Open Access Research Journal of
Engineering and Technology
Journals home page: https://oarjpublication/journals/oarjet/
ISSN: 2783-0128 (Online)

OARJ OPEN ACCESS RESEARCH JOURNALS

(Research Article)

Check for updates

Impact of poultry farming on surface and groundwater quality in Ibadan

Oladiran G. F [1, *], Durojaye A J. [1], Odunfa A [1], Olagunju, D.P [2] and Ajayeoba A.A. [3]

[1] *Department of Civil Engineering, Faculty of Engineering, The Polytechnic, Ibadan, Oyo State, Nigeria*
[2] *Department of Civil Engineering, Faculty of Engineering, Adeseun Ogundoyin Polytechnic, Eruwa, Oyo State, Nigeria*
[3] *Technical Education Department, School of Secondary Education, Oyo State College of Education, Lanlate, Oyo State, Nigeria.*

Open Access Research Journal of Engineering and Technology, 2026, 10(02), 118-126

Publication history: Received on 25 April 2026; revised on 02 June 2026; accepted on 04 June 2026

Article DOI: https://doi.org/10.53022/oarjet.2026.10.2.0045

Abstract

Intensive poultry farming has become an important component of agricultural development and food security in Nigeria; however, poor management of poultry wastes has contributed significantly to environmental pollution and deterioration of water resources. This study investigated the impact of poultry farming activities on the quality of surface and groundwater within the Alaro Stream environment along Eleyele Road, Sango, Ibadan North Local Government Area of Oyo State, Nigeria. Water samples collected from surface water and nearby groundwater sources were analysed for selected physicochemical and bacteriological parameters using standard analytical procedures recommended by APHA (2022). The results obtained were evaluated against World Health Organization (WHO) drinking water standards.

Physicochemical analysis revealed that pH, nitrate, sulphate, chloride, and calcium hardness were within permissible limits, while turbidity, total alkalinity, total hardness, biochemical oxygen demand (BOD), and chemical oxygen demand (COD) exceeded recommended standards. Groundwater turbidity recorded 12.96 NTU, exceeding the WHO limit of 10 NTU, indicating elevated suspended contaminants and possible organic pollution (WHO, 2022). Dissolved oxygen concentrations were relatively low in both samples, suggesting oxygen depletion caused by decomposition of poultry waste materials (UNEP, 2021). Bacteriological analysis showed high colony counts and the presence of coliform organisms and *Escherichia coli* in both water sources, confirming fecal contamination associated with poultry waste infiltration and runoff (Bello et al., 2024). Elevated BOD and COD values further indicate significant organic pollution arising from poultry waste decomposition within the study area (Oyeku et al., 2023).

The findings demonstrate that intensive poultry farming activities have adversely affected both surface and groundwater quality around Alaro Stream and may pose serious environmental and public health risks to nearby residents. The study therefore recommends improved poultry waste management practices, periodic environmental monitoring, and stricter enforcement of sanitation regulations to safeguard water resources and public health.

Keywords: Poultry Farming; Groundwater Contamination; Surface Water Pollution; Poultry Waste

1. Introduction

Water is an essential natural resource required for domestic, agricultural, industrial, and ecological sustainability. The quality of surface and groundwater resources has become a major environmental concern globally due to increasing anthropogenic activities and poor waste management practices (WHO, 2022).

Agricultural activities, particularly poultry farming, contribute significantly to environmental pollution through the generation of large quantities of organic waste materials. Poultry wastes contain nutrients, suspended solids, nitrates,

* Corresponding author: Oladiran G. F

phosphates, pathogenic microorganisms, and dissolved organic matter capable of contaminating nearby water bodies through runoff, seepage, infiltration, and leaching processes (Adewumi et al., 2021).

In Nigeria, rapid urbanisation and increasing demand for poultry products have resulted in the expansion of poultry farming operations, especially in peri-urban communities where environmental monitoring and waste disposal regulations remain weak. Improper disposal of poultry manure and wastewater can deteriorate water quality and increase the occurrence of waterborne diseases such as typhoid fever, cholera, diarrhoea, and dysentery (UNEP, 2021).

