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Water quality analysis of selected schools of Kumaonregion,Uttarakhand, India

Rajendra Dobhal[1], Nasreen Jeelani[1], D.P.Uniyal✉[1], Sarita Khandka[1] and N.G Shrivastava[2]

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Abstract

Water is a precious resource gifted by Mother Nature for the human being. With rapid growing population the pressure on our water resources is increasing and per capita availability of water resources is reducing day by day. The quality of surface and groundwater resources is also deteriorating because of increasing pollutant loads. The objective of this study consisted is to determinate some physiochemical properties of raw and end water samples from 9 identified intermediate (+2 level) schools of kumaon regions of Uttrakhandand their impact on human health is studied. It is observed that the uptake of water supply in almost all the schools is primarily suffering from bacteriological contamination of water. In addition to this, few schools are found to be contaminated with iron and fluorine Contamination. A wider approach is needed where water issues are looked at with the aim of reducing massive threat to health of students owing to contaminants present in drinking water higher than prescribed limits diseases and improving hygiene. This paper highlights strategies to ensure safe drinking water to the school children of Kumaon regions of Uttrakhand.

Keywords:

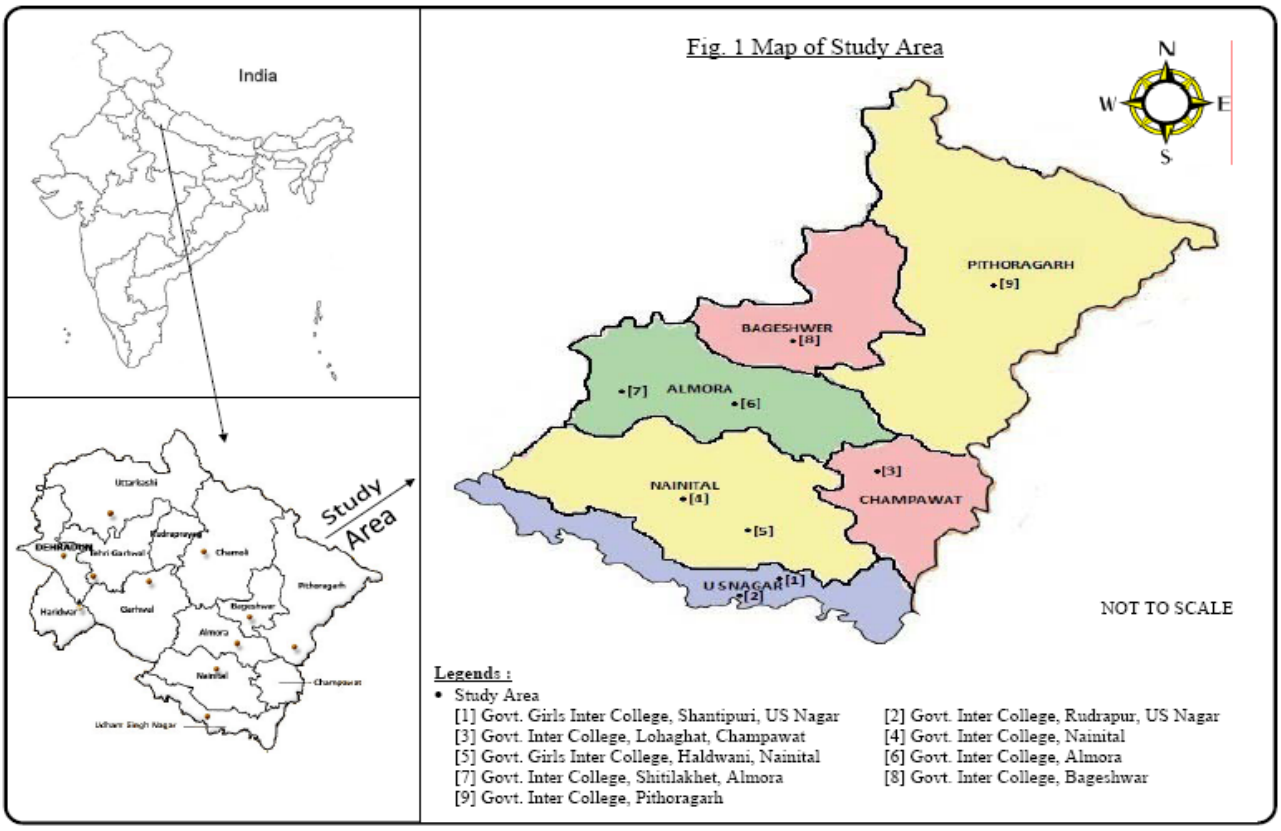
Introduction

Uttarakhand is bounded by Himalayas in the north, Shivalik hills in south, Ganga in the east and Yamuna in the west. It has a moderate climate, maximum temperature in summers is around 36^{o}C while the minimum temperature may fall to 5^{o}C in winters. Summers last from April to July while winter lasts from November to February. With the rapid development in agriculture, mining, urbanization, and industrialization activities, the river water contamination with hazardous waste and wastewater is becoming a common phenomenon. The water quality and human health is closely related. The domestic waste from each building along with the effluent of small scale industries is disposed of into the open drains and gutters which ultimately enter into the rivers[1.] Growing habitation on riversides and increasing industrialization are causing pollution of water [2]. Rivers in Uttaranchal are mostly running, eroding, turbulent, depositing and riffling due to altitudinal gradient and substratum composition.

Author's Address

[1]Uttarakhand State Council for Science and Technology, Dehradun,Uttarakhand.
[2]Pollution Control Research Institute (PCRI) BHEL, Haridwar,Uttarakhand.

However it was observed that on hydroelectric project sites, the natural river path is canalized into tunnels and the water body becomes stagnant at barrages. All these disturbances have drastically changed the ecological sustainability of rivers in the state[3.]A large part of the state of Uttarakhand lies in the hills, where distribution of drinking water supply and its quality is a major problem need in immediate attention. About 90% of the rural population of this region depends upon the natural springs for their daily water demand. However, due to population pressure, unplanned construction, garbage disposal and change in land use patterns, the water of these springs is becoming contaminated besides declining the discharge of these springs[4] . Also use of same water sources for bathing and washing purposes and drinking purposes, are also making situation worse. Improper sewage discharge is one of the major factors of water pollution in rural areas. Most of the schools selected in our study, where availability of drinking water sources and its supply are very difficult. School children mostly depend on water from the available source directly and there is no proper system of water disinfection procedure in



