Original Research Article

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Assessment of water quality standards in the villages of Kanchipuram district, Tamil Nadu, India

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ABSTRACT

Background: Water is the most common yet the most precious resource on earth without which there would be no life on earth. About 1.2 million people in the world still today do not have accessible to safe drinking water. In India only 84% of population has accessible to safe drinking water. Objective: To assess the Physical, Chemical, and Microbiological quality of drinking water in the villages of Kanchipuram district.

Methods: A community-based, cross-sectional study was carried out in Chunampet, a rural area in Kanchipuram district of Tamil Nadu in January 2014 among two villages (Villipakkam and Puthirankottai) near Chunampet. Drinking water was collected from the common water sources of both the villages and sent for Physical, Chemical and Microbiological analysis.

Results: Out of 20 water samples for physical and chemical assessment all the water samples shows the physical parameters of the water such as PH, electrical conductivity (EC), total dissolved solids (TDS) were within the normal limits. In chemical analysis Water samples shows that Mg, HCO₃ levels were above the permissible limits as per BIS guidelines. Ten water samples were taken for biological analysis in which all the samples were heavily contaminated with high coliform count.

Conclusions: The study shows that the water samples collected from both the villages are not at acceptable level and it is not suitable for drinking.

Keywords: Health for all, Rural area, Safe drinking water, Water quality

INTRODUCTION

Water is a vital resource for human survival. In 1981 the 34th World Health Assembly in a resolution emphasized that safe drinking water is a basic element of "Primary health care" which is the key to the attainment of "Health for all" by the year 2000. Safe drinking water is a basic need for human development health and wellbeing and hence drinking water accepted human right. It is estimated that approximately one third of the world's

population uses groundwater for drinking purposes and today more than half the world's population depends on groundwater for survival.² Groundwater resource is under threat from pollution either from human life style manifested by the low level of hygiene practiced in the developing nations With increasing industrialization, urbanization and growth of population, India's environment has become fragile and has been causing concern.^{3,4} Pollution of water is due to increased human population, industrialization, use of fertilizers in agriculture and manmade activity.⁵ Once the groundwater

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contaminated, its quality cannot be restored by stopping the pollutants from the source therefore it becomes very important to regularly monitor the quality of groundwater. About 1.2 million people in the world still today do not have accessible to safe drinking water. In India only 84% of population have accessible to safe drinking water.1 So, health problems in India are dependent on water quality today as most of the Indian towns and cities don't have access to safe drinking water. Most of the water resources are polluted with untreated/partially treated wastes from industry, domestic sewage and fertilizer/pesticide run off from agriculture fields etc. The sewage treatment facilities are inadequate in most cities and almost absent in rural India.6 Especially, in rural areas large numbers of people are affected due to consumption of water with unpleasant taste, excessive amount of certain chemicals substances, pathogenic agents. There can be no state of positive health and wellbeing without safe water. Therefore this study was planned to assess the water quality standards in a rural areas of Kanchipuram district Tamilnadu.

METHODS

This study was conducted in the rural area of Chunampet, which comes under the field practice area of Rural Health and training centre, Pondicherry Institute of Medical Sciences. The field practice area includes ten villages which were listed out and out of which 2 villages Villipakkam and Puthirankottai were selected by simple random sampling method (lottery method). The study was conducted during the month of January (6thJanuary 2014 –1st February 2014). Drinking water was collected from the common water sources of both the villages and sent for, Physical, Chemical and Microbiological analysis.

Water collection method

Physical and chemical assessment of water samples: For physical and chemical analysis, water samples were collected in 1 litre plastic bottles. Before water collection the containers were rinsed twice with nitric acid solution and twice with the water to be collected, after which sample were collected in the plastic bottle without any air column. The collected water samples were sent for physical and chemical analysis to the Department of Earth Sciences, Pondicherry University.

We assessed physical parameters like pH, Electrical conductivity (EC) and Total Dissolved Solvents (TDS) and chemical parameters like F, Na, Ca, Mg, Cl, SO $_4$, NO $_3$, PO $_4$ and HCO $_3$. The results were compared with the normal values and interpreted.

Microbiological assessment of water: Water samples were collected from the common water sources in both Puthirankottai and Villipakkam villages using sterile

containers and sent for Microbiological analysis on the same day. Microbiological analysis of the collected water samples was done in the Department of Microbiology, Pondicherry institute of medical sciences.

