HEALTH RISK ASSESSMENT OF JAHAZPUR TEHSIL DUE TO THE IMPACT OF IRON CONTENT IN GROUNDWATER

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Abstract

Groundwater is often preferred over surface water because it tends to be less susceptible to pollution and contamination. The iron content value in hand pumps and wells ranged in between 0.1mg/l-1.0mg/l, and in ponds, it was recorded at 0.1mg/l-0.2mg/l. Both ferrous iron (Fe^{2+}) and ferric iron (Fe^{3+}) may exist in groundwater. In and of itself, ferrous iron (Fe_2O_3) is water soluble and harmless. Wells and hand pumps typically had iron concentrations between 0.1 and 1.0 mg/l, whereas ponds had values between 0.1 and 0.2 mg/l. The iron content of the groundwater hydrological regime in the current research was found to be beyond the allowed limits for the drinking water category, alarming the Jahazpur tehsil's residents about their health.

Keywords: Groundwater, Iron, Jahazpur, Health Issues

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Introduction

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. The effects on economic growth and population distribution are substantial. Drinking water, agriculture, and manufacturing are just a few of the many industries that rely on groundwater. Due to chemical and biological reactions between water and geological material, groundwater also includes a broad range of dissolved inorganic chemical components. Groundwater is often preferred over surface water because it tends to be less susceptible to pollution and contamination. Therefore, it has been the standard practise in every part of the globe, from sparsely inhabited places to highly populous metropolises, to guarantee a steady supply of water for human consumption, agriculture, and industry. The quality of groundwater may deteriorate as a result of human activities such as population growth, industrialisation, and the use of fertilisers in agriculture. Analysing the water's chemical make-up, as well as its smell, colour, and concentration of organic and inorganic particles, establishes its purity and safety. There are more inorganic compounds than organic ones that might be pollutants in our drinking water. Groundwater's suitability for human consumption is evaluated with respect to inorganic pollutants such salinity, chloride, fluoride, nitrate, and iron. Drinking water, unlike water used for other purposes, must be free of harmful microorganisms (Abubakar et al., 2004). Agarwal (2009) have examined the physical and chemical properties of the water in Dudu, Rajasthan to ascertain its suitability for human consumption. In the present study groundwater samples of Jahazpur tehsil, Rajasthan were examined for iron content.

Materials and Method

To analyse the seasonal fluctuation of ground water 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 the factors such as population size, geographical location, and agricultural practices when selecting the villages.
- Within each village, selected two to three sampling sites. The sampling sites were the 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: premonsoon, monsoon and postmonsoon.

➢ Parameters:

The following groundwater parameter was analyzed:

- Iron

➢ Analysis:

- The groundwater samples were analyzed using standard laboratory methods (APHA, 1998).
- The results of the analysis were statistically analysed 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.

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 fairly shallow to moderately deep. The region has a potential evapotranspiration of 1380 mm and 700 mm of yearly rainfall.

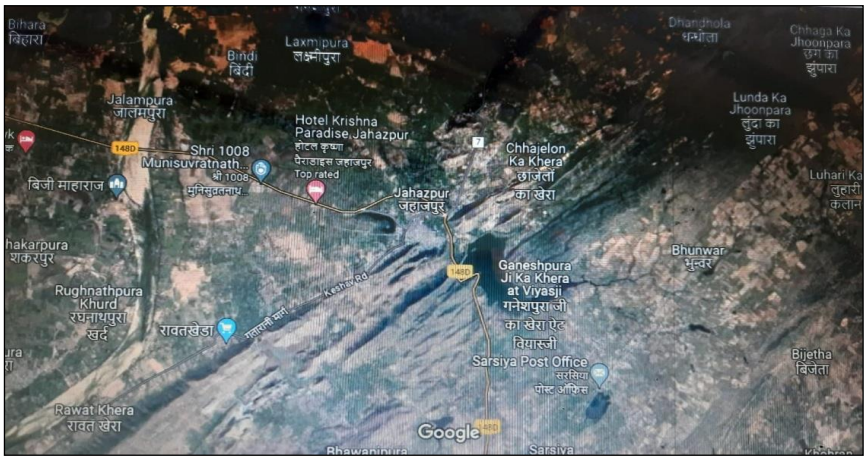


Fig. 1. Google satellite map of Jahazpur tehsil, Rajasthan

Results and Discussion

In the present study water parameters like iron was 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 were colourless and odourless during the study period.