place. Poor environmental sanitation and unsafe drinking water has been one of the major health problems in these areas. Such situation may cause out-break of water borne and water related diseases. Water and sanitation related infections and the diseases of the alimentary tract constitute 60% to 80% of the illness of school children[5] such as diarrhoea, dysentry, typhoid fever, intestinal helminthiasis, jaundice and cholera are endemic particularly in these areas. Access to safe drinking water remains an urgent necessity, as 30% of urban and 90% of rural households still depend completely on untreated surface or groundwater[6] while access to drinking water in India has increased over the past decade, the tremendous adverse impact of unsafe water on health continues [7] . The quality of ground water is variable and often does not meet the drining water requirements.Often ground water is either brakish or saline or contaminated with excess flouride , arsenic,ironetc or micro organisms[8] It is estimated that about 21% of communicable diseases in India are water related[9] .The highest mortality from diarrhoea is said to be among children under the age of five, highlighting the urgent need for focused interventions to prevent diarrhoeal disease in this age group.[10]Safe drinking water not only keeps school children healthy, but also will help them perform better in school. Moreover, at a tender ageit is the responsibility of the scientific communities and government to provide safe drinking water for future healthy society.The first step towards ensuring safe drinking water is to generate reliable and accurate information about water quality monitoring. Monitoring groundwater quality remains a prime concern and a major challenge in rural India, since it is the predominant source of drinking water [11.] The problem of water supply is by no means confined only to the quantity of water available but to quality as well. Surveillance of drinking water quality, from the public health point of view, involves organization, management and number of other activities including follow up action to keep a constant vigil on the safety and acceptability of drinking water supplies. Surveillance of drinking water quality is

an uninterrupted and vigilant public health assessment, and watchdog of drinking water supplies [12-13] . It is also an indispensable activity to ensure that the investments made and assets created thereof on drinking water supply schemes promote and protect the health of the consumers. Unfortunately, proper realization of the importance of this vital function is almost non-existent in our Uttarakhand. In context of the above scenario, it is essential to examine the quality of drinking water samples from the 9 identified schools of six districts of Kumaon regions of Uttarakhand State (India).

It is observed that the uptake of water supply in almost all the schools is in bad condition. In most of the schools bacteriological contamination of water is observed. In addition to this few schools are found with iron and fluorine contamination. However, the source of such contamination is still debated. During the study, it is also observed that there is no proper disinfection system/ practices found in any of these schools. So, there is a need of hour to identify problems related to drinking water and to take corrective measures. A wider approach is needed where water issues are looked at with the aim of reducing water borne diseases and improving hygiene. The main objective of this study is to ensure safe drinking water supplies to the communities ofKumaon regions in six districts of Uttrakhand.

