



Fluoride Content and Health Concern of the Groundwater in Jahazpur Tehsil, Rajasthan, India

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ABSTRACT: Even though water is crucial to life and the environment, its quality has been deteriorating due to abuse over many decades. The quality of available water is crucial in the context of human-centred, long-term sustainable development. Groundwater supplies more than 94% of the demand for potable water in both urban and rural regions. The present study selected a representative sample of 37 villages from the Jahazpur tehsil and seasonally measured the fluoride content from 120 groundwater samples. The fluoride levels in the groundwater samples collected from the designated regions were within safe limits (1.07-1.33 mg/l).

Keywords: Groundwater, Fluoride, Jahazpur, Seasonal.

INTRODUCTION

Water occupies over 71% of the planet's surface. It is one of the most sensitive areas of the ecosystem, yet it is also a need for human and economic progress (Sharma and Singh 2016). A great deal of groundwater is used for human consumption, agricultural irrigation, and industrial processes (Oladipo *et al.*, 2011) state that increasing demand is placing strain on natural water resources. Groundwater is often preferred over surface water because it tends to be less susceptible to pollution and contamination (Kolekar, 2017; Jena and Sinha 2017). Safe consumption of water is a critical aspect of public health, and guidelines have been established by various organizations, including the World Health Organization (WHO) and national bodies like the British Intergovernmental Water Standards, to ensure that water is safe for drinking and other uses. Saxena and Saxena (2015) reported dental and skeletal fluorosis because of the high fluoride content of the local water source of Bassi Tehsil of Jaipur, Rajasthan. Here the present study aimed to analyse the groundwater of Jahazpur tehsil of Bhilwara district of Rajasthan, India focusing on the fluoride content.

MATERIALS AND METHOD

To analyze the seasonal fluctuation of groundwater parameters in the villages of Jahazpur, we have used the following research design:

— Sampling:

- Selected a representative sample of 37 villages from the study area. Considered factors such as population size, geographical location, and agricultural practices when selecting the villages.
- Within each village, two to three sampling sites. The sampling sites were representative of the different types

of groundwater resources in the village, such as shallow wells, deep wells, ponds, or taalao and handpumps.

- Collected groundwater samples from each sampling site during three different seasons: pre-monsoon, monsoon, and post-monsoon.

• Parameters:

The following groundwater parameter was analyzed:

- Fluoride

— Analysis:

- The groundwater samples were analyzed using standard laboratory methods (APHA, 1998).

- The results of the analysis were statistically analyzed to identify any significant seasonal fluctuations in the groundwater parameters.

— **Data collection:** In addition to collecting groundwater samples, we have collected data on the following factors:

- Rainfall patterns in the study area
- Irrigation practices
- Groundwater extraction rates
- Land use patterns
- Population density
- Economic activity

— **Data analysis:** The data collected on the groundwater parameters and other factors were analyzed to identify any relationships between the two. This helped to understand the factors that were influencing the seasonal fluctuation of groundwater parameters in the study area (Kumar and Pareek 2022).

The research design outlined above allowed to study the seasonal fluctuation of ground water parameters in 37 villages in a comprehensive and systematic manner. The findings of the study were useful for developing strategies to manage and protect groundwater resources in the study area.

— **Study Area:** The coordinates of Jahazpur are 25.62°N 75.28°E. Jahazpur is a town and tehsil in the Rajasthan state of India's Bhilwara district. In this Tehsil, there are 225 total villages, and in 2022, there will be 287,460 people living there. The anticipated population of Jahazpur in 2021 is 278,749 people. 54,635 farmers depend on farming for a living. The

Jahazpur tehsil's northeastern region's soils are unsuitable for irrigation. The soil types on the eastern plain have a high pH (8.42) and range in depth from shallow to moderately deep. The region has a potential evapotranspiration of 1380 mm and 700 mm of yearly rainfall.

