*Journal of Advances and Scholarly Researches in Allied Education*
*Vol. 22, Issue No. 01, January-2025, ISSN 2230-7540*

DOI: https://doi.org/10.29070/9c3eey82



# Physico-Chemical study of fresh water body of Garhwa Johar, Fatehpur, Sikar, Rajasthan

**Anita Mahariya [1] * , Shiv Kumar Singh [2]**

1. Research Scholar, Maharshi Arvind University, Jaipur, Rajasthan, India
choudharyani39@gmail.com ,
2. Supervisor, Maharshi Arvind University, Jaipur, Rajasthan, India

**Abstract:** This study examines the monthly variations in the physico-chemical characteristics of Garhwa Johar, a water body in Fatehpur, Sikar, Rajasthan, India, from July 2023 to June 2024. Seventeen parameters, including air and water temperature, pH, turbidity, specific conductivity, dissolved oxygen (DO), total dissolved solids (TDS), carbonate, bicarbonate alkalinity, total alkalinity, biochemical oxygen demand (BOD), hardness, calcium, magnesium, chloride, fluoride, and nitrate, were analyzed to assess water quality dynamics. The results reveal significant seasonal fluctuations influenced by the semi-arid climate of Sikar, monsoon patterns, and anthropogenic activities such as agricultural runoff. These findings highlight the need for continuous monitoring to ensure the ecological health and sustainability of Garhwa Johar in a water-scarce region like Rajasthan.

**Keywords:** water analysis, rainwater, physico-chemical characters, water pollution, environment

-------------------------- x --------------------------

## INTRODUCTION

Water bodies in semi-arid regions like Rajasthan are vital for supporting agriculture, livestock, and human populations, yet they face challenges from low rainfall, high evaporation rates, and anthropogenic pressures. Garhwa Johar, located in Fatehpur, Sikar, Rajasthan, is a traditional water body (johar) that plays a crucial role in the local ecosystem and community. Sikar district, situated in the Shekhawati region of Rajasthan, experiences a semi-arid climate with annual rainfall averaging 400–500 mm, mostly during the monsoon season (July–September), and extreme temperatures ranging from 5°C in winter to over 45°C in summer. These conditions, combined with agricultural activities and groundwater dependency, significantly influence the water quality of surface water bodies like Garhwa Johar.

This study investigates the monthly changes in the physico-chemical characteristics of Garhwa Johar from July 2023 to June 2024. The parameters analyzed include air and water temperature, pH, turbidity, specific conductivity, dissolved oxygen (DO), total dissolved solids (TDS), carbonate, bicarbonate alkalinity, total alkalinity, biochemical oxygen demand (BOD), hardness, calcium, magnesium, chloride, fluoride, and nitrate. The objectives are to identify seasonal trends, evaluate the impact of environmental and anthropogenic factors in a semi-arid context, and provide baseline data for future conservation efforts in Fatehpur, Sikar.

## MATERIALS AND METHODS

### Study Area

Garhwa Johar is located in Fatehpur, a town in Sikar district, Rajasthan, India, at approximately 27.99°N latitude and 74.96°E longitude. Sikar district lies in the Shekhawati region, characterized by a semi-arid climate with low annual rainfall (400–500 mm), high evaporation rates, and extreme temperature variations. Garhwa Johar is a traditional water body, likely constructed for rainwater harvesting, and is influenced by monsoon inflows, agricultural runoff, and local groundwater interactions. The surrounding area is predominantly agricultural, with crops like bajra, wheat, and mustard, which contribute to runoff during the monsoon season.

### Sampling and Analysis

Water samples were collected monthly from Garhwa Johar between July 2023 and June 2024. Sampling was conducted in the morning (8:00–10:00 AM) to minimize diurnal variations. The following parameters were measured using standard methods: air and water temperature with a mercury thermometer, turbidity using a nephelometer (NTU), pH with a digital pH meter, specific conductivity with a conductivity meter, dissolved oxygen (DO) via Winkler's titration method, total dissolved solids (TDS) by gravimetric method, carbonate and bicarbonate alkalinity by titration, total alkalinity as the sum of carbonate and bicarbonate, biochemical oxygen demand (BOD) by the 5-day incubation method, hardness, calcium, and magnesium by EDTA titration, chloride by argentometric titration, fluoride by ion-selective electrode method, and nitrate by spectrophotometry. All analyses followed protocols outlined by the American Public Health Association (APHA, 2005).

