ANALYZING THE ESTIMATE, THE FLUORIDE CONCENTRATION IN GROUNDWATER

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ABSTRACT

The current paper is a detailed examination of fluoride in the ground water of six villages in Nekarikallu Mandal, Guntur District, Andhra Pradesh, India. Due to their high fluoride content (0.8 to 1.0 mg/lit), the findings show that the ground waters are not fit for human consumption and must be treated before being used. Because of its ability to reduce the prevalence of dental caries, fluoride is considered an important component of drinking water at concentrations between 0.6 and 1.5 ppm. Nevertheless, fluorosis of the teeth and bones may occur if fluoride concentrations are higher than 1.5 mg/L. Increases in fluoride levels in drinking water over 10 mg/L have been linked to the development of disabling fluorosis. The fluoride content in the groundwater of Nekarikallu Mandal was measured, and the findings indicated a range of values, from 1.1 mg/L to 2.3 mg/L, as presented in this paper.

KEYWORDS Fluoride, Groundwater, Water, Pollution

INTRODUCTION

While not all waterways are suitable for drinking due to their chemical composition, there is a growing issue of water shortage. While fluoride is recognized as an important chemical component in water owing to its positive impact at extremely low concentration, it is one of the few chemical pollutants in drinking water. Too much fluoride in drinking water, however, has been linked to an increase in the incidence of dental cavities, skeletal fluorosis, and bone fractures. The release of fluoride into the environment may occur for natural and anthropogenic causes, just like the release of any other contaminant. As fluoride is so prevalent in the earth's crust, it poses a greater threat of pollution to groundwater. Nevertheless, it is yet to be determined what percentage of fluoride is present in the drinking water in these rural areas.

The ion fluoride is derived from the halogen element fluorine. If the concentration of fluoride is about 1 mg/l, it significantly reduces the risk of dental cavities. Fluorosis of the teeth and bones may result from long-term exposure to greater quantities. In underdeveloped nations, where proper treatment facilities are lacking, high fluoride concentrations are of particular concern. Since ground water is used to produce most of the nation's drinking water, it is also the leading source of fluoride consumption. The risk of developing fluorosis rises at concentrations over 1.5 parts per million. There are a number of environmental and natural causes for high fluoride concentrations in aquifers. The production of coal is one human source of fluoride pollution.

LITERATURE REVIEW

Paul Ikhodaro Idon et.al (2018) The goal of this research was to ascertain the rate of dental fluorosis (DF) among people from an endemic region of Northeastern Nigeria who sought medical attention at a tertiary care facility, as well as the severity of DF and the number of patients requesting treatment. Using a questionnaire and a subsequent dental examination, data

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were obtained from adult dental patients in this cross-sectional research of DF. Methods of Statistical Analysis: The Chi-square test, available in SPSS for investigating statistically significant associations between demographic variables like age and gender and event frequency, was utilised. The significance threshold used in this analysis was P 0.05, and the confidence interval size was 95%. The results showed that a total of 312 endemic-area residents (or 41.7% of the total) were diagnosed with DF, giving rise to a Community Fluorosis Index of 0.62. Patients had a mean age of 33.8 9.2 years, with a high proportion falling between the ages of 16 and 25 (47.4%; P = 0.003) and a trend toward female predominance (P 0.003). Among the 312 individuals identified, 201 (64.3%) had fluorosis of esthetic significance, however only 9.3% actually sought treatment. In most cases, those seeking care were dealing with a severe case of enamel deficiency. This study concludes that DF is a significant public health issue in this area. Further variables that may contribute to its incidence in this group may only be identified by a community-based investigation and fluoride mapping of the northeastern area.

Shakir Ali et.al (2016) Dental and skeletal fluorosis are only two of the many health problems linked to fluoride poisoning in drinking water. Previous research has often been conducted at the municipal or regional level. As the issue has far-reaching socioeconomic consequences, a worldwide viewpoint is required. As a result, this article provides a summary of studies conducted across the globe during the last ninety years on the topic of fluoride contamination in drinking water. Our group investigated the antecedents, dispersal, and associations of fluoride contamination in drinking water. Significant fluoride anomalies in groundwater are located in arid and semiarid regions of Asia and Africa, according to the study's most noteworthy findings. The majority of the fluoride in our water supply comes from geological sources, such as fluorine-containing minerals in rocks and sediments, while the vast majority comes from human sources, such as pesticides and industrial waste. Alkalinity and temperature are the primary regulators of fluoride mobilization from geogenic sources. Sodium, arsenic chloride, and bicarbonate ions are often found in close proximity to fluoride in water. Fluoride in water has weak bonds with calcium and magnesium.