Previous studies have reported elevated microbial contamination and increased physicochemical pollution in water sources located around livestock production environments (Olajire and Adewoye, 2020; Bello et al., 2024). High Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) values are commonly associated with excessive organic pollution resulting from animal waste decomposition (Oyeku et al., 2023).

The Alaro Stream area along Eleyele Road in Ibadan North Local Government Area hosts several poultry farming activities situated close to residential settlements and domestic water sources. Continuous disposal of poultry waste into surrounding land surfaces and drainage systems may therefore pose serious risks to both surface and groundwater quality within the area.

This study therefore evaluates the impact of poultry farming activities on surface and groundwater quality around Alaro Stream using selected physicochemical and bacteriological indicators.

2. Study area

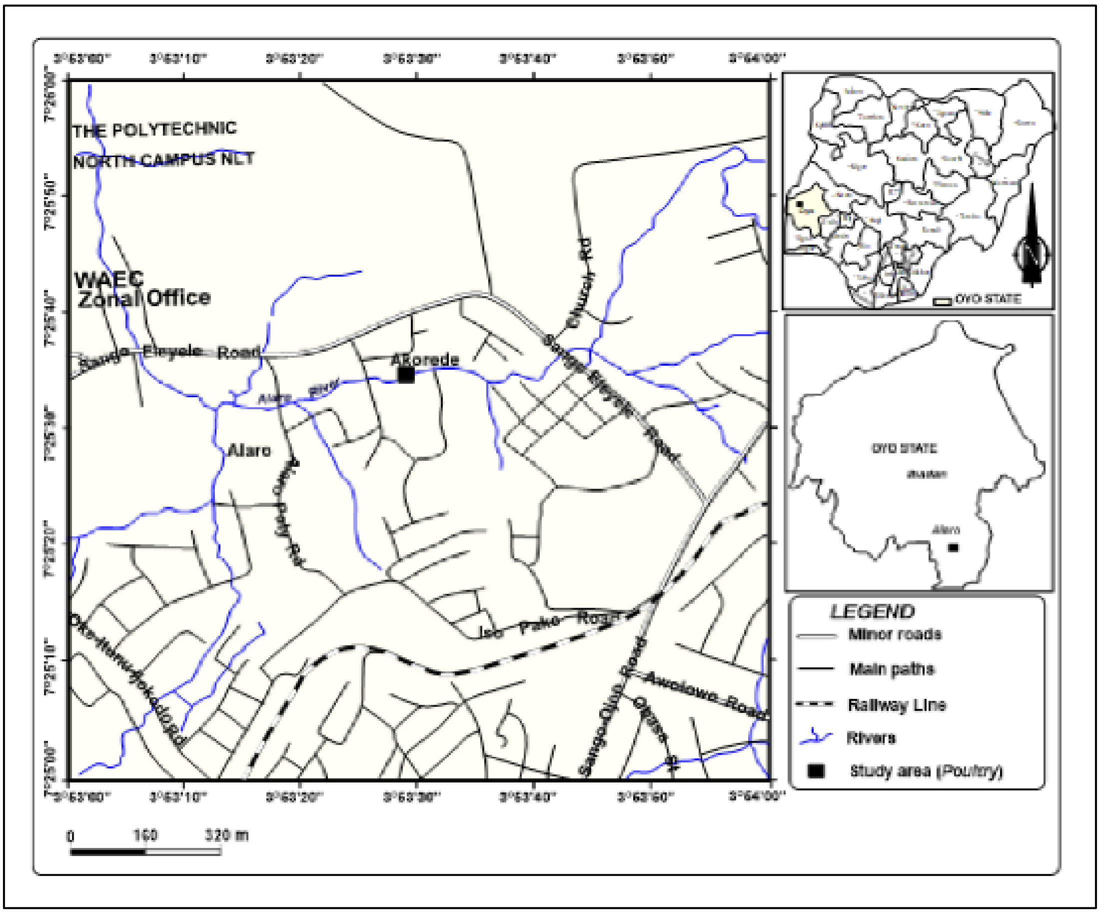

Figure 1 Map showing the location of the study in Alaro

The study was conducted around Alaro Stream, located along Eleyele Road, Sango area, in Ibadan North Local Government Area of Oyo State, Nigeria. The area lies approximately on latitude 7°25′N and longitude 3°53′E.