Material and Methods

1. Generation of Primary Data by monitoring of Water Quality Issues :

The rapid survey were carried out and samples were collected from the source (ie. Raw) and at the end user point (end). The drinking water samples were collected and preserved by appropriate reagent[14] . All the samples are store in sampling kits maintained at 4^{o}C brought to the laboratory for detailed analysis. Under this project total 14 parameters were studied (Table 2). Total 9 numbers of samples were collected and analyzed for relevant parameters once in a year. The following Government Inter colleges were covered in Table 1.

Table-1 ***Details of Schools undertaken for study***

SN	District	Schools
1	Udhamsingh Nagar	Govt Girls Inter College Shantipuri, US Nagar
2		Govt Inter College Rudrapur, US Nagar
3	Champawat	Govt Inter College Lohaghat, Champawat
4	Nainital	Govt Inter College Nainital, Nainital
5		Govt Girls Inter College Haldwani, Nainital
6	Almora	Govt Inter College Alomora
7		Govt Inter College Shitilakhet,Almora
8	Bageshwer	Govt Girls Inter College Bageshwer
9	Pithoragarh	Govt Inter CollegePithoragarh

Results and Discussion

It is clear from the data in (Table-2) that total coliform content is observed in raw water and end user point. The observed values are more than the desirable limit and above [15] .The presence of total coliform in raw watersuggests that the source itself is contaminated. From the site specification of these schools (where raw water contains total coliform) we found that the source of these contamination are due to human activity around the source. The absence of proper sanitation facility adds to the problem .At the end user point the total coliform in the schools either remains same in raw water or slightly decreased. This is due to no proper disinfection practice adopted by the school administration or pump of jalsanstha. The value of Hardness were also found to be slightly higher than the desirable limit in raw water in many schools but were within the permissible limit. Fluoride and Iron content was also slightly higher in the water from hand pump, in two schools but it was also within the desirable limit. The presence of iron could also be due to rusting of pipes. We further found that there was no awareness about the importance of water quality among the staff and students in all the schools.Allthe results from 9 schools are compared with the drinking water quality BIS IS 10500. Based on Primary and Secondary information on different environmental issues the water supply systems are judged. The study showed that most of the schools are located in remote area where drinking water is directly taken from the sources.

S. No.	Parameters		GovtGirlsInter College Rudrapur US Nagar	Govt Inter College A.N J Shantipuri US Nagar	Govt GirlsInter College, Lohaghat, Champawat	GovtInter College Nainital,Nainital	GovtGirls Inter College HaldwaniNainital	Govt Inter College Alomora	Govt InterCollege Shitlakhet,Almora	GovtGirlsInterBageshwer	Govt Inter College Pithoragarh
1	pH	Raw	7.7	7.5	7.6	7.5	7.5	7.5	7.6	7.7	7.5
		End	7.8	7.5	7.6	7.6	7.5	7.5	7.4	7.5	7.6
2	Total Hardness (as $CaCO_3$)	Raw	**380**	**184**	56	364	136	68	52	**144**	260
		End	**192**	**180**	56	376	148	92	52	**140**	**392**
3	Iron (as Fe)	Raw	**0.37**	0.02	0.04	0.06	**0.03**	0.02	**0.02**	0.02	**0.06**
		End	**2.06**	0.05	0.04	0.07	**0.01**	0.05	**0.01**	ND	**0.03**
4	Chloride (as Cl)	Raw	16	8	5	16	10	9	9	7	10
		End	5	6	5	15	10	10	10	6	11
5	Fluoride (as F)	Raw	**1.26**	0.80	0.11	0.20	**1.29**	**0.90**	**0.49**	0.05	0.50
		End	**0.68**	0.65	0.11	0.37	**1.30**	**0.51**	**0.40**	ND	0.89
6	Dissolved Solids (TDS)	Raw	**480**	**292**	180	492	250	188	164	**260**	360
		End	**290**	**290**	180	496	268	192	168	**256**	494
7	Sulphate (as SO_4)	Raw	28.4	21.8	0.9	88.7	17.0	0.5	0.8	0.90	0.8
		End	17.0	21.3	0.9	87.8	24.6	3.8	0.4	0.85	1.2
8	Nitrate (as NO_3)	Raw	1.0	1.0	ND	1.5	1.0	1.0	1.0	1.0	1.0
		End	1.0	1.0	ND	1.7	1.0	ND	1.0	1.0	1.0
9	Cadmium (as Cd)	Raw	ND	ND	ND	ND	ND	ND	ND	ND	ND
		End	ND	ND	ND	ND	ND	ND	ND	ND	ND
10	Arsenic (as As)	Raw	ND	ND	ND	ND	ND	ND	ND	ND	ND
		End	ND	ND	ND	ND	ND	ND	ND	ND	ND
11	Lead (as Pb)	Raw	0.01	0.01	0.01	ND	0.01	0.01	0.01	0.01	0.01
		End	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
12	Copper	Raw	1.5	ND	ND	ND	ND	ND	ND	ND	ND
		End	ND	ND	ND	0.01	ND	ND	ND	ND	ND
13	Total Coliform	Raw	**8**	**8**	**6**	**10**	**8**	**18**	**10**	**20**	**26**
		End	**9**	**7**	**6**	**8**	**4**	**8**	**8**	**18**	**16**
14	Total Residual Chlorine	Raw	ND	ND	ND	ND	ND	ND	ND	ND	ND
		End	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND – Not Detectable Raw:Source of Water , End: Drinking Water