Collection of water samples

Water samples were collected in heat sterilized glass bottles of 230 ml with ground glass stoppers protected by Kraft paper.

Sampling from a tap or pump outlet: The tap or pump outlet was cleaned from outside. The tap was turned at a maximum flow rate and the water was let to flow for 5 minutes. The stopper was opened, filled with water and the stopper was replaced.

Sampling of water from a reservoir (Streams, rivers, lakes and tanks): The stopper was removed and the bottle was submerged to a depth of about 20 cm with mouth facing upwards.

Transport of water samples

The water bottles were wrapped in a Kraft paper. The water samples were properly labelled with details of the source, time and date of collection and delivered to the microbiology laboratory within 4 hours. The water samples were processed on the same day. Presumptive coliform count and Differential coliform count test was done and the results are interrupted.

The results of physical, chemical, biological analysis of water samples are discussed with village panchayat leader and suggested for proper cleaning of all overhead tanks and water tanks.

RESULTS

All the water samples shows the physical parameters of the water such as pH, Electrical conductivity (EC), Total Dissolved Solids (TDS) were within the normal limits (Table 1).

Chemical analysis shows that the Mg, HCO3 levels were above the permissible limits as per BIS (Bureau of Indian standards) guidelines (Table 2).

Out of 20 water samples 10 Samples shows that Hco3-level is more than normal and 5 samples of water shows that magnesium level is more than normal. Note: All the other elements such as Ca, Na, NO₃, Cl, Po₄, So₄, Fe are 100% normal (Table 3).

All the water samples shows that coliform count is more. We also found the growth of *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *E. coli* and *Enterobacter* in the water samples (Table 4).

Table 1: Results of physical analysis of the water samples.

PH (6.5 - 8.5)	TDS (500 - 2000 MG/L)	EC (<2000 US/CM)	Report
7.32	1638.848	(12000 05) 0112)	2100020
1048.863			
	Satisfactory		
7.45	1132.305	724.6752	Satisfactory
7.42	1837.716	1176.138	Satisfactory
7.5	1250.871	800.5574	Satisfactory
7.17	1277.538	817.6243	Satisfactory
7.65	2923.789	1871.225	Satisfactory
6.79	973.946	623.3254	Satisfactory
6.99	1694.681	1084.596	Satisfactory
7.55	1004.771	643.0534	Satisfactory
7.58	968.561	619.879	Satisfactory
6.69	1314.61	841.3504	Satisfactory
7.55	738.59	472.6976	Satisfactory
7.58	1464.987	937.5917	Satisfactory
6.69	1434.849	918.3034	Satisfactory
6.52	1221.775	781.936	Satisfactory
6.54	1057.84	677.0176	Satisfactory
6.51	1625.625	1040.4	Satisfactory
6.5	1979.762	1267.048	Satisfactory
7.34	1638.681	1048.756	Satisfactory
7.42	1527.241	1536.028	Satisfactory

Table 2: Results of chemical analysis of water.

Ca (75 - 200 mg/L)	Mg (30 - 100 mg/L)	Na (20- 250 mg/L)	NO ₃ (45 -100 mg/L)	HCO3 (300- 600 mg/L)	Cl (250- 1000 mg/L)	PO4 (1 - 5 mg/L)	SO4 (200- 400 mg/L)	F (1- 1.5 mg/L)	Report
44	55	242	19.5	829.6	301.32	0.11	15	0.318	HCO3 level is high
92	78	108	20.4	524.6	256	0.105	13	0.2	Satisfactory
84	234	145	36.7	744.2	540.61	0.006	14	0.2	Mg, HCO ₃ levels are high
132	71	73	23.2	707.59	194.97	0.041	24	0.07	HCO3 level is high
92	112	115	24.7	671	186.11	0.038	44	0.69	HCO3 level is high
95.99	355.2	175	132	1183.4	877.38	0.38	14	0.819	Mg, HCO ₃ levels are high
84	56	47	41.5	573.4	132.93	0.038	14	0.078	Satisfactory
80	67	147	84.7	951.59	167	0.46	27	0.391	HCO ₃ level is high
84	50	138	3.15	427	257	0.47	21	0.151	Satisfactory
11.99	112	123	37.4	402.6	248	0.33	6	0.241	Mg level is high
45	78	146	5.13	646.6	310.18	0.44	13	0.26	HCO ₃ level is high
67	35	63	21.7	317.19	186.11	0.46	12	0.13	Satisfactory
167	66	97	4.38	780.8	310.18	0.52	15	0.107	HCO ₃ level is high
56	78	176	21.6	683.2	363.36	0.43	13	0.259	Satisfactory
68	47	167	41.6	549	292.46	0.53	26	0.185	Satisfactory
91.99	56	109	10.5	512.4	239.28	0.48	8	0.19	Satisfactory
124	101	119	40.8	768.59	416.53	0.52	1	0.185	Mg, HCO3 levels are high
189	144	85	66	780.79	638.1	0.46	16	0.412	Mg, HCO3 levels are high
197	90	105	9.46	268.4	868.52	0.05	12	0.251	Satisfactory
154	77	215	45.5	544.1	912.12	0.07	17	0.214	Satisfactory