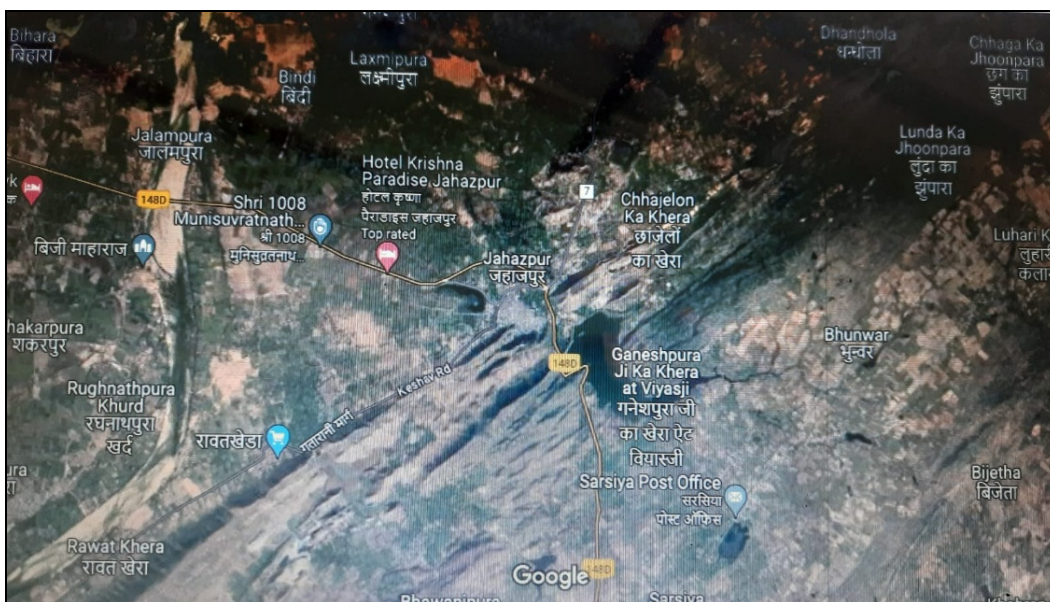


Fig. 1. Google satellite map of Jahazpur tehsil, Rajasthan.

RESULTS AND DISCUSSION

In the present study water parameters like fluoride were measured seasonally (Fig. 2) for two years (December 2020 - November 2022) from 80 wells, 35 hand pumps, and five ponds from the villages under 37-gram panchayets in Jahazpur tehsil of Bhilwara district, Rajasthan, India. All the groundwater of the selected samples was colorless and odorless during the study period.

• Fluoride

— The mineral fluoride is present in various foods and drinks, as well as in groundwater and other water sources. Humans need it because it aids in the formation and maintenance of healthy teeth and bones. However, dental and skeletal fluorosis may occur when exposed to excessive amounts of fluoride. All research locations had fluoride concentrations ranging from 0.9 mg/l to 1.5 mg/l. Between 0.6 and 1.5 milligrams per liter (mg/L) of fluoride is recommended for inclusion in public water supplies. At these concentrations, fluoride may aid in warding off cavities and other dental problems (Hamdani, 2022). However, dental fluorosis, which may lead to white spots, mottling, and discoloration of the teeth, is more likely in those who drink water with fluoride levels over 1.5 mg/L. The mineral fluorosis in the mouth may cause tooth loss in extreme circumstances. The fluoride levels in the groundwater samples collected from the designated regions were within safe limits (1.07-1.33 mg/l).

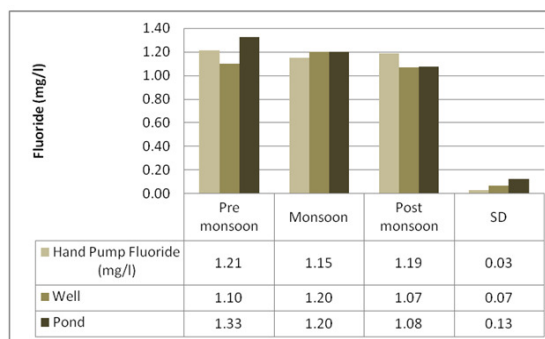


Fig. 2. Seasonal representation of groundwater fluorides in selected sites.

- Fluoride is a mineral that is naturally found in water and is also added to drinking water to prevent tooth decay.
- High fluoride levels can cause dental fluorosis, a discoloration of the teeth.
- Groundwater fluoride levels vary depending on the geology of the area and the depth of the aquifer.
- In general, groundwater fluoride levels range from 0.1 to 1.0 mg/L.

Fluoride is a mineral that is beneficial for dental health. However, too much fluoride can cause dental fluorosis, a condition that causes discoloration and pitting of the teeth. Fluoride can also cause other health problems, such as bone problems and kidney problems.

Implications:

- The implications of total hardness, alkalinity, chloride, and fluoride in groundwater depend on the specific concentrations of these ions. In general, it is important to monitor groundwater quality for these ions to ensure that they are at safe levels for human consumption.
- High levels of nitrate, sulphate, phosphate, and iron in groundwater can have several implications for human health and the environment.

Water naturally contains the mineral fluoride, which is also incorporated into drinking water to avoid tooth decay. Groundwater fluoride levels fluctuate based on the local geology and aquifer depth, but typically range from 0.1 to 1.0 mg/L. High fluoride levels can result in dental fluorosis, a yellowing of the teeth. Dental fluorosis, a yellowing of the teeth, may be brought on by excessive exposure to fluoride. Though in the selected water samples fluoride levels were in the permissible limits.

CONCLUSIONS

Groundwater levels in Rajasthan have been declining in recent years due to several factors, including overexploitation, climate change, and population growth. This has led to water scarcity and quality problems in many parts of the state. It is important to note that the water analyzed in this research had no noticeable odor or flavor. The fluoride content of the groundwater hydrological regime in the current research was found to be within the allowed limits for the drinking water category, not at all alarming the Jahazpur tehsil's residents about their health.

FUTURE SCOPE

The water quality parameters like nitrate, phosphate, and arsenic study can be carried out in the above area to

give a clear picture of the status of the groundwater for potable usage. Microbiological estimation is also needed to explain the presence or absence of pathogenic bacteria in the study area.

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Conflict of Interest. None.

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