The area experiences tropical climatic conditions characterised by distinct wet and dry seasons with annual rainfall ranging between 1200 mm and 1500 mm. Poultry farming, residential development, and commercial activities dominate land use within the study area.

Alaro Stream serves as a major surface water source while hand-dug wells provide groundwater for domestic activities. The close proximity of poultry farms to these water sources increases their vulnerability to contamination from poultry waste runoff and seepage.

3. Materials and methods

3.1. Sample Collection

Water samples were collected from: Surface water source (Alaro Stream and Groundwater source (hand-dug well). Clean, sterilised plastic bottles were used for sample collection and preservation before transportation to the laboratory for analysis.

Figure 2 Well water at Alaro

Figure 3 Surface water at Alaro.

3.2. Physicochemical Analysis

The physicochemical parameters analysed include colour, turbidity, total solids, total filtrable solids, total non-filtrable solids, temperature, pH, dissolved oxygen, total alkalinity, total hardness, calcium hardness, calcium ion, magnesium ion, sulphate, chloride, electrical conductivity, salinity, silica, nitrate, and phosphate. Standard laboratory procedures recommended by APHA (2022) were adopted.

3.3. Bacteriological Analysis

Bacteriological examination was carried out to determine the following parameters: Colony count, coliform organisms, *E. coli*, BOD, and COD. Membrane filtration and multiple tube fermentation techniques were used.

4. Results and discussion

4.1. Physicochemical Characteristics of Water Samples

Table 1 Physicochemical Properties of Surface and Groundwater Samples

Parameters	Surface Water	Groundwater	WHO Standard
Colour	2.0	5.0	5
Turbidity	3.32	12.96	10
Total solids (mg/l)	246	594	500–1500
Total filtrable solids (mg/l)	118	378	500
Total non-filtrable solids (mg/l)	123	216	500
Temperature (°C)	25.6	25.4	-
pH	6.9	8.2	6.5–8.5
Dissolved oxygen (mg/l)	4.4	3.1	---
Total alkalinity (mg/l)	140	194	120 Max
Total hardness (mg/l)	280	190	100–150
Calcium hardness (mg/l)	186	162	75–200
Calcium ion (mg/l)	74.4	64.8	-
Magnesium ion (mg/l)	22.93	6.83	30–50
Sulphate (mg/l)	28	39	250–400
Chloride (mg/l)	94	72	250
Conductivity (μS/cm)	862	1184	-
Salinity	729.3	620	-
Silica (mg/l)	3	4	-
Nitrate (mg/l)	2.64	3.37	25–50
Phosphate (mg/l)	0.21	0.97	-

4.2. Grouped bar chart presentation

Figure 4: Grouped Bar Chart for pH, Turbidity and Colour. This chart compares parameters with relatively close numerical ranges: pH, turbidity and colour.

The physicochemical characteristics of the water samples revealed variations in pH, turbidity, and colour between the surface and groundwater samples. Groundwater recorded higher turbidity values than surface water, indicating increased suspended contaminants possibly arising from poultry waste infiltration and runoff (Bello et al., 2024).

