



STUDIES ON THE OCCURRENCE OF *E. COLI* IN THE SELECTED LAKES OF KOLAR KARNATAKA

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Abstract

The occurrence of waterborne pathogen (*E. coli*) was investigated at three different sites in Muduvadi and Uttanur lakes located in Kolar district, Karnataka from July 2022 to June 2024 in water samples. The results showed that shootup in colony during the study period. As the results indicated that 1000 or more than 1000 colonies in 100 ml of samples water in the August 2022, October 2022, January 2023, February 2023, April 2023, January 2024, February 2024, May 2024 and June 2024 months in Muduvadi lake. Whereas, in Uttanuru lake, only in January to February 2024 the colonies raised to 1000 and more. Further in Muduvadi lake, the colonies raised to the maximum i.e. ≥ 2000 during March 2023, May, 2023, August 2023 and October 2023. Whereas, in Uttanur only in the month of March the values were increased. The highest colonies were recorded in March 2023, July 2023 (only in Muduvadi lake water), October-November-December of 2023 in all the selected study sites. The lowest (lesser than 1000 MPN/100ml) count was noticed in the early and latter months of the experiment. The present study showed that both the quality of water in the lakes were fluctuating between fair and poor category due to various anthropocentric activities.

Key words: *E. coli*, pathogens, Heterotrophic bacteria

Introduction

Bacteria are known to efficiently decompose organic matter and regenerate minerals in aquatic ecosystems, and their abundance represents an index of heterotrophic activity (Tranvik, 1990; Overbeck and Chrost, 1998). It has been shown that bacterial metabolism can change very rapidly in response to changes in environmental conditions, probably more rapidly than in other planktonic organisms (Eduardo Santero, et al., 2016). Bacteria play an important role in the structure and function of the microbial food web, in relation to environmental conditions such as temperature (Burian Alfred et al., 2023), resource availability (Cole, 1996) and predation (Thouvenot et al., 1999). According to Ryan et al. (2006) the combination of continuous nutrient input and a general lack of higher trophic level food chain results in a system dominated by microbial activity. In terms of ecology of aquatic environments, bacteria serve a number of functions including the mineralization of organic matter, contributing essential growth factors to organisms to other trophic levels. Several investigators have noticed that the bacterial population varies greatly between different types of lakes (Lindstrom, 2000; Zwart et al. 2002; Yannarell and Triplett, 2004). Heterotrophic bacteria such as *Pseudomonas*, *Aeromonas*, *Staphylococcus* are regarded as indicators of degree of pollution by organic substances, they are fast assimilators (Albinger, 1992). Sewage effluent harbors *Shigella* and *E. coli* and several pathogenic species (Yu, et al., 2022). It has been shown that bacterial metabolism can change very rapidly in response to changes in environmental conditions, probably more rapidly than in other organisms (Debashis and Chanchal, 1992; Eduardo Santero, et al., 2016). Whipple and Rohovec (1994) and APHA, (1998) reported that the temperature and pH are the limiting factors for the survival of the bacteria in the environment.

Materials and methods

Study area

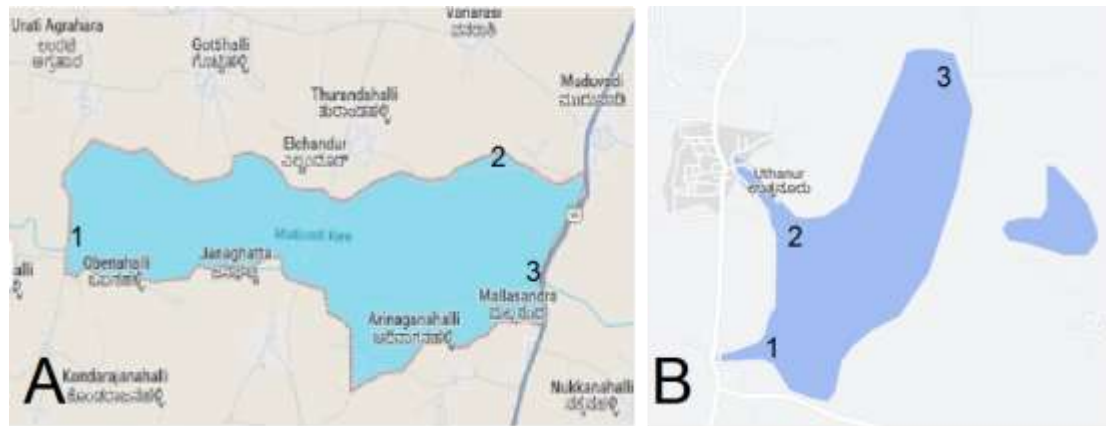


Fig. 1 Map of the study area: A) Muduvadi lake B) Uttanur lake (1,2,3 are collection sites)

