A Pilot Study: Evaluation of Fluoride in Groundwater of the Southern Part of Aravali Hill

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Abstract: The physicochemical parameters were studied for water samples collected from different sites of Southern parts of Aravali Hills. It is one of the important part of India. The main purpose of the study was to analyse the quality of water for drinking from selected sites. Assessment of water quality was done by comparing the parameters with standard values prescribed by different parameters. Most of the parameters were found within permissible limits of above standards.

Keywords: Fluoride, osteo-dental fluorosis, water quality, testing kit, beverages

1. Introduction

Groundwater is that major supply of beverage in each urban and rural areas. The importance of groundwater for the existence of individual cannot be hyperbolize. The fashionable civilization, industry, urbanization and increase in population have rest to the quick degradation of our groundwater quality. Groundwater is concerning 200th of the planet resource of H₂O and is widely used for various functions. Slowly concerning chronicles of all of H₂O is accessible from rivers, ponds, lakes etc. The standard of water depends upon numerous chemical constituents and their concentration generated by fertilizers, industrial waste, garbage or domestic waste. The groundwater analysis for physical and chemical properties is incredibly necessary for public health studies. These studies are mainly a part of pollution studies within the surroundings.1 At present, fluoride concentration of drinking water and the dental caries are regarded as one of the most common health problems and main analysis of dentists, since low fluoride concentration of the consumed water, i. e. less than the standard rate (1.2-6 ppm), results in caries and if progressed, fluorosis.2 Fluorine is usually found in soil, air, food, and water as fluorides. Fluorine remained as a laboratory curiosity when nuclear energy requirements stimulated commercial production. Fluorine and its compounds are used in producing uranium, plastics, ceramics, pesticides, and pharmaceuticals. The impact of fluorine on human teeth was recognized in 1909 in Colorado, United States when two dental surgeons, Frederick McKay and Grant Black, launched an investigation into the causes of mottled enamel.3 Permissible limit of halide as per WHO pointers for drinks is 1.5 ppm yank Public Health Association and as per Bureau of Indian Science specification permissible limit is 1.2 ppm. Exposure to halide in drinks has variety of adverse effects on human health as well as unhealthy skeletal pathology which is a big reason behind morbidity in a variety of regions of the planet. Halide is a lot poisonous than lead as it conjointly reduces the ratio in humans⁴. Available literature shows that many areas in Rajasthan state are affected due to problem of fluorosis; major reason being consumption of water having high concentration of fluoride in the range of 0.8-10 ppm. Hence the present study was undertaken with an aim to estimate the fluoride concentration in drinking water in urban & rural area of Rajasthan and to determine the prevalence of dental fluorosis.5

Water Quality:

The quality of ground water is poorly understood due to the variety in the interaction between water and soluble minerals and salts. Fluoride come to be toxic once it happens in ground water away from the extreme permissible limit of 1.5 ppm. Chronic exposure to fluoridated ground water creates a health problem not only in human beings but also in domestic animals in the form of osteo-dental fluorosis. In present times, bio-indicators of common fluor toxicosis is due to fluoridated water. In India, several states are endemic for hydro fluorosis due to the high Fluorine content in ground water. Various reports present conflicting data about the availability and quality of ground water to the public in Rajasthan.6

2. Material and Method

In this pilot study, samples of water from different sources like tube well, river, tap water and drinking water were collected randomly from rural and urban sites. It was ensured that the provision of water was primarily groundwater, and so the water wasn't subjected through any physical or chemical filtration technique. Each sample was of 100 ml. They were collected in polyether jar and were subjected to analysis. After sample assortment, the collected specimens were numbered and were conferred for analysis. The samples were analyzed through chemical analysis methodology. This technique of analysis involved the use of element dye. Following the reaction, a modification in colour happens. The lighter the color, larger the salt content. The obtained values were tabulated and so the mean was calculated.7 This area was usually associated with high level of fluoride in groundwater because of mountainous rocks and basaltic rocks, which are more likely to release a high concentration of fluoride. Peer reviewed journal articles which have reported the mean concentration of fluoride in ground water source and prevalence of dental fluorosis in human beings.8

Table A: Site Source, Sample collection from Study Area.

S. No.	Site (Sourthan Hills)	Source	No. of Sample were collected
S1	Well	Farm House	05
S2	River	Near The Village	03
S3	Tubewell	Home	05
S4	Tap Water	Home	05
S5	Drinking Water	Another Place	04

Experimental:

Water samples from the chosen sites were collected from March to May. Five samples were taken in a pair of precleaned polyethylene bottles (cubic decimeter unit). Assortment and analysis of samples was done monthly for the measurement of temperature, pH, electrical conduction (EC), total dissolved solids (TDS), turbidity, total hardness (TH), chloride contents. Knowledge analysis was in hot water of summer seasons. Out of 5 samples one was municipal sample (from well, river, tube well, H₂O and drinking water). All samples were properly tagged as S1, S2, S3, S4 and S5 and record was ready as indicated in Table 1.

