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A COMPARATIVE STUDY ON WATER QUALITY ASSESSMENT OF VATADAHOSALLI LAKE AND DANDIGANAHALLI DAM

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Abstract
This study aims to evaluate and compare the water quality of two prominent water bodies, Vatadahosalli Lake and Dandiganahalli Dam, located in the region. The assessment is based on extensive data collected from three monitoring sites at each water body, covering various physicochemical and microbiological parameters over a period of one year. The data reveals significant variations in water quality parameters across the sites and water bodies. Vatadahosalli Lake exhibited relatively higher turbidity levels, with values ranging from 0 to 42 NTU, indicating the presence of suspended solids. Dandiganahalli Dam, on the other hand, showed elevated levels of dissolved solids, ranging from 87 to 298 mg/L, suggesting the influence of anthropogenic activities or geological factors. The pH values fluctuated between 6.7 and 8.55 across both water bodies, indicating slightly alkaline conditions. Total hardness, a measure of calcium and magnesium ions, varied from 24.02 to 112.1 mg/L in Vatadahosalli Lake and 36.03 to 107 mg/L in Dandiganahalli Dam, reflecting the impact of mineral composition and water sources. Microbiological parameters, such as total coliforms, fecal coliforms, and *E. coli*, were detected at several sites, indicating potential contamination from sewage or agricultural runoff. The presence of heavy metals like iron, copper, and lead was also observed, albeit at varying concentrations.

Keywords: Environmental Monitoring; Freshwater Ecosystems; Physicochemical Parameters; Spatial Variability; Water Quality Assessment

1. Introduction

Water is an essential resource for sustaining life on our planet, and its quality plays a crucial role in determining the well-being of ecosystems and human populations. Freshwater bodies, such as lakes and dams, serve as vital sources of water for various purposes, including drinking, agriculture, industry, and recreation [1-3]. However, these water bodies are increasingly facing threats from anthropogenic activities and environmental changes, which can significantly impact their water quality [4]. The present study focuses on the water quality assessment of two important water bodies, Vatadahosalli Lake and Dandiganahalli Dam, located in the region. Vatadahosalli Lake is a prominent freshwater lake that serves as a significant source of water for the surrounding areas. It plays a vital role in supporting aquatic life, providing recreational opportunities, and contributing to the overall ecosystem balance. On the other

hand, Dandiganahalli Dam is a crucial water storage and supply system, catering to the water needs of agriculture, domestic, and industrial sectors in the region [5-7].

Monitoring and evaluating the water quality of these water bodies is essential for ensuring their sustainable use and management. The quality of water is influenced by various factors, including natural processes, anthropogenic activities, and climatic conditions [8, 9]. Physicochemical parameters, such as pH, turbidity, dissolved solids, hardness, and nutrients, provide valuable insights into the overall water quality and potential sources of pollution. Additionally, microbiological parameters, including total coliforms, fecal coliforms, and *E. coli*, serve as indicators of potential health risks associated with water contamination [10, 11]. The study aims to comprehensively assess the water quality of Vatadahosalli Lake and Dandiganahalli Dam by analyzing a wide range of physicochemical and microbiological parameters. The data collected from three monitoring sites at each water body over a period of one year will enable a thorough understanding of the spatial and temporal variations in water quality.

2. Materials and Methods

2.1. Study Area

The study was conducted in the region where the two water bodies, Vatadahosalli Lake and Dandiganahalli Dam, are located. Vatadahosalli Lake is a freshwater lake situated in the heart of the city, serving as a recreational spot and an important habitat for aquatic life. The lake covers an area of approximately 2.5 square kilometers and has an average depth of 5 meters. Dandiganahalli Dam is a multipurpose dam located in the outskirts of the city, primarily used for water storage and supply for agricultural, domestic, and industrial purposes. The dam has a catchment area of around 50 square kilometers and a storage capacity of 20 million cubic meters.

2.2. Sampling Sites

Dandiganahalli Dam is located at 13°30'34" N and 77°39'29" E co-ordinates in the draught affected taluk of Gauribidanur taluk in Chikkaballapura District of South-East Karnataka (Fig 1). It is a perennial dam feeding the neighbouring agricultural farms, a site of sport fish and a picnic spot.

Vatadahosahalli Lake, an artificial rainfed-lake, was constructed in 1888 in Gudibande taluk of Chikkaballapur district, Karnataka. It is situated at an elevation of 750 m above sea level between 13.695268°N and 77.655207°E (Fig 2).

To obtain a comprehensive representation of the water quality, three sampling sites were selected for each water body based on factors such as accessibility, potential pollution sources, and proximity to human activities [12]. The sampling sites for Vatadahosalli Lake were designated as Site 1, Site 2, and Site 3, while the sampling sites for Dandiganahalli Dam were labelled as Site 1, Site 2, and Site 3.