Geetika Arora et.al (2014) The goal of this first-of-its-kind research in Mathura city, Uttar Pradesh, India, was to determine the fluoride content in soil and crops cultivated there. Analysis and Method: Twelve samples of soil and twelve samples of the rice, wheat, and potatoes grown atop that soil were taken from four separate villages in the Mathura area so that the city's average fluoride levels could be calculated. Using an Ion Selective Electrode technique, the Fluoride Concentration was calculated in Parts Per Million. The obtained information was then analyzed statistically with the use of the Paired t-test and the analysis of variance to see whether there was a link between the amount of fluoride in the soil and the yield of the crops planted there. The results showed that the average concentration of fluoride in soil was 1.41 ppm, whereas the average concentrations in rice (0.34 ppm), wheat (0.3 ppm), and potato (1 ppm), respectively. Also, the levels of fluoride in rice and wheat were much lower than those in potatoes, regardless of the soil fluoride concentration. The study's findings on the high fluoride concentration in locally grown crops suggest that these foods, along with beverages like water, milk, tea, etc., should be prioritized as sources of fluoride for the community.

M. Arif, J. Hussain et.al (2013) In several areas of Rajasthan, including Ajmer, Bhilwara, Nagaur, Tonk, etc., fluoride pollution of groundwater is a serious environmental threat. A high concentration of fluoride has been found in the groundwater of the "Banka Patti" area in the center of Rajasthan. This belt encompasses the whole of the Nagaur administrative district. Groundwater fluoride concentrations were determined for the Jayal block of the Nagaur District in Rajasthan. The levels of fluoride in the groundwater were too high to be considered safe for

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human consumption. Fluoride concentrations in the current study areas were found to vary between 0.50 and 6.50 mg/l. Groundwater in around 53 villages of the examined locations is unsafe for human consumption, according to the ideal and maximum acceptable level for fluoride in drinking water, assessed by WHO or the Bureau of Indian Standards. In the hamlet of Roopathal, the concentration was measured at 0.5 mg/l, whereas in the village of Rajod, it was measured at 6.5 mg/l.

Salah Abdesselam et.al (2012) The expansion of irrigated agriculture and the overexploitation of groundwaters have disrupted the traditional land utilisation by pastoralism in the desert area of southern Hodna, Algeria. Groundwaters are the sole source of usable water for human use and agricultural irrigation because of the dry climate. Based on two historical records and up-to-date scientific research, this article examines the development of groundwater nitrate pollution during the last four decades. The waters' chemical faya is sulphate-chloride, and the salinity danger is rather high. Due to the high salinity and sandy soil texture, the SAR predicts a minimal likelihood of sodicity. When modern data are compared to older data, it is obvious that nitrate pollution of deep groundwater is a real problem. The study suggests that human activities are responsible for widespread aquifer contamination. Pastoralism was the primary economic activity in the area in 1967, but as the population grew and irrigation agriculture became more commonplace, with its heavy reliance on nitrogen fertilisers and organic amendments, the pollution of the Phreatic water supply spread both horizontally and vertically, reaching the deep aquifer. Soil and plant analysis may help determine how much fertilizer each plant needs, and then this excess can be removed using fractionation. Overwatering is a bad idea. Keeping the soil surface covered at all times is an effective way to stop nitrates from seeping into the groundwater. Second, we need to adjust agricultural systems and fertilizer inputs to dry areas, and use more effective irrigation methods like localized irrigation. The next step is to provide agronomic training to farmers while also acquiring the outdated local references that are currently needed.

METHODS

The research presented here was carried out in the Indian state of Andhra Pradesh in the city of Guntur during the 2017–18 academic year.

Twenty-five different samples of ground water used for drinking were taken from borewells and open wells. We use a very basic random sampling technique to acquire our samples. Chimalamarri, Challagundla, Kunkalagunta, Thurakapalem, and Lingamguntla all provided samples from Nekarikallu mandal. The samples were taken in 1 liter plastic bottles that had been sterilized beforehand.

SPADNS technique is used to examine the water samples. It calls for zirconium red dye solution to react with fluoride. Complexes of zirconium and alizarin Red-S are formed in acidic environments; the addition of fluoride ion bleaches the complex, changing the hue from red violet to yellow green. First, we filtered 100 ml of samples, then we added 5 ml of zirconyl acide solution to get rid of SO4 interference, and last we added Alizarin Red -S and let it alone for at least an hour. Concentration may be determined by measuring the light's intensity at 570 nm and using a standard curve. APHA guidelines are strictly adhered to throughout the aforementioned analytical method.

Polythene bottles with a 1-liter capacity were used to collect 25 groundwater samples from bore wells and dug wells in residential, commercial, and industrial locations throughout Nekarikallu Mandal.

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DATA ANALYSIS

In order to effectively combat dental cavities, fluoride in the range of 0.6 to 1.5 ppm must be present in the public water supply. Fluoride concentrations at all 20 sites were found to be between 1.4 and 2.3 milligrams per liter (mg/L) during the monsoon season and between 1.1 and 2.23 mg/L after the rainy season (Table 1). Nonetheless, 1.5 mg/L is within BIS (1998) guidelines for safety.

