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Assessment of water quality parameters when Nile tilapia (*Oreochromis niloticus*) fingerlings fed with Tulsi (*Ocimum sanctum*)

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Abstract
The 60 days experiments was conducted to assessment of water quality parameters when Nile tilapia (*Oreochromis niloticus*) fingerlings fed with Tulsi (*Ocimum sanctum*). Tilapia fingerlings were stocked at the rate of 10 fishes per tank. In this experiment 5 experimental diets were prepared by using dried leaves of Tulsi. T_0 diets were considered as control. Tulsi (*Ocimum sanctum*) leaves powder was added at the rate of 2%, 4%, 6% and 8% per kg of feed in T_1, T_2, T_3 and T_4 respectively**.** The range of water quality reported during the test was observed water temperature from (24.70 °C to 26.80 °C), electrical conductivity from (1230.75-1420.25 µS/cm), pH from (7.23 to 8.32), dissolved oxygen from (6.22 to 9.00 mg/l), total alkalinity from (74.5 to 132.5 mg/l), and total hardness from (319.12 mg/l to 468.00 mg/l). In the present study, the water quality parameters remained suitable during experimental period and were suitable for fish growth and survival. The result shows that 8% of Tulsi leaves powder added in experimental diet showed highest relative percent survival and growth in (*Oreochromis niloticus*). We can conclude that by added Tulsi leaves powder in the diet had shown positive impact on water quality.

Keywords: *Ocimum sanctum*, *Oreochromis niloticus*, water quality parameters

Introduction
The main cultivated freshwater species in the world belong to carps and tilapia. The Nile tilapia, *Oreochromis niloticus* is one of the most important freshwater fish in world aquaculture. It is widely cultured in many tropical and subtropical countries. Some of advantages of Nile tilapia are rapid growth, high tolerance to environment conditions, easy to spawn, resistance to disease, and good consumer acceptance make it a suitable fish for culture. This species is the most familiar and popular fishes in Indonesia, especially, in Sumatera, Java, Bali, and Borneo Islands. The production of aquaculture technique is usually extensive, semi-intensive and intensive culture systems, but the commonest technique in Indonesia is semi-intensive and intensive systems. The intensive culture has usually high level of management input such as feed and fertilizers are intensively applied following appropriate recommended rates. Most commercial farm adopts this approach due to the fish grow is very faster compare to the others. However, intensive culture system has encountered many problems such as high cost due to commercial food utility during the operation where commercial food constitutes 50 – 70% of the total production cost (Setiadi, 2018) [14].
Kumar *et al*, (2023) [9] concluded that the water quality parameters remained suitable during experimental period and were suitable for fish growth and survival and the result shows that 8% of tulsi leaves powder added in experimental diet showed highest relative percent survival and growth in (*Oreochromis niloticus*). By this study we can conclude that by added tulsi powder in the diet had shown positive impact on fish growth and survival.
Nile tilapia *Oreochromis niloticus* is cultured worldwide mostly in semi-intensive culture systems using fertilization. Nevertheless, variety of pond input schemes, including inorganic and/or organic fertilizers, formulated feed and combination of both, were involved in Nile tilapia production. Previous researches have shown that supplemental feeding in fertilized ponds resulted in significantly higher growth rates and greater yield than fertilization alone (Green, 1992) [8]. Pond management perspective, fertilization early in the grow-out, then adding supplemental feed once Nile tilapia reach 100- 150 g, is the efficient way to grow large tilapia. However, excessive increase in variable cost due to the high price of formulated feed is a growing concern among tilapia growers as this could lead to a negative net return and thus, an economically unviable practice.

Certainly, it is the economic viability of aquaculture practice, more than any other factor, which influences its long-term adoptability and, therefore, proper assessment of economic performance of culture system is essential (Dian, 1996). Tidwell *et al*. (2000) [18] reported that polyculture of prawn and tilapia in cages increased total pond productivity by 81%. However, cage confinement might reduce the ability of tilapia to efficiently harvest phytoplankton for pH control.

Some studies have indicated that confined tilapia may still be effective biological controls but that their ability to control algae may be density dependent. (Dunseth, 1977) [7] reported that tilapia stocked at a pond surface area of 0.25/m² did not affect algae populations when compared with ponds without tilapia. However, Perschbacher and Lorio (1993) [12] found that caged Nile tilapia provided control over phytoplankton populations in channel catfish, Ictalurus punctatus, production ponds when stocked at surface densities of 0.5/m².