Site 1 for Vatadahosalli Lake was located near the inflow point, where a stream enters the lake, potentially carrying pollutants from upstream sources. Site 2 was situated in the central part of the lake, representing the overall water quality. Site 3 was chosen near the outflow point, where water exits the lake, reflecting the cumulative impact of pollution sources. For Dandiganahalli Dam, Site 1 was established near the dam's spillway, where water is released for downstream

activities. Site 2 was located in the middle region of the reservoir, and Site 3 was positioned closer to the inflow point, where water enters the dam from various sources.

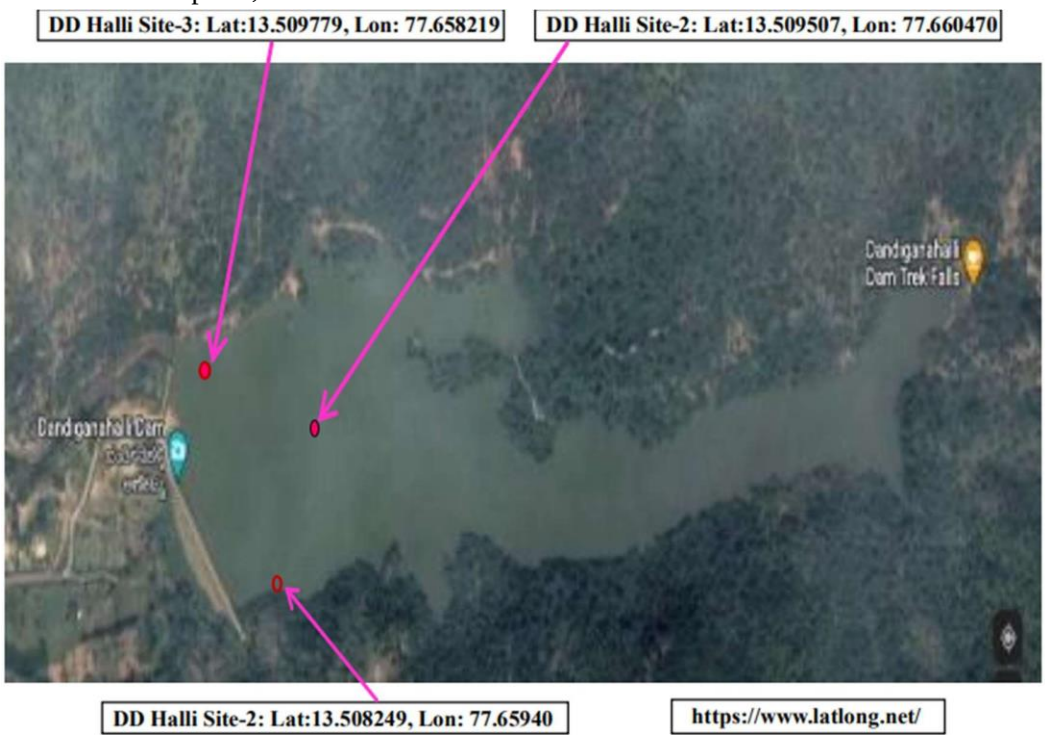

Fig 1. The site selection for the sampling A, B, and C in the map depicts the study area at Vatadahosalli Lake in Chikkaballapura, Karnataka, India

