Analysis of Physicochemical Parameters to Evaluate the Drinking Water Quality in District Bandipora of Jammu & Kashmir, India

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Abstract : The drinking water quality was investigated in different parts of district Bandipora to ensure the continuous supply of clean and safe drinking water for the public health protection. In this regard, a detailed physical and chemical analysis of drinking water samples was carried out in GHSS Aragam. A number of parameters such as pH, turbidity, fluoride, iron, nitrate, chloride, etc were analysed for each water sample collected during month of july 2018. The obtained values of all parameters were compared with the standard values set by the World Health Organization (WHO) and local standards of the state. The values of different parameter were almost found to be within the safe limits set by the WHO. Overall, the water from all the locations was found to be safe as drinking water. However, it is also important to investigate other potential water contaminations such as heavy metals, pesticides, other toxic chemicals and radiological materials for a longer period of time in order to assess the overall water quality of the aforementioned area. The increasing trend of spraying harmful pesticides and other chemicals adjacent to school premises by local farmers may wreak havoc to educational institutions in future. Therefore it is need of hour to curb pesticide menace around spring waters accessible to school children in Jammu and Kashmir as well as in other states of India.

Key words: Fluoride; Iron; Nitrate; Chloride Turbidity; pH

1. INTRODUCTION

Water plays a significant role in maintaining the human health and welfare. Clean drinking water is now recognized as a fundamental right of human beings. Around 780 million people do not have access to clean and safe water and around 2.5 billion people do not have proper sanitation. As a result, around 6–8 million people die each year due to water related diseases and disasters [1]. Therefore, water quality control is a top-priority policy agenda in many parts of the world [2]. In the today world, the water use in household supplies is commonly defined as domestic water. This water is processed to be safely consumed as drinking water and other purposes. Water quality and suitability for use are determined by its taste, odor, colour and concentration of organic and inorganic matters [3]. Contaminants in the water can affect the water quality and consequently the human health. The potential sources of water contamination are geological conditions, industrial and agricultural activities, and water treatment plants. These contaminants are further categorized as microorganisms, inorganics, organics, radionuclides, and disinfectants [4].

Fig-1.1: Venue of present study, Govt. Hr Sec School (GHSS), Aragam, Bandipora, J&K-India.

The inorganic chemicals hold a greater portion as contaminants in drinking water in comparison to organic chemicals [5]. A part of inorganics are in mineral form of heavy metals. Heavy metals tend to accumulate in human organs and nervous system and interfere with their normal functions. In recent years, heavy metals such as lead (Pb), arsenic (As), magnesium (Mg), nickel (Ni), copper (Cu), and zinc (Zn) have received significant attention due to causing health problems [2]. Moreover, the cardiovascular diseases, kidney-related problems, neurocognitive diseases, and cancer are related to the traces of metals such as cadmium (Cd) and chromium (Cr) as reported in epidemiological studies [6]. The Pb is known to delay the physical and mental growth in infants, while as Arsenic (As) and mercury (Hg) can cause serious poisoning with skin pathology and cancer and further damage to kidney and liver, respectively [2, 7]. According to the International Agency for Research on Cancer (IARC), Hg and inorganic Hg compounds are classified in group 3 carcinogens [8, 9]. Moreover, the presence of toxic and radioactive elements like uranium in the groundwater is another serious concern in many parts of the world such as USA, Canada, Germany, Norway, Greece,

and Finland. It has high chemical toxicity and lethal effects on human skeleton and kidney [10, 11]. A number of scientific procedures and tools have been developed to assess the water contaminants [3]. These procedures include the analysis of different parameters such as pH, turbidity, conductivity, total suspended solids (TSS), total dissolved solids (TDS), total organic carbon (TOC), and heavy metals. These parameters can affect the drinking water quality, if their values are in higher concentrations than the safe limits set by the World Health Organization (WHO) and other regulatory bodies [2]. Therefore, the investigation of the drinking water quality by researchers and governmental departments has been performed regularly throughout the world [8–12].

In J&K India, the main water sources are rivers, springs and streams, which depend heavily on snowfall and rainfall in allied areas. Therefore it necessary to analyze the water quality of Jammu & Kashmir state including Schools, Colleges, Universities so that it should not pave a way for any kind of major epidemic. Further, there is a dire need to check the excessive use of harmful pesticides, horticulture mineral oils(HMO) etc to ensure pollution free water supply to educational institutions and allied areas [20]. Keeping this into consideration, a detailed study was carried out at recently upgraded chemistry laboratory (Fig 1.1)at GHSS, Aragam, Bandipora, J&K India.

2. Materials and Methods
2.1 Sample collection
The Water Samples from Tap water (Chitaybanday), Spring water (GHSS Aragam), River water (Kishengaga), Glacier water (Harmukh Papchan) , River water (Madumati Nallah) and triple distilled water (Kashmir University) were collected from different locations in the morning hours between 08.00am to 10.00am in the month of July-2018. The Water samples were immediately brought in to Laboratory for the Estimation of various Physico-chemical parameters including pH by Pocket Digital pH Meter/pH paper. While other Parameters Such as turbidity, fluoride, iron, nitrate, chloride, etc were estimated in the Laboratory by using Standard Procedures. [18,19]. The main chemical kit used in current study was from plastic surge industries and the other chemicals used were from Merck, BDH and Thomas Baker.