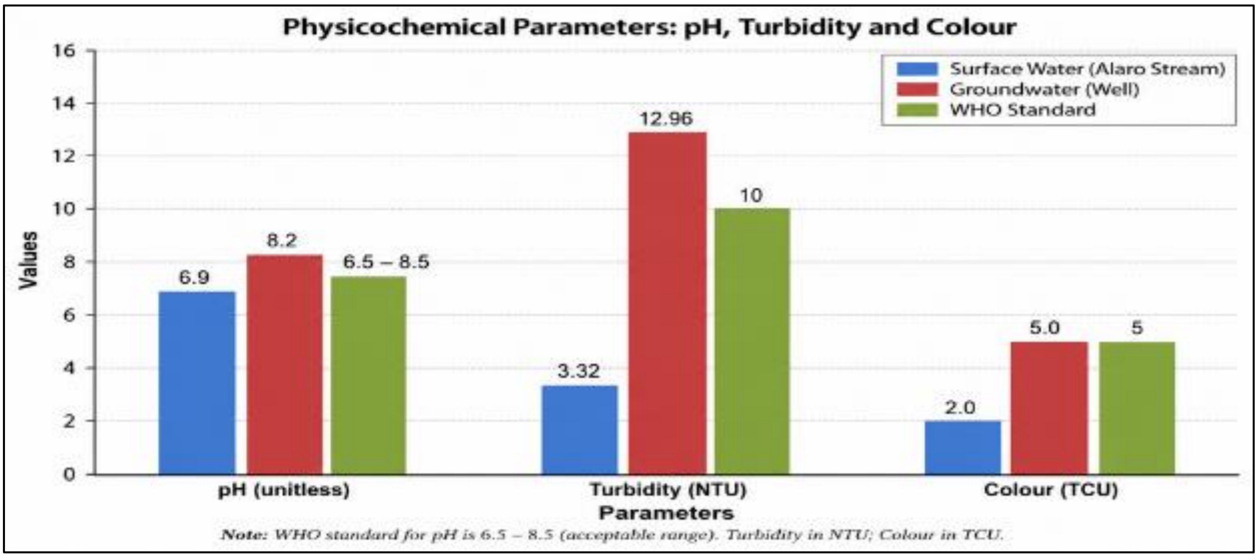

Figure 4 Bar chart showing pH, turbidity, and colour of surface and groundwater samples compared with WHO standards

The chart further indicates that the pH values for both samples remained within the WHO permissible range of 6.5–8.5, while groundwater turbidity exceeded the WHO recommended limit of 10 NTU. Elevated turbidity levels in groundwater sources around livestock environments have been linked to microbial contamination and poor sanitary conditions (WHO, 2022).

Figure 5 Grouped Bar Chart for Total Solids, Total Filtrable Solids and Total Non-Filtrable Solids

