentration can impart undesirable taste and may cause corrosion in the container. The Chloride value ranged between 34-

84 mg/L and 40-57 mg/L in groundwater and surface water samples respectively which is under desirable limit of 250 mg/L.

Nitrate content in all the water samples ranged from0.3 -0.75 mg/L. The results show that minimum value recorded in stream water0.36-0.59mg/l while maximum value in the range of 0.50-0.75 mg/L in ground water samples of dugwell and tubewell. All the samples were within the permissible limit of 45 mg/L. Significant concentration of nitrate in groundwater was probably due to leaching of the same with percolating water of agricultural runoff. Nitrate content in stream might be derived as allochthonous input through rainfall and surface runoff.

Fluoride content ranged between 0.1-1.4 mg/L in groundwater and 0.30-0.53 mg/L in streamwater sample against the prescribed standard value of 1.0-1.5 mg/L. Maximum concentration of fluoride 1.4 mg/L was recorded in a dugwell sampling station II which is above the minimum desirable limit but well within the maximum permissible limit. Higher fluoride concentration in ground water sample may be attributed to the geogenic and rock water interaction and rapid depletion of water table. Regular consumption of 1.5 mg/L fluoride was found to be injurious to health (Sinha and Musturia, 2004). However, changing appearance of teeth due to dental fluorosis was recorded among tribals of Beldiha village where fluoride content in dugwell water was approaching maximum desirable limit. Other sample of groundwater and stream water was free from fluoride toxicity.

Phosphate content of water sample ranged from 0.50-0.68 mg/L in ground water and 0.35-0.47 mg/L in stream water. In dugwell sampling spot II maximum value was recorded. Phosphate value in groundwater was primarily derived from weathering of rocks added by carbonic acid might have liberated phosphate in groundwater. Rainfall, leaching of soil and various human activities might have contributed significant amount of phosphate in groundwater and streamwater samples.

The value of total coliform (MPN) estimated in groundwater (08-20MPN/100 ml) in bore well,85-260MPN/100ml in dug well and stream water (700-1480MPN/100 ml) appeared to reflect the bacterial contamination of dugwell and stream water influenced by anthropogenic activities. Generally drinking water sample should be free from coliform organisms or not more than 10-50 per 100 ml should be present in any sample, WHO (1994). Allochthonous input due to influx of rain water, soil sewage and surface runoff might be favourable for the proliferation of bacterial density in stream water. Human activities and poor sanitation around dugwell might be responsible for bacterial contamination in ground water sample.

Thus, the investigation revealed that both groundwater and stream water appeared to be bacterially contaminated, hence potability of such water may be harmful and dangerous to the Paharia tribes living amidst acute scarcity of safe and clean water. There is an extreme scarcity of drinking water at one hand and poor quality with high degree of bacterial contamination on the other, appeared to be serious health hazard for the paharia tribal community of this area. General health of paharia tribe as a whole appeared very poor and badly suffering from acute diseases like Malaria and Kala-a-zar followed by the cases of Diarrhoea, Dysentry, Liver enlargement and Stomach disorder. It is recommended that water of dugwell is to be used for drinking only after conventional treatment like filtering, boiling, chlorination etc. Lack of awareness about their health and environment alongwith poor sanitation, open defaecation, improper waste disposal system and illiteracy are the principal reason for poor general health of the tribals of this locality. Such situation need environmental planning and suitable water management by the serious involvement of village based voluntary organization, ecoplanner and Govt. agencies are urgently required for the redressal of these poor tribals of the locality.

REFERENCE

APHA. 1996. Standard Methods for the Examination of Water and Waste water 19th Edition, American Public Health Association, Washington DC.

BIS. 1998. Indian Standard specification for drinking water. IS : 10500, Bureau of Indian Standards, New Delhi.

Jha, A. N. and Verma, P. K. 2011. Physico-chemical properties of drinking water in town area of Godda district under Santal Pargana. India. *Poll. Res*. 19(2):245-247.

Mumtazuddin, S. Azad, A. K., Kumar, M. and Gautam, A. K. 2009. Determination of physio-chemical parameters in some groundwater samples at Muzaffarpur town. *Asian Jr. Chemical and Env. Research*. 2(1-2): 18-20.

Pande, K. S. 2001. An integrated pollution study of surface water, sediment and groundwater of River Ramganga at Moradabad. *Pollution Research*. 20(4): 601-608.

Ramkrishnaiah. 2009. Assessment of water quality index for the groundwater in Tumkur Taluk, Karnataka state, India. *E. J. Chem*. 6: 523-530.

Sinha, A. K. and Musturia Y. 2004. High fluoride groundwater in Chaksu tehsil, Jaipur, Rajasthan. *Ind. J. Environ Sci*. 8: 103-107.

Subin, M. P. and Aneesha, V. A 2011. An evaluation of physio-chemical properties to asses well water quality in some areas of Ernakulam district, Kerala, India. *Nat. Env. & Poll. Tech*. 10(3):409-413.

Swingle, H. S. 1967. Standardization of chemical analysis for water and pond mud. *FAO Fish Rep*. 44 (4): 397-421.

Tihansky, D .P. 1974. Economic damages from residential use of mineralized water supply. *Water Resource Res*. 10(2):145

Trivedy, R. K. and Goel, P. K. 1986. Chemical and Biological Methods for water pollution studies. *Environmental Publications*. 215 pp.

WHO. 1984. Guidelines for Drinking water quality Vol. 2 Health Criteria and other supporting Information, Geneva.