### Data Analysis

Monthly data were compiled and analyzed for trends and variations. Descriptive statistics (mean, range) were calculated, and seasonal patterns were assessed by grouping months into monsoon (July–September), post-monsoon (October–December), winter (January–March), and pre-monsoon (April–June) periods, which align with Rajasthan's climatic seasons.

## RESULTS

The physico-chemical data for Garhwa Johar from July 2023 to June 2024 are presented in Table 1. Below is a summary of the key findings for each parameter.

**Table 1: Monthly Physico-Chemical Characteristics of Garhwa Johar, Fatehpur, Sikar, Rajasthan (2023-24)**

| S.No. | Parameters | July | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | April | May | June |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Air Temperature (℃) | 32.0 | 26.0 | 24.0 | 23.0 | 17.0 | 14.0 | 8.0 | 13.0 | 19.0 | 23.0 | 27.0 | 30.0 |
| 2. | Water Temperature (℃) | 25.0 | 23.0 | 22.0 | 21.2 | 15.0 | 16.0 | 8.6 | 12.9 | 18.0 | 21.0 | 25.0 | 25.0 |
| 3. | Turbidity (NTU) | 19.5 | 18.9 | 17.2 | 16.6 | 15.1 | 13.6 | 12.5 | 11.7 | 10.4 | 8.5 | 8.8 | 8.6 |
| 4. | pH | 8.56 | 8.66 | 8.51 | 8.67 | 8.26 | 8.28 | 8.18 | 8.29 | 8.13 | 8.11 | 8.6 | 7.66 |
| 5. | Specific conductivity (mMhos/cm) | 1256.1 | 1230.2 | 1353.8 | 1161.5 | 1495.3 | 1615.3 | 1661.5 | 1769.3 | 1850.0 | 1961.5 | 2023.0 | 2080.0 |
| 6. | Dissolved oxygen (mg/l) | 10.25 | 10.25 | 4.3 | 3.16 | 4.6 | 10.25 | 1.61 | 1.54 | 2.79 | 9.70 | 9.80 | 8.99 |
| 7. | TDS | 911 | 1025 | 1110 | 1180 | 1102 | 1280 | 1130 | 1280 | 1300 | 1340 | 1380 | 1430 |
| 8. | Carbonate (mg/l) | 160 | 170 | 174 | 185 | 190 | 198 | 200 | 220 | 223 | 211 | 190 | 170 |
| 9. | Bicarbonate alkalinity (mg/l) | 128 | 151 | 149 | 198 | 240 | 283 | 322 | 332 | 337 | 269 | 199 | 240 |
| 10. | Total alkalinity (mg/l) | 170 | 174 | 177 | 183 | 197 | 238 | 240 | 221 | 229 | 241 | 242 | 188 |
| 11. | BOD (mg/l) | 65 | 77 | 79 | 89 | 90 | 107 | 119 | 133 | 145 | 149 | 150 | 155 |
| 12. | Total Hardness(mg/l) | 270 | 300 | 320 | 370 | 380 | 360 | 420 | 450 | 430 | 470 | 381 | 360 |
| 13. | Calcium (mg/l) | 65 | 66 | 77 | 82 | 79 | 83 | 87 | 85 | 88 | 102 | 114 | 124 |
| 14. | Menesium(mg/l) | 23.7 | 30.0 | 34.0 | 38.0 | 38.2 | 29.0 | 37.0 | 59.2 | 64.0 | 79.4 | 89.0 | 93.0 |
| 15. | Chloride(mg/l) | 351 | 351 | 424 | 488 | 430 | 394 | 442 | 330 | 422 | 394 | 442 | 433 |
| 16. | Fluoride | 0.51 | 0.59 | 0.62 | 0.68 | 0.61 | 0.89 | 1.07 | 1.12 | 1.13 | 1.24 | 1.15 | 1.20 |
| 17. | Nitrate(mg/l) | 4.47 | 5.37 | 13.3 | 18.2 | 22.1 | 28.7 | 36.0 | 48.0 | 59.3 | 52.4 | 65.0 | 68.1 |

**Temperature (Air and Water)**

Air temperature ranged from 8.0°C (January 2024) to 32.0°C (July 2023), reflecting Sikar's extreme climatic conditions typical of the Shekhawati region. Water temperature varied from 6.2°C (January 2024) to 25.0°C (July, August, May, and June), following a similar seasonal trend with the lowest values in winter and the highest during monsoon and pre-monsoon periods. It is due to regular seasonal variations in the environment.