Muduvadi lake second biggest lake spread over 1,000 acres and 8 Km away from Kolar City. It is manmade, rain fed and being used for agricultural purpose, located geographically at latitude latitude 13 ° 12' 0" N and longitude 13 ° 12' 0" E. Uttanur lake located geographically at 13°11'48.2"N 78°17'49.3"E, covers around 230 acres. The lakes surrounded by diverse landscape with Bamboo, Auriculiformis tree vegetation and are part of Karnataka watershed development program of Govt of Karnataka. Despite of wide use of these lakes in fishing and aquaculture activities, the lake receives discharges from human settlement, plain land agricultural area, Dish-washing, cloth washing and cattle washing are common daily observed activities.

Sample collection

The water samples were collected from three stations in each lake for enumeration of bacterial population. The samples were collected on sterilized containers aseptically and kept in ice box in order to avoid temperature variations. In the laboratory, pour plate method was performed using nutrient agar after making appropriate serial dilution of the samples. The plates were incubated at 35° C. The enumeration of the colonies was done after 12-24 hours and recorded as number of CFU/ml for water sample (Garrrity, 2001). Staining the bacterial smear on a clean glass slide with a drops of Crystal violet (primary stain) followed by a few drops of safranin (secondary stain) after a drop of Gram stain. Iodine (mordant) showed crystal violet or purple appearance under the microscope. The gram positive bacteria stain purple (violet) in color while the gram negative bacteria appear pink.

Results and Discussion

Table 1. Comparison of *E. coli* counts (MPN/100 ml) in Muduvadi Lake and Uttanuru lake water sources

Months	Muduvadi Lake			Uttanuru lake		
	Site 1	Site 2	Site 3	Site 1	Site 2	Site 3
July-2022	490	460	1100	160	150	150
Aug-2022	1100	1100	1100	95	95	64
Sep-2022	490	490	490	160	150	150
Oct-2022	1100	1100	1100	75	95	93
Nov-2022	460	460	1100	210	290	210
Dec-2022	1100	1100	1100	290	290	160
Jan -2023	1294.5	1200	1172.7	986.3	940.9	-
Feb -2023	1163.6	1690.9	1272.7	231.8	309.8	554.5
Mar-2023	2182	2272	2591	1454	2227	2681
April-2023	1636	3136.3	2227.1	768.1	340.9	609.9
May-2023	2091	1386.3	1268.1	955	1119.9	918.1

June-2023	922.7	1004.5	1527.5	659	1081.9	822.7
July-2023	3500	4000	3454.5	818.1	1090.9	727.2
Aug-2023	2227	2454.5	2772.7	954.5	1636.3	1500
Sept-2023	922	1004.5	1527.2	659	1081.9	822.7
Oct-2023	2454.5	3136.3	3227.2	1318.1	1727.2	1090.9
Nov-2023	3409.9	3181.8	2909.9	1636.3	1818.1	2000
Dec-2023	4136.3	3863.6	4136.3	2545.4	2727.2	2272.7
Jan -2024	1181.8	1272.2	1454.5	774.5	1090.9	636.3
Feb-2024	1318.8	1515.4	2772.7	727.2	818.18	1000
Mar-2024	945.5	909	818.8	636.2	774.5	409.9
April-2024	818.8	1000	1090.9	590.9	508	681.8
May-2024	1118.8	1000	1363.6	681.8	409.9	772.7
June-2024	1090.9	1454.5	1545.4	500	681.8	681.8

Coliform bacteria (CB) are a group of bacteria found in many environments, but are primarily associated with human and animal intestines and wastes. *Escherichia coli* is abundantly found in the gastro intestinal tracts of humans, birds and animals, but rarely found in water or soil that has not been subjected to faecal pollution (Jennings et al., 2018). They are commonly used as an indicator of water quality, and have a long history of being used for assessing drinking water seafood safety (Brown et al., 2020).