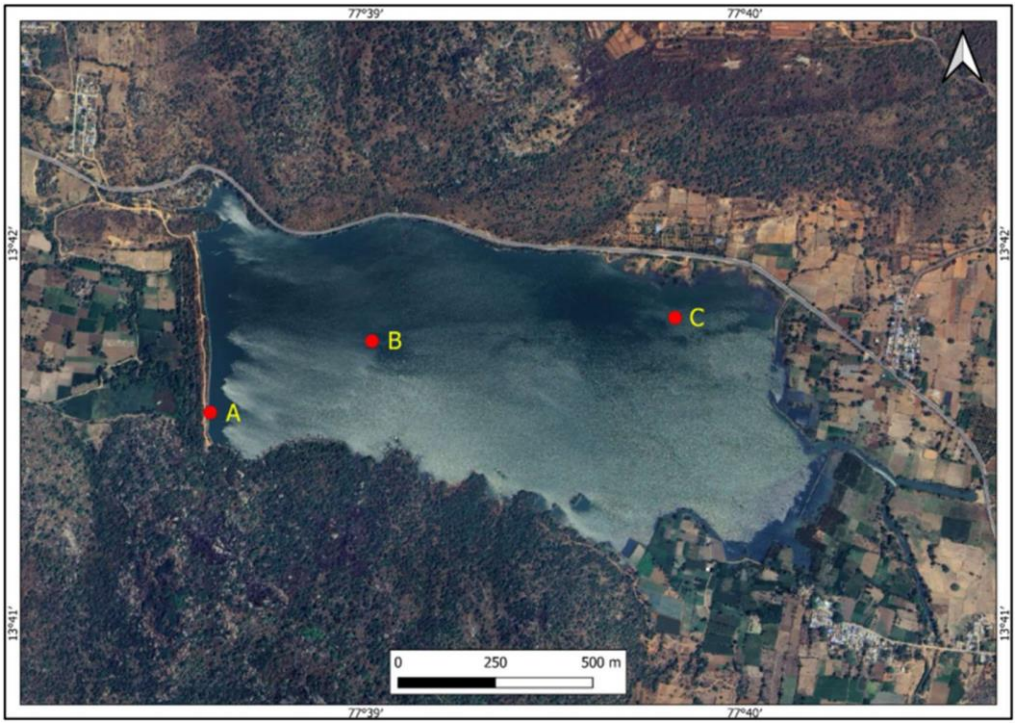

Fig 2. The site selection for the sampling A, B, and C in the map depicts the study area at Vatadahosahaali Lake in Chikkaballapura, Karnataka, India

2.3. Sampling and Analytical Procedures

Water samples were collected monthly from each of the six sampling sites over a period of one year, ensuring comprehensive coverage of seasonal variations. Standard sampling protocols were followed to ensure the integrity of the samples [13]. The collected water samples were immediately transported to the laboratory for analysis of various physicochemical and microbiological parameters. The physicochemical parameters analyzed included temperature, pH, turbidity, dissolved solids, hardness, alkalinity, chlorides, calcium, fluoride, nitrate, sulfate, total suspended solids, biochemical oxygen demand (BOD), chemical oxygen demand (COD), phosphate, conductivity, phenolic compounds, color, dissolved oxygen, free carbon dioxide, magnesium, iron, mercury, cadmium, selenium, manganese, copper, arsenic, lead, cyanide, chromium, zinc, silica, nickel, and aluminium. The microbiological parameters analyzed were total coliforms, fecal coliforms, and Escherichia coli (*E. coli*), which are indicators of potential contamination from sewage or animal waste [14, 15].

The analyses were performed using standard methods and procedures outlined by recognized authorities, such as the American Public Health Association (APHA), the United States Environmental Protection Agency (EPA), and the World Health Organization (WHO) [1, 9, 14, 15]. Appropriate quality control measures were implemented to ensure the reliability and accuracy of the analytical results.

2.4. Data Analysis

The collected data was subjected to rigorous statistical analysis to evaluate the water quality of the two water bodies and identify any significant spatial and temporal variations. Descriptive statistics, including mean, median, and range, were calculated for each parameter to summarize the data and facilitate comparisons [3, 7]. Analysis of Variance (ANOVA) is employed to identify patterns and relationships among the water quality parameters, as well as to determine potential sources of pollution.

3. Results and Discussion

3.1. Physicochemical Parameters

3.1.1. Temperature, pH, and Turbidity

Temperature plays a crucial role in regulating various physicochemical and biological processes in water bodies. The temperature data for Vatadahosalli Lake and Dandiganahalli Dam is presented in Table 1.

Table 1: Temperature data for Vatadahosalli Lake

Site	Vatadahosalli Lake			Dandiganahalli Dam		
	Minimum (°C)	Maximum (°C)	Mean ± SD (°C)	Minimum (°C)	Maximum (°C)	Mean ± SD (°C)
Site 1	21.0	29.5	25.6 ± 2.1	21.0	29.0	25.4 ± 1.9
Site 2	21.0	28.5	25.2 ± 1.8	21.0	29.5	25.7 ± 2.2
Site 3	22.0	28.0	25.0 ± 1.6	22.0	28.0	25.1 ± 1.5

The temperature range observed in both water bodies was similar, with values ranging from

21°C to 29.5°C. The variations in temperature can be attributed to seasonal changes and climatic factors. Higher temperatures were recorded during the summer months, while lower temperatures were observed during the winter season. pH is a crucial parameter that influences the solubility and availability of nutrients and heavy metals in water [16, 17]. The pH values for Vatadahosalli Lake and Dandiganahalli Dam are presented in Table 2.