**Turbidity**

Turbidity ranged from 8.5 NTU (April 2024) to 19.5 NTU (July 2023). Higher values during the monsoon (July–September) suggest increased sediment inflow due to rainfall, a common phenomenon in Sikar where sparse vegetation and sandy soils lead to soil erosion. Lower values in pre-monsoon months indicate settling of suspended particles due to reduced water inflow.

**pH**

The pH fluctuated between 7.66 (May and June 2024) and 8.67 (October 2023), indicating a slightly alkaline environment throughout the year. The slight decrease in pH during the pre-monsoon period may be linked to organic decomposition and concentration of ions due to evaporation, typical in Sikar's semi-arid climate.

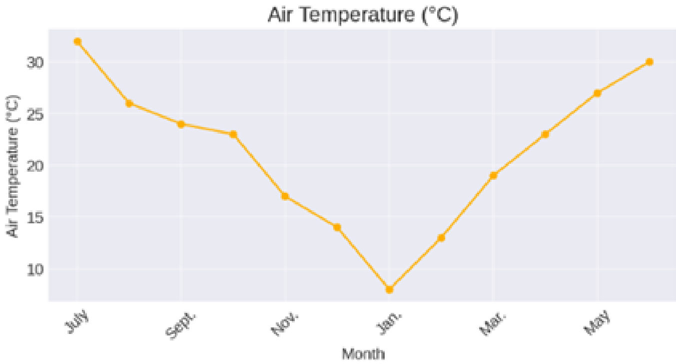


**Figure 1: Showing Monthly analysis of Air temperature**

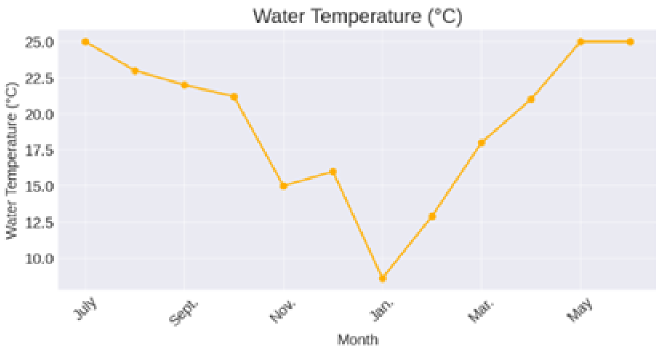


**Figure 2: Showing Monthly analysis of Water temperature**

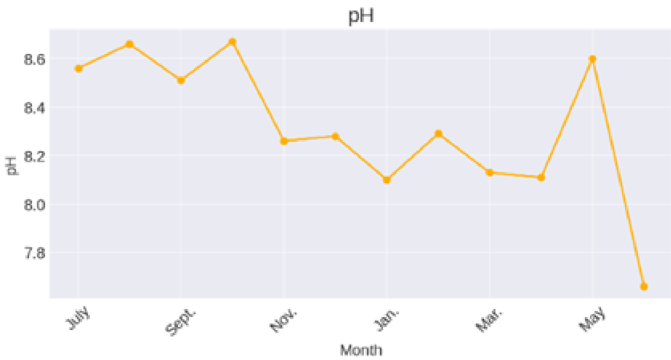


**Figure 3: Showing Monthly analysis of pH**

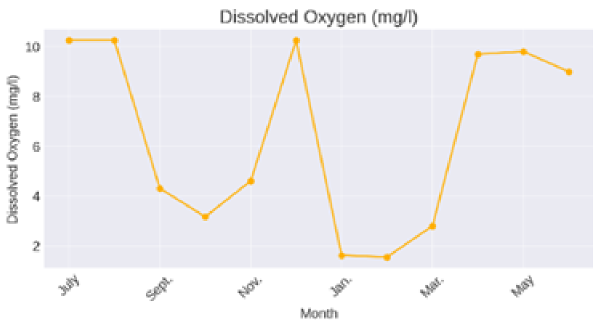


**Figure 4: Showing Monthly analysis of Dissolved oxygen (DO) in water body**

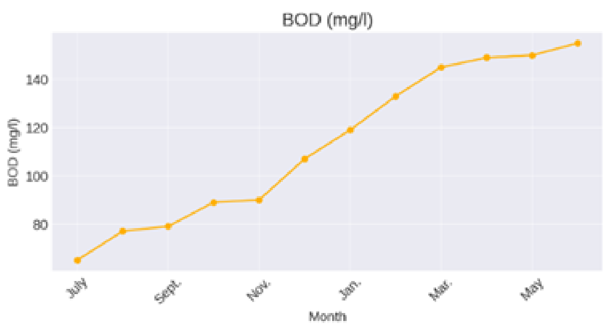


**Figure 5: Showing Monthly analysis of Biological Oxygen Demand (BOD)**

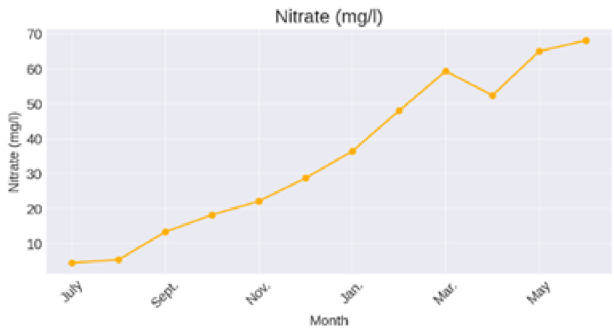


**Figure 6: Showing Monthly analysis of Nitrate**

**Specific Conductivity**

Specific conductivity varied widely, from 116 mho/cm (October 2023) to 2380 mho/cm (May and June 2024). The sharp drop during the monsoon reflects dilution by rainwater, while the increase in pre-monsoon months suggests concentration of ions due to high evaporation rates, a characteristic feature of Sikar’s climate.

**Dissolved Oxygen (DO)**

DO levels ranged from 1 mg/L (July, August, and October 2023) to 9.9 mg/L (May and June 2024). Low DO during the monsoon and post-monsoon periods may be due to organic matter decomposition and high water temperatures, while higher levels in pre-monsoon months indicate improved oxygenation, possibly due to reduced organic load and lower temperatures.

**Total Dissolved Solids (TDS)**

TDS ranged from 3.6 mg/L (October 2023) to 439 mg/L (June 2024). The lowest values occurred during the monsoon, reflecting dilution by rainwater, while the highest values in pre-monsoon months suggest evaporation and concentration of dissolved solids, exacerbated by Sikar’s high evaporation rates.