3. Results and Discussion
The increasing trend of spraying harmful pesticides and other chemicals adjacent to school premises by local farmers may wreak havoc to educational institutions in future. Therefore it is need of hour to curb pesticide menace around spring waters accessible to school children in Jammu and Kashmir as well as in other states of India. In the present study the following parameters were studied in detail.

3.1 pH
Most of bio-chemical and chemical reactions are influenced by the pH. pH is considered as one of the most important water quality parameter. Measurement of pH relates to the acidity or alkalinity of the water. A sample is considered to be acidic if the pH is below 7.0. Meanwhile, it is alkaline if the pH is higher than 7.0. Acidic water can lead to corrosion of metal pipes and plumping system. Meanwhile, alkaline water shows disinfection in water. The reduced rate of photosynthetic activities reduces the assimilation of carbon dioxide and bicarbonates which are ultimately responsible for increase in pH, the low oxygen values coincided with high temperature during the summer month. The factors like temperature can bring about change in pH of water. The higher pH values suggests that carbon dioxide, carbonate-bicarbonate equilibrium is affected more due to change in physico-chemical conditions [16,17]. The normal drinking water pH range mentioned in WHO guidelines is between 6.5 and 8.5. The pH values of all the drinking water samples from different locations of Bandipora district are found to be in the range between 7-8 (Table 1.1), which indicates that it is with in the proper range set by world health organization (WHO).

3.2 Water Temperature
Generally, the weather in study area was warm pleasant around 30ºC, however the water temperature plays an important role which influences the chemical, bio-chemical characteristics of water body [13]. Water Temperature in summer was high due to high temperature and clear atmosphere

3.3 Turbidity
The turbidity of water fluctuated during the present study and its higher value may be due to human activities and presence of suspended particulate matter. Furthermore it was slightly rainy before few days of sample collection and therefore turbidity may have increased beyond permissible limit of 5NTU (table 1.1). However distilled water obtained from Kashmir University showed turbidity range within proper limit.

3.4 Hardness
The value of hardness fluctuates from 50 mg/l to 100 mg/l. The maximum value (100 mg/l) was recorded in the river water Kishenganga in month of July(summer). High value of hardness during summer can be attributed to increase of rate of evaporation of water [14] or it may be due to a particular path traversed by its water through different types of rocks.

TABLE-1.1 : WATER QUALITY PROFILE OF DISTRICT BANDIPORA, J&K, INDIA.

S.No	Parameters	Tap water Chitayban day	Spring water GHSS Aragam	River water Kishenga ga	Glacier water Harmuk h Papchan	River water Maduma ti Nallah	Distilled water	Permissi ble limits	Max tolleranc e limits
01	Fluoride	0.0-0.5ppm	0.5ppm	0.0-0.5ppm	0.0-0.5ppm	0.0-0.5ppm	0.00ppm	1.00ppm	1.5ppm
02	Nitrate	0.0ppm	0.0ppm	0.0ppm	0.0ppm	0.0ppm	0.0ppm	45ppm	100ppm

03	Iron	0.0ppm	0.0ppm	0.0ppm	0.0ppm	0.0ppm	0.0ppm	0.3ppm	1.0ppm
04	Residual chlorine	-	0.2ppm	-	-	-	-	0.2ppm	-
05	Total alkalinity	20ppm	40ppm	10ppm	10ppm	10ppm	10ppm	200ppm	600ppm
06	Total Hardness	90ppm	90ppm	100ppm	70ppm	50ppm	Negligible	300ppm	600ppm
07	Chloride	130ppm	140ppm	180ppm	130ppm	170ppm	50ppm	250ppm	1000ppm
08	PH	7-8	7	7-8	7-8	7-8	6-7	6.5-8.5	
09	Turbidity	10	10	10	10	10	0-5	5NTU	10NTU
10	Bacteria	Nil	Slight growth	Nil	Nil	Nil	Nil	-	-
11	**Phosphate**	0.6ppm	0.6ppm	0.6ppm	0.6ppm	0.6ppm	Negligible	1.0ppm	1.5ppm

3.5 Alkalinity

Total alkalinity ranged between 10 mg/l to 40 mg/l in this study and alkalinity value can increase due to increase in bicarbonates in the water. [14].

3.6 Chlorides

The values of chlorides was found in between 130 mg/l to 180 mg/l. The maximum value (180mg/l) was recorded in river water in summer season which augments the previously reported results [15].

4. Conclusion

Detailed physical and chemical analysis of drinking water samples carried out at GHSS Aragam, Bandipora showed that different water quality parameters were almost within the safe limits set by the WHO. Overall, the water from all the locations was found to be safe as drinking water. However, it is also important to investigate other potential water contaminations such as heavy metals, pesticides and other toxic chemicals in order to assess the overall water quality of the aforementioned area. Therefore this study can hopefully be considered in the future for more analysis/evaluations along with pesticide analysis of water supplies especially in educational institutions. The findings from the present study will provide an insight for rest of the states in India to ensure clean drinking water supply in schools and allied educational institutions so that any kind of epidemic can be avoided.

5. ACKNOWLEDGMENT

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