Table 2: pH data of Vatadahosalli Lake and Dandiganahalli Dam

Site	Vatadahosalli Lake			Dandiganahalli Dam		
	Minimum	**Maximum**	**Mean ± SD**	**Minimum**	**Maximum**	**Mean ± SD**
Site 1	6.7	8.2	7.5 ± 0.4	6.92	8.54	7.8 ± 0.5
Site 2	6.9	8.1	7.6 ± 0.3	6.92	8.54	7.8 ± 0.5
Site 3	7.0	8.55	7.7 ± 0.4	7.14	8.54	7.9 ± 0.4

The pH values for both water bodies ranged from slightly acidic to slightly alkaline conditions, with the majority of the values falling within the acceptable range for aquatic life and domestic use. However, some sites exhibited pH values outside the recommended range, which could potentially impact the ecosystem and water quality [18, 19].

Turbidity is a measure of the clarity of water and is influenced by the presence of suspended particles, such as clay, silt, organic matter, and microscopic organisms [20, 21]. The turbidity data for Vatadahosalli Lake and Dandiganahalli Dam is presented in Table 3.

Table 3: Turbidity data for Vatadahosalli Lake (in NTU)

Site	Vatadahosalli Lake				Dandiganahalli Dam			
	Min	**Max**	**Mean ± SD**	**Median**	**Min**	**Max**	**Mean ± SD**	**Median**
Site 1	0	43	15.2	7	0	9.4	3.1	1
Site 2	0	34	11.8	6	0	34	7.2	1
Site 3	0	20	6.5	4	0	7	2.3	1

The turbidity levels in Vatadahosalli Lake were generally higher compared to Dandiganahalli Dam, with Site 1 exhibiting the highest turbidity values. This could be attributed to the inflow of water carrying suspended particles from upstream sources or resuspension of sediments due to human activities or natural processes [22].

Dandiganahalli Dam exhibited relatively lower turbidity levels, with occasional spikes observed at certain sites, potentially due to factors such as rainfall events or construction activities in the surrounding areas [23]. High turbidity levels can have adverse impacts on aquatic life by reducing light penetration, affecting photosynthesis, and clogging the gills of aquatic organisms. Additionally, turbid water can harbor pathogens and contaminants, posing health risks for human consumption and recreational activities.

3.1.2. Dissolved Solids and Hardness

Dissolved solids refer to the total concentration of inorganic salts and organic matter present in water. The dissolved solids data for Vatadahosalli Lake and Dandiganahalli Dam is presented in Table 4.

Table 4: Dissolved Solids data for Vatadahosalli Lake (in mg/L)

Site	Vatadahosalli Lake				Dandiganahalli Dam			
	Min	Max	Mean ± SD	Median	Min	Max	Mean ± SD	Median
Site 1	130	250	172	150	87	298	207	211
Site 2	130	192	159	150	87	282	208	238
Site 3	87	198	149	155	136	276	196	179

The dissolved solids levels in Dandiganahalli Dam were generally higher compared to Vatadahosalli Lake, with maximum values reaching up to 298 mg/L. High dissolved solids can be attributed to various factors, including natural processes such as weathering of rocks and soil erosion, as well as anthropogenic activities like agricultural runoff, industrial effluents, and domestic wastewater discharges [24, 25].

Hardness is a measure of the concentration of divalent cations, primarily calcium and magnesium, present in water. The hardness data for Vatadahosalli Lake and Dandiganahalli Dam is presented in Table 5.

Table 5: Hardness data for Vatadahosalli Lake (in mg/L as $CaCO_3$)

Site	Vatadahosalli Lake				Dandiganahalli Dam			
	Min	Max	Mean ± SD	Median	Min	Max	Mean ± SD	Median
Site 1	36.03	92.08	68.2 ± 16.5	66.98	36.03	107	71.5 ± 21.4	72
Site 2	36.03	80.07	62.1 ± 13.2	63.08	36.03	107	67.8 ± 22.1	60.05
Site 3	24.02	112.1	64.8 ± 25.6	60.05	36.03	78.25	58.1 ± 12.8	57.86

The hardness levels in both water bodies were relatively high, with some sites exceeding the recommended levels for domestic and industrial use. High hardness can lead to scaling in pipes and heating systems, as well as reduced efficiency of soaps and detergents [26].

3.1.3. Nutrients and Organic Matter

Nutrients, such as nitrate and phosphate, play a crucial role in supporting aquatic life but can also contribute to excessive algal growth and eutrophication when present in excessive amounts. The data for nutrients and organic matter in Vatadahosalli Lake and Dandiganahalli Dam is presented in Table 6, respectively.