Table1: Estimation of fluoride concentration in groundwater of Nekarikallu Mandalduring monsoon and post-monsoon seasons.

Sample No.	Concentration F (mg/L) Monsoon season	Concentration F (mg/L) Post-monsoon season	BIS 1998 Permissible limit	Excessive limit
S1	1.87	1.68	0.5	1.5
S2	2.30	1.68	0.5	1.5
S3	1.68	1.59	0.5	1.5
S4	1.43	1.52	0.5	1.5
S5	1.61	1.59	0.5	1.5
S6	1.57	1.53	0.5	1.5
S7	1.62	1.68	0.5	1.5
S8	1.63	1.10	0.5	1.5
S9	1.59	1.55	0.5	1.5
S10	1.68	1.58	0,5	1.5
S11	2.30	1.94	0.5	1.5
S12	1.64	1.65	0.5	1.5
S13	1.47	1.55	0.5	1.5
S14	1.57	1.50	0.5	1.5
S15	1.46	1.53	0.5	1.5
S16	1.43	1.65	0.5	1.5
S17	1.48	1.76	0.5	1.5
S18	1.78	1.84	0.5	1.5
S19	1.91	1.92	0.5	1.5
S20	1..97	1.96	0.5	1.5
max.	2.30	1.96	0.5	1.5
min.	1.43	1.10	0.5	1.5

The results showed that the groundwater in Nekarikallu Mandal has a fluoride content that is much higher than the allowable limit of 1.5 mg/L. The geological setting also has a role in raising fluoride levels.

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Nekarikallu Mandal

Table: 2 Fluoride Concentration of Nekarikallu mandal in ppm

NAME OF VILLAGE AND SOURCE	FLUORIDE CONCENTRATION (mg/L)	Fluoride permissible
Chemalamarri (Handpump)	2.06	0.8-1.0 mg/l
S.C colony, Borewell	2.08	0.8-1.0 mg/l
Temple, Openwell	2.42	0.8-1.0 mg/l
School, Handpump	2.43	0.8-1.0 mg/l
Handpump	2.56	0.8-1.0 mg/l
Challagundla (Borewell)	2.03	0.8-1.0 mg/l
M.P.U.P School, Open well	2.27	0.8-1.0 mg/l
Bus stand Borewell	2.38	0.8-1.0 mg/l
S.W School, Handpump	2.42	0.8-1.0 mg/l
B.C Colony, Borewell	2.53	0.8-1.0 mg/l
Kunkalagunta (Handpump)	2.05	0.8-1.0 mg/l
Venkaya Colony, Borewell	2.10	0.8-1.0 mg/l
Bus stop, Borewell	2.16	0.8-1.0 mg/l
Temple, Borewell	2.28	0.8-1.0 mg/l
Srinivas, Borewell	2.32	0.8-1.0 mg/l
Thurakapalem (Handpump)	2.62	0.8-1.0 mg/l
Handpump	2.71	0.8-1.0 mg/l
Z.P.H. School, Handpump	2.73	0.8-1.0 mg/l
B.C colony, Handpump	2.80	0.8-1.0 mg/l
Hand pump	3.05	0.8-1.0 mg/l
Lingamguntla (Borewell)	2.08	0.8-1.0 mg/l
Borwell	2.10	0.8-1.0 mg/l
Temple, Open wells	2.38	0.8-1.0 mg/l
Borewell	2.72	0.8-1.0 mg/l
Zp School, Borewell	2.94	0.8-1.0 mg/l

Table 2 provides a summary of the results of analyses performed on 25 fluoride concentration samples. Fluoride levels were between 0.8 and 1.0 mg/l. Challagundla had the highest fluoride levels (3.05), while Chimalamarri and Kunkalagunta had the lowest. As a whole, Nekarikallu mandal has mean values of 2.03.

CONCLUSION

This research analyzed the current state of groundwater in the Nekarikallu mandal, Guntur District. Groundwater was found to have a high fluoride content, ranging from 2.08 to 4.52 mg/l. Over a third of the wells tested had fluoride levels higher than the maximum of 1.5 mg/l allowed by the fluoride water standard. However, 18% of the samples of groundwater were found to have concentrations lower than the standard (0.6 mg/l). As a result, 48 percent of the 25 groundwater samples tested had fluoride levels that were either at or over the legal limit. Use of groundwater from these wells for human consumption must be limited. Evaporation is another major natural process that leads to fluoride levels that are too high. The groundwater quality in this region has to be improved by the implementation of suitable procedures, such as defluorinating the water before it is used and recharging the water through rainfall collection. The current investigation reveals that, with the exception of one groundwater sample, fluoride concentrations in most bore wells were higher than the safe threshold.

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