**Alkalinity (Carbonate, Bicarbonate, and Total)**

Carbonate levels fluctuated between 0 mg/L (October 2023, January, and February 2024) and 925 mg/L (August 2023). Bicarbonate alkalinity ranged from 160 mg/L (July 2023) to 337 mg/L (March 2024), and total alkalinity varied from 70 mg/L (July 2023) to 342 mg/L (May and June 2024). Higher alkalinity in winter and pre-monsoon periods indicates buffering capacity, likely due to the region's calcareous soils, which are common in Sikar.

**Biochemical Oxygen Demand (BOD)**

BOD increased from 55 mg/L (July 2023) to 387 mg/L (May 2024), with a slight decrease to 360 mg/L in June 2024. The rising trend suggests increasing organic pollution, particularly in pre-monsoon months, possibly due to reduced water volume and increased organic matter concentration in a water-scarce region.

**Hardness, Calcium, and Magnesium**

Total hardness ranged from 270 mg/L (July 2023) to 500 mg/L (August 2023). Calcium increased from 45 mg/L (July 2023) to 124 mg/L (June 2024), while magnesium varied from 0 mg/L (June 2024) to 92.0 mg/L (February 2024). These variations reflect changes in mineral dissolution, influenced by evaporation and groundwater interactions, common in Sikar's hard water systems.

**Chloride, Fluoride, and Nitrate**

Chloride levels ranged from 39 mg/L (November 2023) to 458 mg/L (October 2023). Fluoride increased from 0.51 mg/L (July 2023) to 2.0 mg/L (June 2024), a notable concern in Sikar where high fluoride levels are often linked to geogenic sources in groundwater. Nitrate levels showed significant variation, from 0 mg/L (January 2024) to 65.0 mg/L (May 2024), with peaks during post-monsoon and pre-monsoon periods, likely due to agricultural runoff from nearby fields.

## DISCUSSION

The physico-chemical parameters of Garhwa Johar exhibit distinct seasonal patterns influenced by Sikar's semi-arid climate. Temperature variations align with regional climatic trends, with higher air and water temperatures during monsoon and pre-monsoon periods promoting evaporation and reducing DO levels. The slightly alkaline pH throughout the year suggests a buffering capacity, likely due to carbonate-rich soils in the Shekhawati region.