Table 6: Nutrients and Organic Matter data for Vatadahosalli Lake

Parameter	Vatadahosalli Lake				Dandiganahalli Dam			
	Min	Max	Mean ± SD	Median	Min	Max	Mean ± SD	Median
Nitrate (mg/L)	0	0.8	0.18	0.018	0	0.452	0.15	0.019
Phosphate (mg/L)	0	1.78	0.52	0.1	0	1.45	0.54	0.1
BOD (mg/L)	1	17.2	5.3	4.3	1.65	7.9	4.7	4.8
COD (mg/L)	10	93	39.6	35	10	90	38.4	32

The nitrate and phosphate levels in both water bodies exhibited considerable variations, with some sites showing elevated concentrations. High levels of these nutrients can lead to excessive algal growth, depletion of dissolved oxygen, and potential eutrophication [27].

Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) are indicators of organic matter and the potential for oxygen depletion in water bodies. Both water bodies exhibited moderate to high levels of BOD and COD, suggesting the presence of organic pollution from sources such as domestic wastewater, agricultural runoff, or industrial effluents [28].

3.1.4. Heavy Metals

Heavy metals are naturally occurring elements that can be toxic to aquatic life and human health at elevated concentrations. The data for selected heavy metals in Vatadahosalli Lake and Dandiganahalli Dam is presented in Table 7.

Table 7: Heavy Metal data for Vatadahosalli Lake (in mg/L)

Parameter	Vatadahosalli Lake				Dandiganahalli Dam			
	Min	Max	Mean ± SD	Median	Min	Max	Mean ± SD	Median
Iron (mg/L)	0.01	0.35	0.15	0.12	0.05	0.5	0.23	0.2
Copper (mg/L)	0.001	0.025	0.01	0.009	0.002	0.04	0.02	0.015
Lead (mg/L)	0.001	0.02	0.01	0.005	0.001	0.03	0.01	0.008

The levels of heavy metals, such as iron, copper, and lead, were generally low to moderate in both water bodies. However, some sites exhibited slightly elevated concentrations, potentially due to industrial effluents, agricultural runoff, or natural geological sources. Elevated levels of heavy metals can have adverse effects on aquatic organisms, accumulate in the food chain, and pose health risks to humans through consumption of contaminated water or food sources [29]

3.2. Microbiological Parameters

Microbiological parameters, such as total coliforms, fecal coliforms, and Escherichia coli (*E. coli*), are essential indicators of potential contamination from sewage or animal waste. The presence of these microorganisms in water bodies can pose significant health risks for human consumption and recreational activities.

3.2.1. Total Coliforms

Total coliforms are a group of bacteria that are commonly found in the environment and can originate from various sources, including soil, plants, and fecal matter. The data for total coliforms in Vatadahosalli Lake and Dandiganahalli Dam is presented in Table 8.

Table 8: Total Coliforms data for Vatadahosalli Lake (in MPN/100 mL)

Site	Vatadahosalli Lake				Dandiganahalli Dam			
	Min	Max	Mean ± SD	Median	Min	Max	Mean ± SD	Median
Site 1	16	2800	898	650	6	1800	521	460
Site 2	8	1600	427	350	4	1100	340	290
Site 3	4	900	287	220	2	600	218	180

The total coliform levels in both water bodies varied considerably across the sampling sites and throughout the year. Vatadahosalli Lake exhibited higher levels of total coliforms compared to Dandiganahalli Dam, with maximum values reaching up to 2800 MPN/100 mL at Site 1. These elevated levels could be attributed to factors such as urban runoff, leakage from sewage systems, or animal waste [30].

3.2.2. Fecal Coliforms and *E. coli*

Fecal coliforms and *E. coli* are specific subgroups of coliform bacteria that are directly associated with fecal contamination from warm-blooded animals, including humans. Their presence in water bodies is a direct indicator of potential health risks and the need for appropriate treatment and disinfection. The data for fecal coliforms and *E. coli* in Vatadahosalli Lake and Dandiganahalli Dam are presented in Table 9.

Table 9: Fecal Coliforms and *E. coli* data for Vatadahosalli Lake (in MPN/100 mL)

Parameter	Site	Vatadahosalli Lake				Dandiganahalli Dam			
		Min	Max	Mean ± SD	Median	Min	Max	Mean ± SD	Median
Fecal Coliforms	1	4	1100	284	160	2	700	193	130
	2	2	800	172	90	0	400	116	80
	3	0	400	98	50	0	200	58	30
E. coli	1	2	600	168	100	0	300	92	60
	2	0	300	82	40	0	200	48	30
	3	0	200	42	20	0	100	22	10

The presence of fecal coliforms and *E. coli* was detected in both water bodies, with higher concentrations observed in Vatadahosalli Lake compared to Dandiganahalli Dam. The maximum values of fecal coliforms and *E. coli* in Vatadahosalli Lake were 1100 MPN/100 mL and 600 MPN/100 mL, respectively, at Site 1. These elevated levels indicate potential fecal contamination, likely from sewage leakages, improper waste disposal, or agricultural runoff [32].