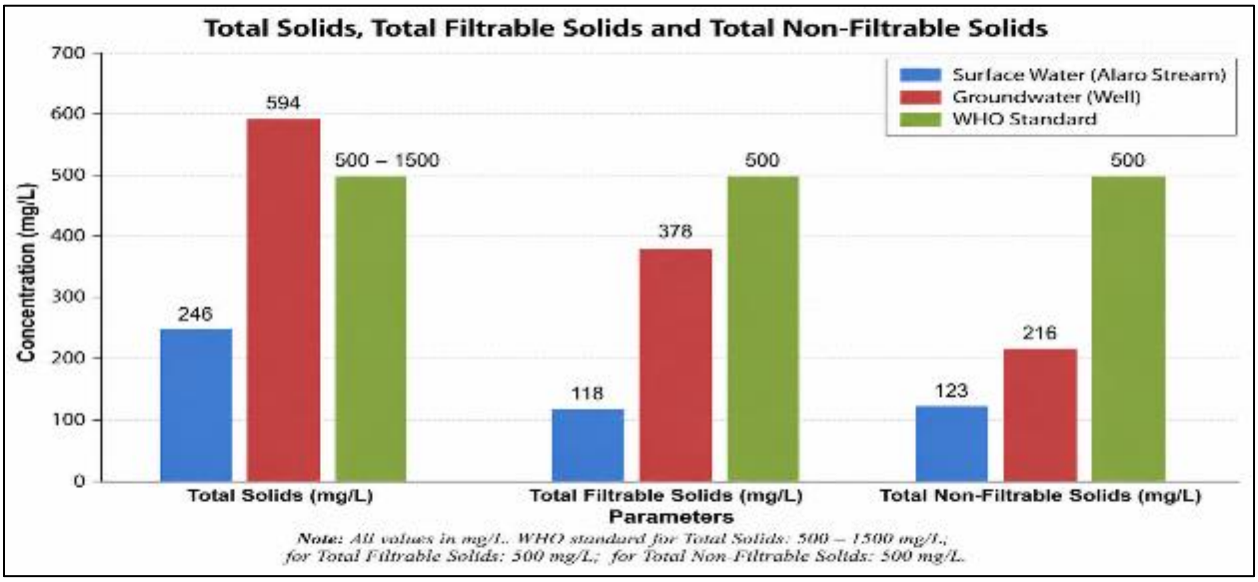

Figure 5 Bar chart showing total solids, TS, total filterable solids, and total non-filtrable solids of surface and groundwater samples compared with WHO standards

Groundwater recorded higher concentrations of total solids compared to surface water, indicating increased infiltration of dissolved and suspended contaminants into the aquifer system. Poultry waste materials contain substantial quantities of organic and inorganic substances capable of increasing total dissolved and suspended solids in nearby groundwater sources (Adewumi et al., 2021). Elevated solids concentration may impair water clarity and affect domestic usability.

Figure 6: Grouped Bar Chart for Total Hardness, Calcium Hardness and Total Alkalinity

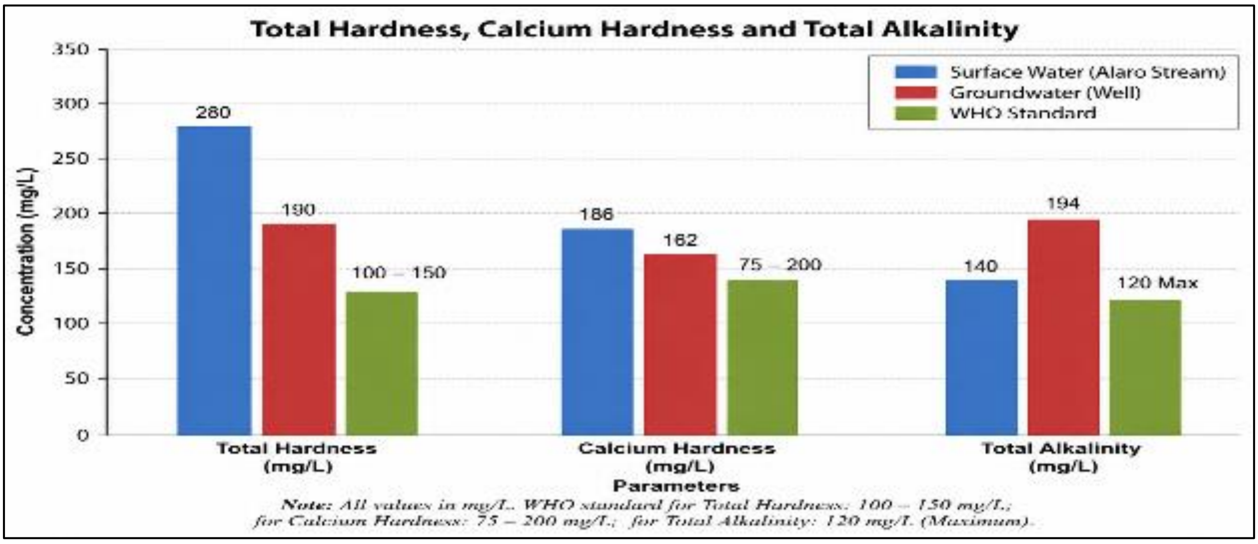

Figure 6 Bar chart showing total hardness, calcium hardness, and total alkalinity of surface and groundwater samples compared with WHO standards

Elevated hardness and alkalinity values observed in both water samples may be attributed to mineral dissolution and decomposition of poultry manure within the environment. According to Oyeku et al. (2023), animal waste decomposition contributes significantly to increased calcium, magnesium, and bicarbonate concentrations in groundwater systems surrounding livestock farms. High hardness levels may also affect water taste and cause scaling in household equipment and pipes.