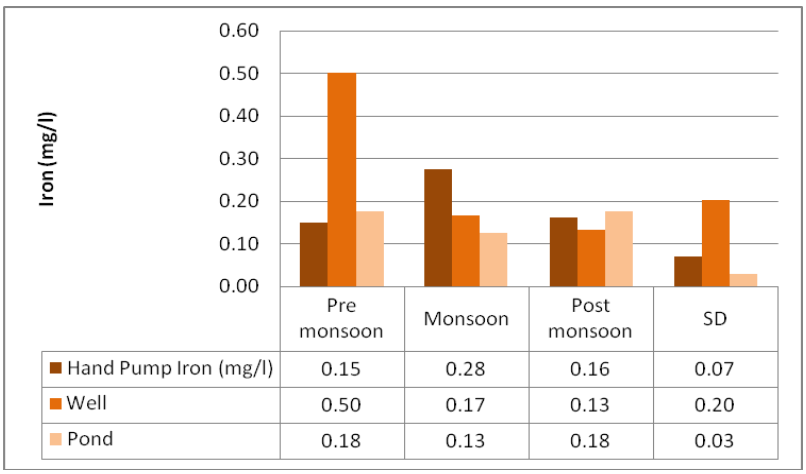
➢ **Iron**

Iron is a naturally occurring element that is found in groundwater in varying concentrations. The amount of iron in groundwater depends on a number of factors, including the type of rocks and minerals in the aquifer, the pH of the water, and the presence of oxygen. The iron content value in hand pumps and wells ranged in between 0.1mg/l-1.0mg/l, and in ponds it was recorded 0.1mg/l-0.2mg/l. Both ferrous iron (Fe^{2+}) and ferric iron (Fe^{3+}) may exist in groundwater. In and of itself, ferrous iron (Fe_2O_3) is water soluble and harmless. But ferrous iron oxidises to ferric iron when exposed to oxygen, and ferric iron is insoluble and produces rusty-red precipitates. These precipitates may leave stains on fabrics and fixtures, block plumbing and filtration systems, and impart a metallic flavour and odour to the water.

Iron levels in drinking water should be less than 0.3 mg/L, as recommended by the World Health Organisation (WHO). While our research found iron concentrations of 0.13-0.5mg/l in surface water, groundwater concentrations are typically significantly higher, particularly in rural regions. For instance, one analysis of Bangladeshi groundwater revealed an average iron content of 1.5 mg/L, with readings ranging from 0.05 to 50 mg/L.

The high levels of iron in groundwater can pose a number of problems, including:

- Aesthetic problems: Iron-rich water can have a metallic taste and odor, and can stain clothes and fixtures.
- Operational problems: Iron precipitates can clog pipes and screens, and can damage water treatment equipment.
- Health problems: High levels of iron in drinking water have been linked to a number of health problems, including anemia, liver damage, and heart disease.



	Pre monsoon	Monsoon	Post monsoon	SD
Hand Pump Iron (mg/l)	0.15	0.28	0.16	0.07
Well	0.50	0.17	0.13	0.20
Pond	0.18	0.13	0.18	0.03

Fig. 2. Seasonal representation of ground water iron in selected sites

- Iron is a common element found in groundwater, and it is generally not harmful to human health at low levels.
- High levels of iron can cause a number of aesthetic problems, such as discoloration, taste, and odor.
- Iron can also clog pipes and fixtures, and it can interfere with the effectiveness of water treatment processes.
- Iron can irritate the stomach and intestines, causing nausea, vomiting, and diarrhoea.
- Iron can irritate the skin, causing redness, itching, and rashes.
- Anemia can occur if the body does not absorb enough iron from food or water.

Iron is a mineral that is essential for human health. However, high levels of iron in groundwater can cause a number of problems, including taste and odour problems, staining of plumbing fixtures, and encrustation of water pipes. Iron can also promote the growth of bacteria in water, which can lead to health problems. Groundwater frequently contains the metal iron, which is typically safe for human health at low concentrations. Discoloration, taste, and odour are just a few of the aesthetic issues that high iron levels can bring about. Iron may also block plumbing fittings and pipelines and reduce the efficiency of water filtration systems. Iron can irritate the skin, producing redness, itching, and rashes. Iron can irritate the stomach and intestines, causing nausea, vomiting, and diarrhoea. If the body does not absorb enough iron from food or drink, anaemia may result. Nausea, vomiting, and diarrhoea are all symptoms of stomach and intestinal irritation, which iron may cause. Redness, itching, and even rashes may result from iron's ability to irritate the skin. Inadequate iron absorption from diet or drink may cause anaemia.

Conclusion

Wells and hand pumps typically had iron concentrations between 0.1 and 1.0 mg/l, whereas ponds had values between 0.1 and 0.2 mg/l. The iron content of the groundwater hydrological regime in the current research was found to be beyond the allowed limits for the drinking water category, alarming the Jahazpur tehsil's residents about their health.

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