3.3. Spatial and Temporal Variations

The water quality parameters exhibited significant spatial and temporal variations across the sampling sites and throughout the sampling period. These variations can be attributed to various factors, including seasonal changes, climatic conditions, anthropogenic activities, and inherent characteristics of the water bodies [33].

3.3.1 Spatial Variations:

The spatial variations in water quality parameters were observed among the sampling sites within each water body. Table 10 presents the spatial variations in selected parameters for Vatadahosalli Lake and Dandiganahalli Dam.

Table 10: Spatial variations in selected parameters for Vatadahosalli Lake

Parameter	Vatadahosalli Lake			Dandiganahalli Dam		
	Site 1	Site 2	Site 3	Site 1	Site 2	Site 3
pH	7.5	7.6	7.7	7.8	7.8	7.9
Turbidity (NTU)	15.2	11.8	6.5	3.1	7.2	2.3
Dissolved Solids (mg/L)	172	159	149	207	208	196
Nitrate (mg/L)	0.28	0.14	0.12	0.22	0.18	0.05
BOD (mg/L)	7.4	4.8	3.7	5.6	4.3	4.2
Total Coliforms (MPN/100 mL)	898	427	287	521	340	218

The spatial variations can be attributed to factors such as:

- Inflow points of pollutants or contaminants
- Local anthropogenic activities (e.g., domestic wastewater discharge, agricultural runoff)
- Hydrodynamic patterns and water circulation within the water bodies
- Presence of aquatic vegetation or sediment resuspension

3.3.2 Temporal Variations:

Temporal variations in water quality parameters were observed throughout the sampling period, influenced by seasonal changes, climatic conditions, and human activities. Table 11 illustrate the temporal variations in selected parameters for Vatadahosalli Lake and Dandiganahalli Dam.

Table 11: Temporal variations in selected parameters for Vatadahosalli Lake

Parameter	Vatadahosalli Lake		Dandiganahalli Dam	
	Dry Season	Rainy Season	Dry Season	Rainy Season
Temperature (°C)	27.5	23.8	27.2	23.6
Turbidity (NTU)	8.2	16.8	2.8	7.6
Dissolved Oxygen (mg/L)	6.1	4.8	6.8	5.2
BOD (mg/L)	3.9	6.7	3.1	6.3
Total Coliforms (MPN/100 mL)	420	805	280	560

The temporal variations can be influenced by factors such as:

- Rainfall patterns and runoff
- Temperature fluctuations affecting biological and chemical processes
- Seasonal changes in anthropogenic activities (e.g., agricultural practices, tourism)
- Stratification and mixing patterns in the water bodies

Understanding spatial and temporal variations in water quality is crucial for effective management strategies and mitigation measures [34]. Regular monitoring and targeted interventions at specific locations or during critical seasons can help address the identified issues and maintain the water quality within acceptable limits.

3.4. Comparison of Water Quality between Vatadahosalli Lake and Dandiganahalli Dam

The water quality of Vatadahosalli Lake and Dandiganahalli Dam exhibited distinct differences in various parameters, reflecting the unique characteristics and influences of each water body. Figure 1 presents a comparison of selected water quality parameters between the two water bodies.