Figure 7: Grouped Bar Chart for Sulphate, Chloride, Nitrate and Phosphate

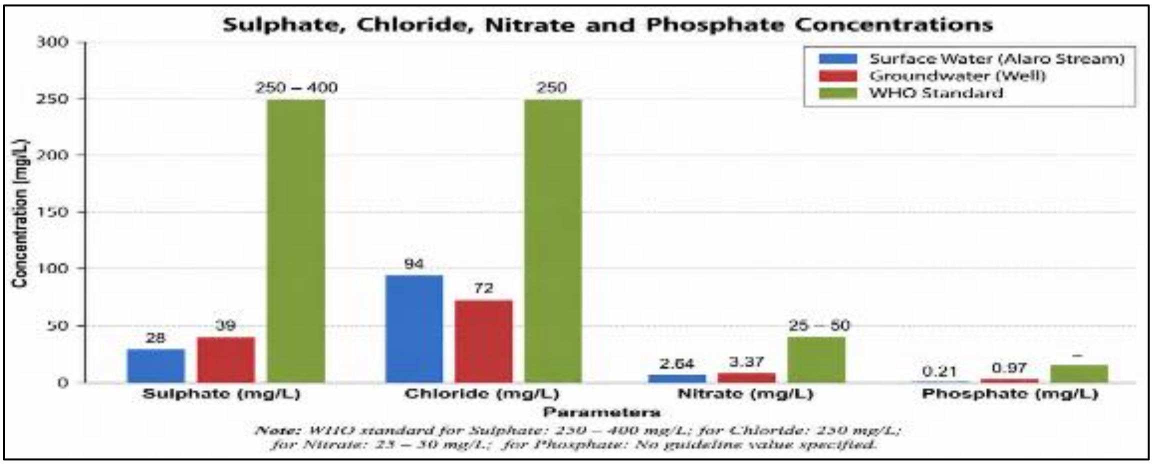

Figure 7 Bar chart showing sulphate, chloride, nitrate and phosphate of surface and groundwater samples compared with WHO standards

Although sulphate, chloride, nitrate, and phosphate concentrations remained within WHO permissible limits, slightly elevated nutrient concentrations in groundwater indicate nutrient enrichment from poultry waste infiltration. Excessive accumulation of nitrates and phosphates in water bodies has been linked to agricultural runoff and may contribute to eutrophication and ecological imbalance (UNEP, 2021). Similar findings were reported by Yusuf and Afolabi (2025) in groundwater contamination studies around poultry farming environments in Nigeria.