A natural science parameter water testing kit "PCS Tester 35" (Eutech make) was used for the live results of temperature, pH, EC, TDS and salinity. A Plantronics build nephelometer (Model No.34) having vary 0-200 NTU was used for the live results of cloudiness. TH was measured by EDTA (Ethylenediaminetetra acetic acid) methodology at intervals that EBT (Erichrome black-T) is utilized as associate indicator. Chloride contents were measured by a triturative mohr's methodology. Total hydrogen ion concentration was together measured by a volumetrically analysis methodology exploitation dyestuff and laxative as indicator. All the chemicals used for the analysis were of AR grade. The water quality for drinking purposes shall be determined by assessing some of the important quality parameters, making it possible to identify problems which may need immediate intervention.9

3. Result and Discussion

The results obtained for the above tests according to various parameters are given in table-1 to 3

Temperature

A rise in temperature of water ends up in the rushing of chemical reactions in water, reduces the solubility of gases and amplifies the tastes and odour. The common temperature of this study ranged from 26.80-29.90 C. pH scale of water (6.6 to 8.6) doesn't has no direct impact on health. However, lower worth below 5.5 manufacture sore style and has higher worth on top of 9.0. The pH scale values of this investigation were inside the ICMR standards (7.0 to 8.9).

Chloride

The high concentrations of chloride are considered to be an indication of pollution. The main sources of chloride in water are Industries. Chloride values obtained in the study are found to be higher (212.5mg /lit) in SI sampling.

pН

pH, the acidic/basic water is depends on the ranges from 0-14, and 7 is neutral. pH of less than 7 is acidic in nature, whereas a pH of greater than 7 is a basic in nature. pH is really a measure of the relative amount of free hydrogen and hydroxyl ions in the water. As pH can be affected by chemicals in the water, pH is an important indicator of water that is changing chemically.1⁰

 Table 1: Physico – Chemical Parameters of Water Samples
 Collected on March

S. No.	Color	pН	Chloride (mg/lit)	Temperature	Fluoride (mg/lit)
S1	Colorless	7.22	89.10	27.07	1.30
S2	Colorless	7.74	86.33	27.60	1.33
S3	Colorless	7.88	48.64	28.95	0.86
S4	Colorless	8.05	45.92	28.90	0.99
S5	Colorless	8.09	40.65	28.74	0.75

 Table 2: Physico – Chemical Parameters of Water Samples
 Collected on April:

S. No.	Color	pН	Chloride (mg/lit.)	Temperature	Fluoride (mg/lit.)
S1	Colorless	7.88	89.10	26.55	1.30
S2	Colorless	6.92	86.33	26.76	1.33
S3	Colorless	7.81	48.64	28.94	0.86
S4	Colorless	7.39	45.92	29.37	0.99
S5	Colorless	8.99	40.65	28.07	0.75

 Table 3: Physico – Chemical Parameters of Water Samples
 Collected on May

S. No.	Color	pН	Chloride (mg/lit.)	Temperature	Fluoride (mg/lit.)
S1	Colorless	8.02	92.55	30.18	1.35
S2	Colorless	7.63	85.70	29.68	1.20
S3	Colorless	7.15	43.27	28.30	0.84
S4	Colorless	7.38	48.60	28.99	0.72
S5	Colorless	7.92	45.22	29.66	0.50

4. Conclusion

Water quality parameters were found deviating for various samples. All water samples were found with alkaline trend and with slightly higher prices of TDS than fascinating value. The water sample S3 was found unfit for drinking because of high values of European Economic Community (WHO standards 11), TH and chloride contents. It is suggested that the water of S3 ought to be used after correct treatment. Fluoride is found to be low in the study area 0correlation with HCO³⁻, Na⁺ and Cl⁻while it has negative correlation with Ca⁺⁺. Most of the water samples in the study area got within the suitable range. For efficient management of the water resources, regular monitoring of the groundwater resource is essential in such areas where sustainable mechanism for water security is severely limited for maintaining proper health conditions of the population.1¹

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Water sample of S1, S2, S3, S4, and S5 of Rajasthan. Registered significant amount of fluoride content in ground water. Out of 3 months highest recorded fluoride content (1.70ppm) by WHO. Five samples also showed significant amount of fluoride content (1.80 to 2.64 ppm) which is also comparatively higher than permissible limit. Only two samples have fluoride content within permissible limit. Therefore, it could be stated that 60% villages were found fluoride affected. Under studies have recorded the higher level of fluoride content in ground water as compared to prescribed level suggested by WHO. Therefore, it state the defluoridation process of ground water using appropriate adsorbents. On the basis of physicochemical analysis of the studied water sources in The Sourthern Part of The AravaliHills, India. It has been concluded that the groundwater and tube well water quality varied spatially. Water at most of the locations is not suitable for drinking purposes as per WHO guidelines. Hardness and fluoride were major health related issues. It is further adviced that some methods of treatment for hardness and fluoride removal is immediately required in the studied area to avoid health problems.1²

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