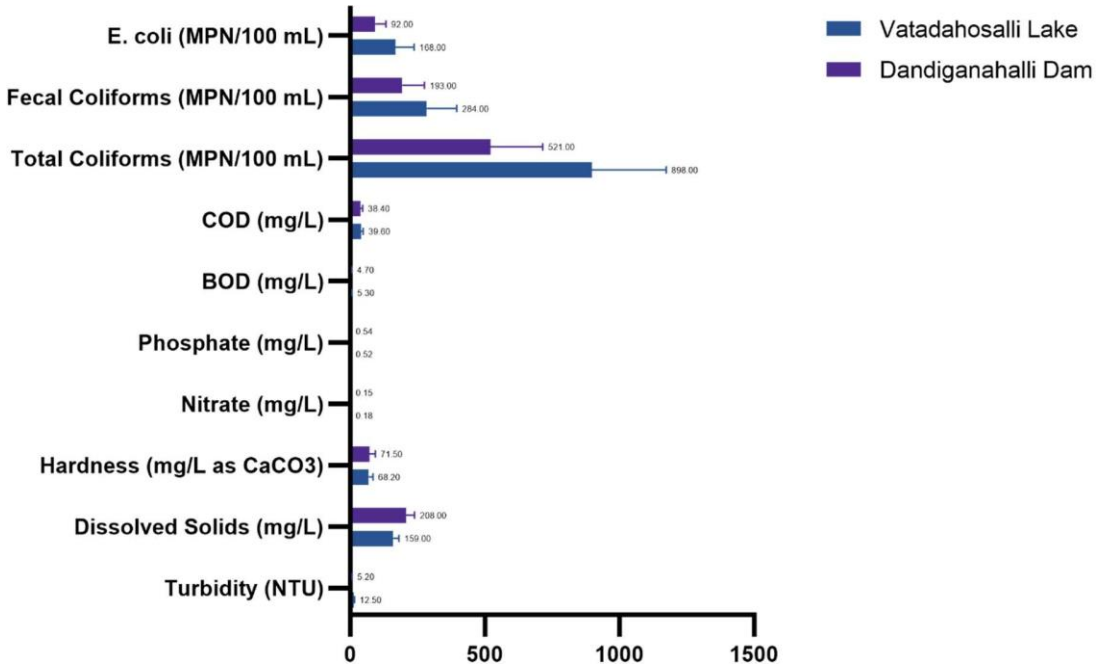

Figure 1: Comparison of water quality parameters between Vatadahosalli Lake and Dandiganahalli Dam

The comparison reveals that Vatadahosalli Lake exhibited higher levels of turbidity, hardness, nitrate, BOD, total coliforms, fecal coliforms, and *E. coli* compared to Dandiganahalli Dam. These elevated levels can be attributed to factors such as urban runoff, domestic wastewater discharge, and proximity to human activities within the city.

On the other hand, Dandiganahalli Dam had higher concentrations of dissolved solids, likely due to natural geological sources and agricultural activities in the surrounding areas. The differences in water quality between the two water bodies highlight the impact of their respective locations, catchment characteristics, and anthropogenic influences [35]. Vatadahosalli Lake, being situated within the city limits, is more susceptible to urban pollution sources, while Dandiganahalli Dam is influenced by agricultural and industrial activities in the surrounding regions.

3.5 Statistical Analysis

The analysis of variance (ANOVA) was conducted to assess the differences in various water quality parameters across multiple lakes and sites. The results revealed that most parameters did not exhibit significant variations among the different locations. However, the total suspended solids showed a statistically significant difference (p-value = 0.0264), indicating that the levels of suspended solids varied significantly across the water bodies and sites.

It is important to note that the p-value is a measure of the strength of evidence against the null hypothesis, which assumes no difference among the groups. A p-value lower than the chosen significance level (typically 0.05) indicates a statistically significant difference, while a higher p-value suggests that the observed differences could be due to chance.

The findings of this study suggest that, while most water quality parameters were relatively

consistent across the studied locations, the total suspended solids varied significantly. This variation could be attributed to various factors, such as the presence of organic matter, soil erosion, or anthropogenic activities in the respective areas.

Table 12: Statistical analysis of various parameters using one-way ANOVA

Parameter	**p-value**	**Significant Difference**
Water Temperature	0.8900	No
Total Hardness	0.1512	No
Chlorides	0.5540	No
Calcium as $CaCO_3$	0.1814	No
Fluoride	0.3019	No
Nitrate	0.9842	No
Sulphate	0.7523	No
Total Suspended Solids	0.0264	Yes
Biochemical Oxygen Demand	0.7570	No
Chemical Oxygen Demand	0.8427	No
Phosphate	0.5299	No
Conductivity	0.8706	No
Phenolic Compounds	-	No compounds detected
Colour	0.7280	No
Total Dissolved Oxygen	0.6212	No
Free Carbon Dioxide	0.2642	No
Magnesium	0.5301	No