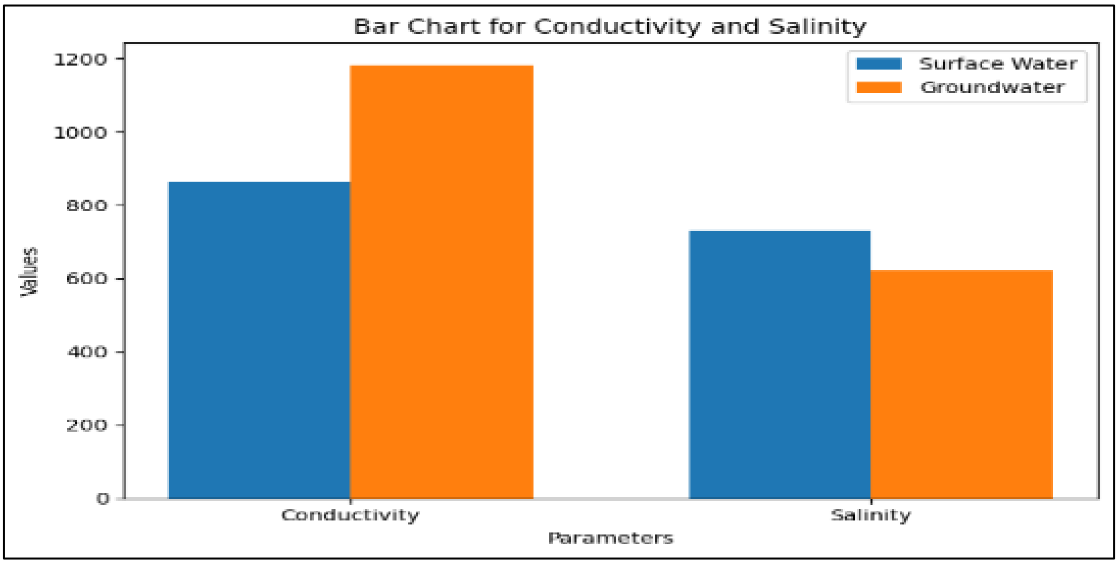

Figure 8 Grouped Bar Chart for Conductivity and Salinity

The high conductivity and salinity values observed in both water samples indicate increased concentrations of dissolved ionic substances. Elevated conductivity in groundwater is commonly associated with infiltration of agricultural and livestock waste containing dissolved salts and organic matter (Olajire and Adewoye, 2020). Groundwater recorded higher conductivity values, suggesting greater contaminant accumulation within the aquifer system.

4.3. Bacteriological Characteristics of Water Samples

Table 2 Bacteriological Properties of Water Samples

Parameters	Surface Water	Groundwater	WHO Standard
Colony count (mpn/100 ml)	217	305	100 Max
Coliform organisms (mpn/100 ml)	28	39	Nil
E. coli organisms	11	17	Nil
BOD (mg/l)	19.23	25.20	5
COD (mg/l)	24.53	28.26	2–5

Groundwater recorded higher bacteriological contamination than surface water. The presence of *E. coli* and coliform organisms confirm faecal contamination associated with poultry waste disposal practices. High microbial contamination in water sources around livestock farming areas has been widely reported in developing countries due to poor waste management systems (Bello et al., 2024).

Elevated BOD and COD values indicate excessive organic pollution resulting from microbial decomposition of poultry waste materials (WHO, 2022). High organic pollution levels may reduce dissolved oxygen concentrations and negatively affect aquatic ecosystems (UNEP, 2021).

The contamination levels observed may expose nearby residents to serious waterborne diseases such as cholera, typhoid fever, diarrhoea, and dysentery if untreated water is consumed.

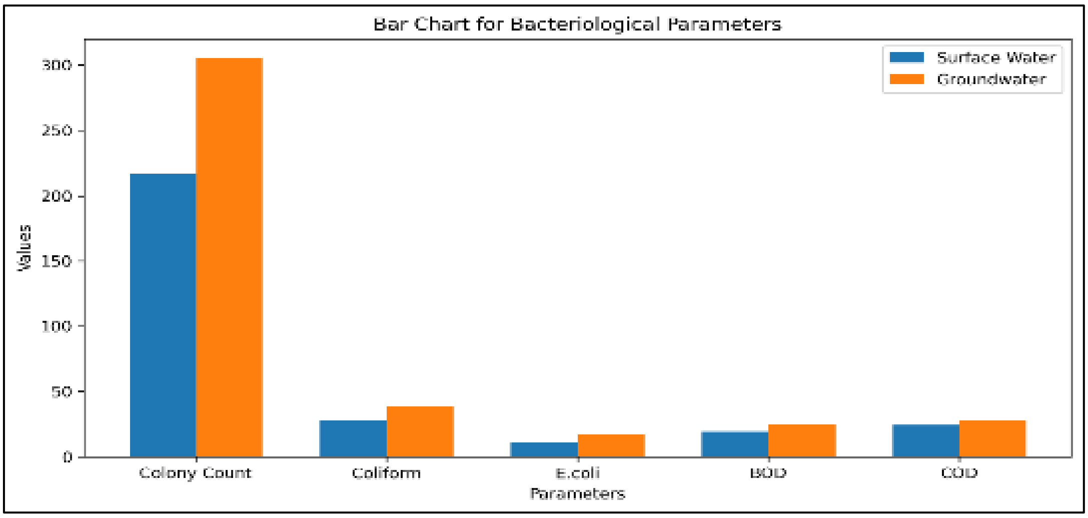

Figure 9 Bar chart showing colony count, coliform, *E. coli,* BOD and COD of surface and groundwater samples compared with WHO standards

5. General discussion

The findings of this study clearly demonstrate the significant impact of poultry farming activities on both surface and groundwater quality within the Alaro Stream environment. Elevated turbidity, hardness, alkalinity, BOD, COD, and microbial contamination indicate deterioration of water quality due to improper poultry waste management practices.