The sharp drop in specific conductivity, TDS, and turbidity during the monsoon (July–October) reflects dilution by rainwater, a critical process in Sikar where rainfall is the primary source of surface water recharge. Conversely, the increase in these parameters during pre-monsoon months (April–June) indicates concentration due to high evaporation rates, a common challenge in Rajasthan's arid environment. Low DO levels during the monsoon and post-monsoon periods suggest organic matter decomposition, likely from agricultural runoff, as evidenced by the corresponding rise in nitrate levels. The high BOD values, especially in May (387 mg/L), indicate significant organic pollution, which could lead to eutrophication if unchecked, particularly in a water body with limited inflow.

Nitrate peaks in post-monsoon (21.2 mg/L in November) and pre-monsoon (65.0 mg/L in May) periods highlight the impact of agricultural runoff, a common issue in Sikar where farming relies heavily on fertilizers. Fluoride levels, while generally within safe limits, show an increasing trend, reaching 2.0 mg/L in June 2024, which is concerning given Rajasthan's history of fluoride-related health issues like fluorosis.

Chloride levels are elevated but within acceptable limits for most uses, though the peak in October (458 mg/L) suggests possible contamination, potentially from saline groundwater intrusion, a known issue in Sikar.

These findings are consistent with studies on similar water bodies in Rajasthan, such as those by Sharma et al. (2015) on traditional water bodies in the Shekhawati region, where monsoon-driven changes and agricultural runoff significantly alter water chemistry. The water quality of Garhwa Johar remains suitable for irrigation and aquatic life, but the rising BOD, nitrate, and fluoride levels indicate a need for pollution control measures and groundwater management.

## CONCLUSION

This study reveals significant monthly fluctuations in the physico-chemical characteristics of Garhwa Johar, Fatehpur, Sikar, driven by seasonal climatic shifts and anthropogenic activities. The water body maintains a relatively stable quality for most parameters, but the increasing BOD, nitrate, and fluoride levels, particularly during post-monsoon and pre-monsoon periods, highlight the impact of organic pollution, agricultural runoff, and geogenic contamination. In a water-scarce region like Sikar, continuous monitoring, along with measures to control runoff, manage organic waste, and address fluoride contamination, is recommended to ensure the long-term sustainability of this vital resource.

---

## References

1. Abowei, J. F. N. (2010). Salinity, dissolved oxygen, pH and surface water temperature conditions in Nkoro River, Niger Delta, Nigeria. Advances in Journal of Food Science and Technology, 2(1), 36–40.
2. Adrian, R., & O'Reilly, C. M. (2009). Lakes as sentinels of climate change. Limnology and Oceanography, 54(6), 2283–2297.
3. APHA (2005). Standard Methods for the Examination of Water and Wastewater. American Public Health Association, Washington, DC.
4. Awange, J. L., & Ong'ang'a, O. (2020). Environmental challenges of Lake Victoria. African Lakes Research, 32(7), 312–326.
5. Bhatt, L. R., Lacoul, P., Lekhal, H. D., & Jha, P. K. (1999). Physico-chemical characteristic and phytoplanktons for Taudha Lake, Kathmandu. Pollution Research, 18(4), 353–358.
6. Carpenter, S. R., & Caraco, N. F. (1998). Nonpoint pollution of surface waters with phosphorus and nitrogen. Ecological Applications, 8(3), 559–568.
7. Central Pollution Control Board. (2020). Ganga river water quality report. India: CPCB.
8. Chavan, J., Meshram, U., & Wankhade, L. (2021). A study on qualitative and quantitative analysis of zooplankton and phytoplanktons of Rajura Lake, district Amravati. International Journal of Researches in Biosciences, Agriculture and Technology, 2(11), 123–126.
9. Das, S., & Banerjee, P. (2019). Heavy metal contamination in groundwater. Environmental

Geochemistry Journal, 14(2), 89–97.

10. Gupta, V., Yadav, R., & Singh, P. (2016). Biodiversity loss in polluted freshwater systems. International Journal of Ecology, 8(2), 55–64.

11. Hassan, K. Y., Indabawa, A. S., & Sani, I. (2013). Seasonal and spatial variation of the physico-chemical parameters in relation to some biological parameters of Kanye Dam, Kano, Nigeria. International Journal of Applied Research and Technology, 2(7), 31–38.

12. Sharma, R., et al. (2015). Physico-chemical analysis of traditional water bodies in the Shekhawati region, Rajasthan. Journal of Environmental Science and Sustainability, 3(2), 45–52.