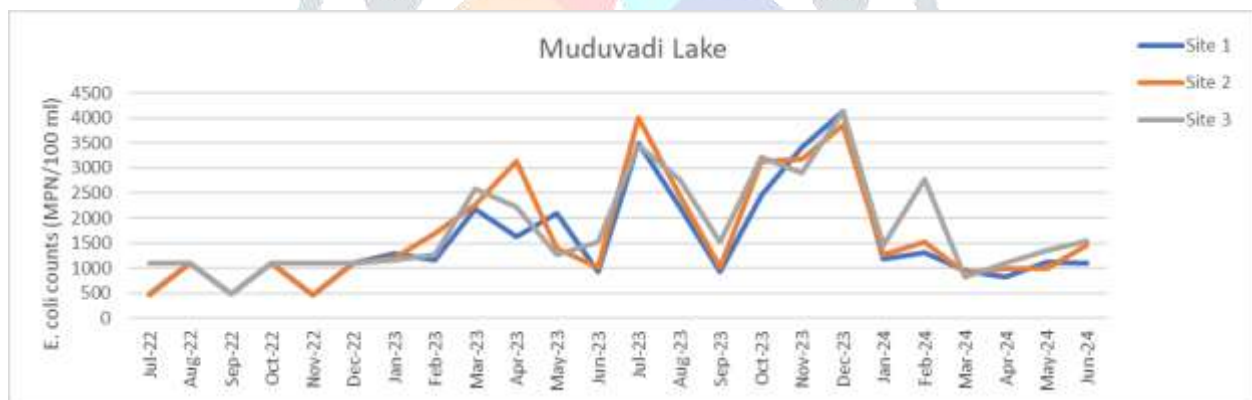


Fig. 2. Trend variation in *E.coli* colonies (MPN/100ml) in Muduvadi lake water

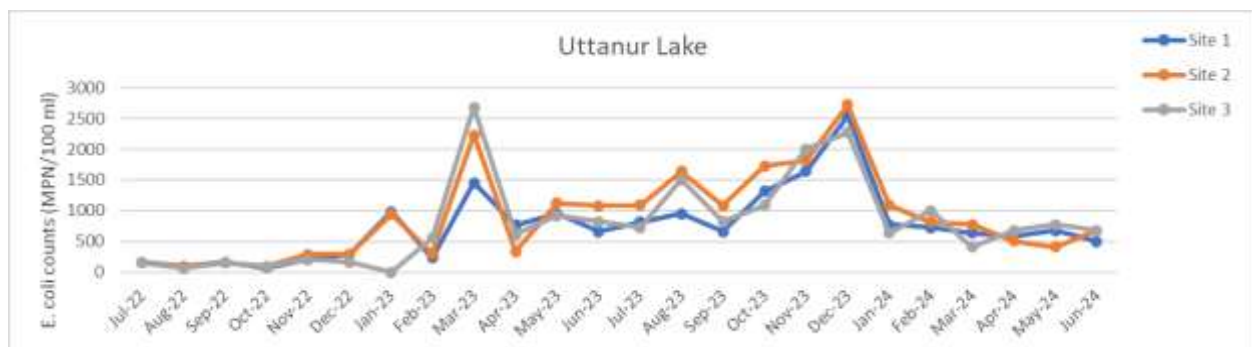


Fig. 3. Trend variation in *E.coli* colonies (MPN/100ml) in Uttanur lake water

In the present study was carried from July 2022 to June 2024 in the water samples from Muduvadi and Uttanuru lakes. The results of the present study showed that 1000 or more than 1000 colonies in 100 ml of samples water in the august 2022, October 2022, January 2023, February 2023, April 2023, January 2024, February 2024, may

2024 and June 2024 in Muduvadi lake. Whereas, in Uttunuru lake, only in January to February 2024 the colonies raised to 1000 and add. Further in muduvadi lake the colonies raised to the maximum level i.e. ≥ 2000 during March 2023, May, 2023, August 2023 and October 2023. Whereas, in Uttanur only in the month of March the values were increased. The lowest (lesser than 1000 MPN/100ml count was noticed in the early and latter months of the experiment period. The increased values of bacterial colonies were recorded in March 2023, July 2023 (only in Muduvadi lake water), October-November-December of 2023 in all the selected study sites (fig. 2 and 3).

The presence of high level of E.coli in water suggests the presence enteric pathogens (Akoleowo 2002; Shrestha and Dorevitch 2019) and there is a direct relationship between the numbers of E. coli and the extent of faecal pollution (David and Jill 2020). Further, Kundangar et al. (2003) also has attributed increase in total coliform count to environmental variables such as low dissolved oxygen and human influence at inshore sites. Wetzel (1975) emphasised that highest values in the lakes revealed the amount domestic influx during rainy seasons. The present results are in conformity with the results of Procopio et al. (2017) and Tabanelli et al. (2017). According to Shafi et al. (2013), the category wise distribution of coliform count into four categories with MPN range of zero for category I (excellent water quality), 4 to 50 MPN/100ml for category II (good), 51 to 400 MPN/100ml for category III (fair) and 401 to 1100 MPN/100ml for category IV (poor). The present study showed that both the lakes are fluctuating between fair and poor category. The concentration of total coliform bacteria in the lake water signaled that the water is declining its quality and is not fit for drinking purposes. It is also proved that the heavy influence of human activities by the locals which light have resulted in elevated levels of total coliforms. further, it is recommended that monitoring of land use pattern in the immediate catchment and control the discharge of waste water contentiously.

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