The school children mostly depend upon the available source only to meet the drinking water requirement. Based on the actual monitoring, collection, analysis and evaluation of drinking water samples from all the identified 9 schools of Kumaon region spread in six districts, we have shown that the uptake of drinking water in almostall the schools is in poor condition. In most of the schools total coliform contamination of water was observed which has adverse impact on the health. There is no proper disinfection system/ practices found in any of these schools.Total Hardness,Total ,Iron and Fluoride content were also found in many schools like Government Inter college Govt Inter College Rudrapur , Pithorgarh, Nanital and are found to be slightly higher though their values were within the permissible limit.

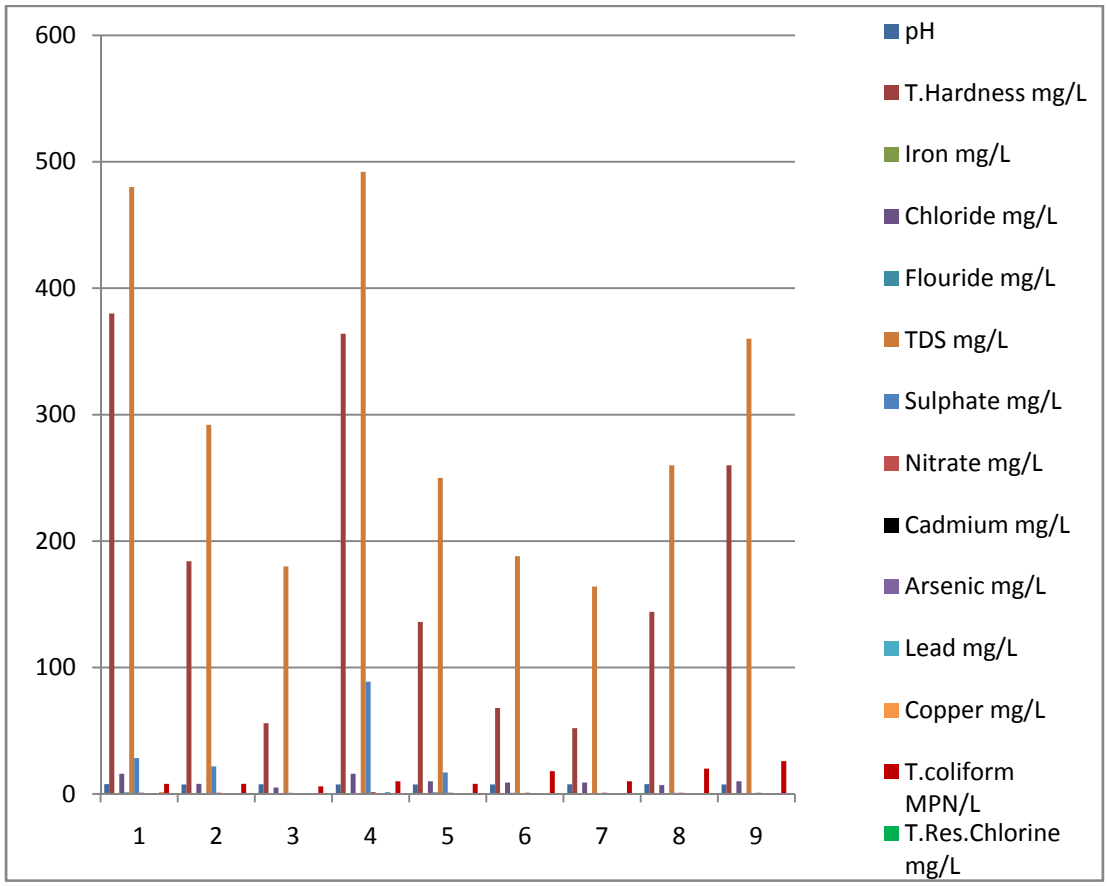


Fig. 1 ***Physico chemical parameters of Raw water***

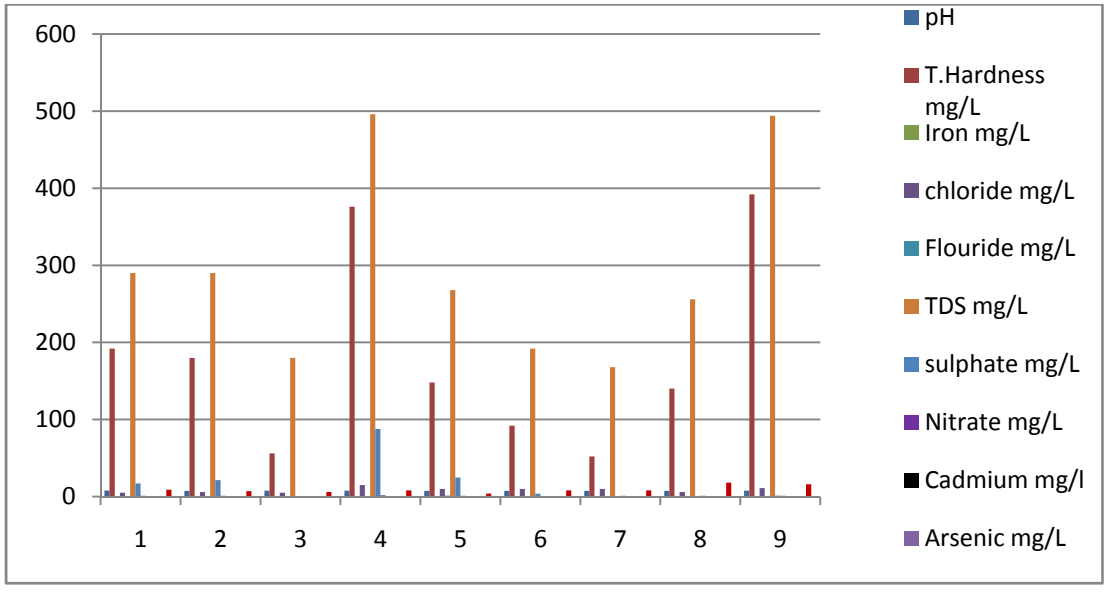


Fig. 2: Physico chemical parameters of End water

It has also been found in many schools that the total dissolved Solids (TDS) in raw water is more and decreases at End point. We have found that in these schools water gets stored in a tank and this could be one of the causes for reduction in TDS. Similarly the Total Hardness, Iron and Flouride content also gets decreased from raw to end point .This also seems as a consequence of storage of water in a tank.This may be due to lack of awareness towards water quality of the area or the adverse impact of contaminated water. Further it has been observed that in many schools the total coliform contamination has decreased from raw to end. This is because of chlorination done in these schools and where there is no decrease of bacterial contamination from raw to end point is observed, it is found that in these schools the water is being used directly from the source itself without any chlorination or any practice for water purification. The total coliform contamination in raw water has been found in almost all