Table 3: Summary of chemical analysis of water (n=20).

Elements	Normal n (%)	Abnormal n (%)
HCO ₃ -	10 (50%)	10 (50%)
Mg	15 (75%)	5 (25%)

Table 4: Results of microbiological analysis of the water samples.

Sample No.	Village	Source	Organisms grown in culture	Report (heavy contamination of)	Status
1		Pond water	Klebsiella pneumoniae	Vegetative organisms	Unsatisfactory
2	Villipakkam	Overhead water tank	Pseudomonas aeruginosa	Coliform organisms	Unsatisfactory
3		Water tank	Klebsiella pneumoniae, Enterobacter	Coliform organisms	Unsatisfactory
4		Water tank	Klebsiella pneumoniae, Enterobacter	Coliform organisms	Unsatisfactory
5		Water tank	Klebsiella pneumoniae,	Coliform and	Unsatisfactory
			Pseudomonas aeruginosa	vegetative organisms	
6		Hand pump	Pseudomonas aeruginosa	Coliform organisms	Unsatisfactory
7	Puthirankottai	Hand pump	Klebsiella pneumoniae, Pseudomonas aeruginosa	Coliform and vegetative organisms	Unsatisfactory
8		Water tank	Klebsiella pneumoniae, Pseudomonas aeruginosa	Coliform and vegetative organisms	Unsatisfactory
9		Water tank	Klebsiella pneumoniae	Coliform and vegetative organisms	Unsatisfactory
10		Water tank	Klebsiella pneumoniae, E. coli	Vegetative organisms	Unsatisfactory

DISCUSSION

In our study all the water samples (100%) collected from both the villages shows that coliform count is more and found to be unsuitable for drinking. Residents of these villages were un aware of the fact and utilizing the water from these sources for drinking and cooking purposes. It is known fact that more chances of outbreak of diarrheal diseases will occur if the coliform count is more in drinking water. The people in these villages are at risk of almost all water borne diseases concerned efforts should be taken by public health department for regular/proper chlorination in these villages.

Studies done in various parts of India also found that the coliform counts are high in water samples collected from rural areas during different seasons. Article 21 of our constitution guarantees Right to life, and Right to safe water. It is the duty of the state to provide the rights guaranteed by our constitution.

The study also found abnormalities in the level of elements such as Magnesium and Bicarbonate. However we found PH and TDS are in normal in the water samples collected. Chronic intake of high levels of Magnesium leads to Hypotension, difficulty in breathing, irregular heart beat etc. and chronic intake of bicarbonate leads to metabolic alkalosis, Hypernatremia, Hypertension, odema etc. and Health impact of chronic intake of these elements was not studied in our study is one of the

limitations of our study.^{9,10} The author recommends further studies preferably longitudinal studies to study the long term health impact of intake of these elements.

Subjective experience of the author during the study indicated that the awareness regarding safe water among the community is very poor .IEC campaigns should be given to the community regarding the usage of safe water and to protect the common water sources by avoiding the practices such as open air defecation, deforestation etc.

CONCLUSION

As India is aspiring to become developed nation in the global community. The pathetic condition of Indian villages in terms of drinking water is not acceptable. Thus with strong political commitment and with community participation, there is a hope that we can achieve 100% safe water availability by 2030 to full fill our commitment towards sustainable goals.

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