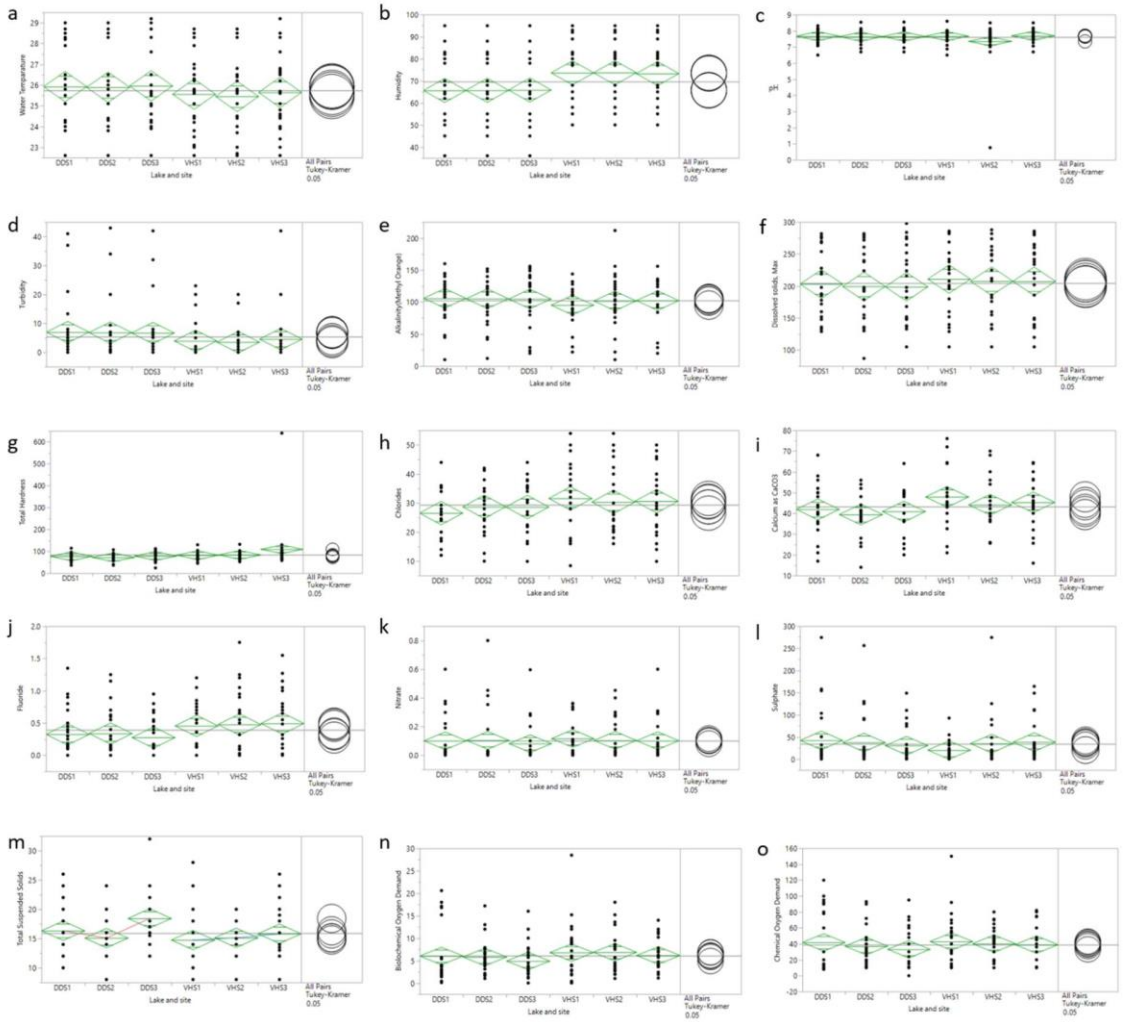

Figure 2: One way ANOVA of a. Water temperature b. humidity c. pH d. Turbidity e. Alkalinity f. Dissolved solids g. Total hardness h. Chlorides i. Calcium j. Fluorides k. Nitrates l. Sulphates m. Total suspended solids n. BOD o. COD in different sites of Vatadahosalli Lake and Dandiganahalli Dam

Conclusion

In the conclusion, significant variations in the water quality, which has evidenced by the findings in all the seasons in selected sites of the reservoirs, it has been due to pollution and less use of water for the agriculture or consumption, may standing long time deteriorate the physicochemical properties of the lake and dam. The findings revealed significant spatial and temporal variations in water quality parameters across the sampling sites and throughout the sampling period. Vatadahosalli Lake exhibited higher levels of turbidity, hardness, nutrients (nitrate), organic pollution indicators (BOD), and microbiological contamination (total coliforms, fecal coliforms, and *E. coli*) compared to Dandiganahalli Dam. These elevated levels can be attributed to factors such as urban runoff, domestic wastewater discharge, and proximity to human activities within the city limits. On the other hand, Dandiganahalli Dam had higher concentrations of dissolved solids, likely due to natural geological sources and agricultural

activities in the surrounding areas. The temporal variations in water quality parameters were influenced by factors such as rainfall patterns, temperature fluctuations, and seasonal changes in anthropogenic activities. The experimental data indicate that the lake is moderately polluted and certain precautionary and constructive steps may avoid further eutrophication of lakes. The entry of pesticide containers, thinners, lubricants and direct flow of drainage from livestock facilities into lake should be restricted to reduce pollution. People should be educated regarding method of domestic water treatment, type of toilet facility and human waste disposal. This may contribute to decrease in the water pollution. Some of the measures like maintaining grass buffer strip around the lake, remediation of sewage domestic waste and sedimentation of agricultural runoff to reduce the particulate matter before entering lake may reduce rate of pollution.

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