the samples and it's beyond limits as per BIS standard. This implies that the source of water is itself contaminated for total coliform. The primary and site specification data suggests that the human activity has caused the contamination itself. These contaminations are mainly due to improper sewage disposal and the use of same water sources for bathing and washing purposes. Inadequate treatment of human and animal wastes contributes to the high incidence of water-related diseases.

Conclusion

This study allowed us to have a general view of the existing scenario in the schools in kumaon region of Uttarakhand. The study also gave insight of the prevalent drinking water practices in Kumaon region. Research and review of national drinking standards taking into consideration the local condition, especially with regard to critical parameters like iron and fluoride is vital for preserving public health. Outsourcing water quality data management and sample collection and monitoring could be an alternative mechanism that can be explored, which would ease the burden on the state and bring better efficiency and sustainability. However it is felt that continuous monitoring is very essential. Good drinking water quality is essential for the well being of all people. Unfortunately in many rural areas drinking water supplies have been contaminated from the local sources. Regular monitoring of water samples from the schools is required. So that any kind of contamination can be detected and an early solution be administered for the well being of the students who are the backbone of any society and economy. The camping and training of teachers for water analysis will be done for the period of one year so that seasonal pattern of water quality can be understood and necessary measure can be known for the improvement of the water quality in the schools of Uttarakhand and best possible technology can be implied which is simple and cost effective in nature.

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