The presence of coliform organisms and *E. coli* confirms fecal contamination resulting from poultry manure runoff and infiltration into water sources. Similar findings were reported by Bello et al. (2024) and Yusuf and Afolabi (2025) in studies investigating agricultural pollution impacts on groundwater systems in Nigeria.

Low dissolved oxygen concentrations recorded in both samples suggest oxygen depletion caused by microbial decomposition of organic matter. Elevated BOD and COD values further indicate high levels of biodegradable and chemically oxidisable pollutants associated with poultry waste accumulation (Oyeku et al., 2023).

Although nitrate and sulphate concentrations remained within WHO standards, continuous discharge of poultry waste into the environment may eventually lead to nutrient enrichment, eutrophication, and severe degradation of aquatic ecosystems (UNEP, 2021).

6. Conclusion

This study evaluated the impact of poultry farming activities on surface and groundwater quality around Alaro Stream in Ibadan. The results revealed significant deterioration in water quality resulting from poultry waste contamination.

Several physicochemical and bacteriological parameters exceeded WHO permissible limits, particularly turbidity, total hardness, alkalinity, BOD, COD, and microbial indicators. The presence of coliform bacteria and *E. coli* suggests that the water sources may not be suitable for direct human consumption without adequate treatment.

The study concludes that intensive poultry farming activities constitute a major source of environmental pollution capable of threatening public health and degrading water resources within the study area.

Recommendations

Poultry farms should implement proper waste treatment and disposal systems. Government environmental agencies should strengthen monitoring and enforcement of environmental sanitation regulations. Regular assessment of groundwater and surface water quality should be conducted in poultry farming environments. Wells located near poultry farms should be adequately protected against contamination. Public awareness campaigns should be organised to educate farmers and residents on the dangers of contaminated water. Proper drainage systems should be constructed to minimise poultry waste runoff into nearby streams and groundwater recharge zones.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

[1] Adewumi, J. R., Adebayo, O. S., & Oladipo, A. A. (2021). Assessment of agricultural waste impact on groundwater quality in southwestern Nigeria. *Journal of Environmental Hydrology*, 29(3), 45–58.

[2] American Public Health Association (APHA). (2022). *Standard Methods for the Examination of Water and Wastewater* (24th ed.). Washington DC, USA.

[3] Bello, M. O., Akinyemi, T. O., & Yusuf, A. R. (2024). Water quality deterioration around livestock production areas in Nigeria. *African Journal of Environmental Science and Technology*, 18(2), 101–113.

[4] Olajire, A. A., & Adewoye, S. O. (2020). Microbial contamination of groundwater sources in peri-urban agricultural settlements. *Environmental Monitoring and Assessment*, 192(5), 311–320.

[5] Oyeku, O. M., Adesina, B. T., & Lawal, M. A. (2023). Influence of poultry farming on groundwater chemistry and public health. *Nigerian Journal of Environmental Engineering*, 15(1), 55–68.

[6] United Nations Environment Programme (UNEP). (2021). *Environmental Impacts of Agricultural Waste Management*. Nairobi, Kenya.

[7] World Health Organization (WHO). (2011). *Guidelines for Drinking-water Quality* (4th ed.). Geneva, Switzerland.

[8] World Health Organization (WHO). (2022). *Water Sanitation and Hygiene Progress Report 2000–2022*. Geneva, Switzerland.

[9] Yusuf, K. A., & Afolabi, T. A. (2025). Evaluation of groundwater pollution associated with intensive poultry farming in urban Nigeria. *International Journal of Water Resources and Environmental Engineering*, 17(1), 22–34.