Aquaculture is increasingly considered as an integral component in the search for global world food security and economic development. The vast majority of aquaculture production takes place in China. The automation of aquaculture systems will allow the industry to improve environmental control, reduce catastrophic losses, reduce production cost, and improve product quality. The most important parameters to be monitored and controlled in an aquaculture system include temperature, dissolved oxygen, pH, ammonia, nitrates, salinity, and alkalinity, since they directly affect animal health, feed utilization, growth rates and carrying capacities (Simbeye and Yang, 2014) [14].

Material and Method

The present study was conducted at the Aquaculture Research and seed unit, Directorate of Research, MPUAT, Udaipur for 60 days. 20 plastic tanks with a volume of 225 litres were used. Total numbers of 200 fingerlings of *Oreochromis niloticus* were provided by Aquaculture Research and seed unit, Directorate of Research, MPUAT, Udaipur. The current experiment was conducted in 225-liter plastic tanks. Prior to the start of the experiment, the fish were acclimated under experimental conditions for at least a week. Each treatment is provided with four replication using a complete randomized design, the healthy fingerlings of uniform size was randomly distributed in four experimental groups and one control group. 200 liters of fresh, filtered, ground water used to fill the tanks. Every day, the water was aerated for at least 8 hours. 10 tilapia fingerlings were stocked in each tank. Before adding fish, all the tanks were carefully cleaned and disinfected. Ground water was used during the whole experimental period and filled the tanks up to 200 liters. In the form of pellets, fingerlings were fed once per day at a rate of 4% of their body weight. Every weekend, syphoning was used to remove uneaten food and waste, and water levels were maintained by replenishing. With the use of hand net, the fish in each tank were removed and placed in the tank. Measurements were taken at initial day and intervals of 15 days for the examination of the growth parameter. Water quality was also measured in initial day and every 15 days interval during experimental period.

The water of the experimental units was partially replaced using bore well water to provide the fish comfortable habitat in the experimental tanks. Every 15 days, water quality parameters including temperature, pH, DO, electrical conductivity, total alkalinity, and total hardness were evaluated. For evaluating water quality parameters stated above, standard methods of American Public Health Association's Standard Procedures (2017) were followed.

Result and Discussion

In the present study, the administration of Tulsi leaves powder supplemented diet for *O. niloticus* fingerlings has been assessed. The addition of Tulsi leaves powder in fish diet has been found beneficial for tilapia as it manifest that the growth parameters of experimental fish tilapia in all treatments were initiate better result than the control group. In the present study, the administration of Tulsi leaves powder supplemented diet for *Oreochromis niloticus* fingerlings has been assessed. Environmental factors such as water quality parameters have a significant impact on fish growth and survival. Experiment done by DeLong *et al*. (2009) [5] shows that a special set of water chemistry required and optimal water quality is essential to a healthy, balanced, and functioning aquaculture system. Sikotariya and Yusufzai (2019) [16] described that the temperature was found within the optimum range throughout the experimental period. Water temperature ranged from 21.75 - 26.25 °C. In the current study, the water temperature was within the optimum range of 24.7 – 26.8 °C. pH range between 6.5 – 9.0 is the ideal range for tilapia as reported by Bolorunduro and Abba (1996) [2]. In the present experimental study, the pH of water ranged between 7.23-8.32 with average mean value 7.78-7.86. Riche and Garling (2003) [13] suggested that the dissolved oxygen for optimum growth of tilapia is above 5 mg/L. Boyd (1979) [3] also suggested that DO is the one of the most important factor for maintaining life and survival of fish. During the experimental period, DO was observed in the range of 6.22 to 9.00 mg/l which was always reported above minimum essential level. Electrical conductivity is an important parameter of water quality that regulates growth and survival of fish. Water EC is based on the ions that are found in water. Stone and Thomforde (2004) [17] recommended the desirable range 100–2000 µS/cm and acceptable range 30–5000 µS/cm for pond fish culture. During the current study, the range of EC was 1230.75 to 1420.25 µS/cm and was found to be ideal for fish growth. The overall alkalinity level of water in the current study was 74.50 -132.50 mg/l. This is the optimal alkalinity level for growth and digestive metabolism, i.e. 50-150 mg/l as observed by Stone and Thomforde as $CaCO_3$ (2004) [17]. Water hardness shows the carbonate and bi-carbonate of Ca and Mg ions in the water. In the current investigation, the total hardness range was 319.12 to 468.00 mg/l. Choudhary and Sharma (2018) [4] indicated that the hardness value of 488.56 to 530.22 mg/l was suitable for the growth of fish. Water quality in ideal range correlate with the higher fish production as suggested by Mali *et al*. (2023a, 2023b) [11, 12].

Table 1: Range and mean values of water quality parameters in different treatments during the experimental period.

Parameters	T_0	T_1	T_2	T_3	T_4
Water Temperature (°C)	24.70 -26.80 (25.80)	24.90- 26.80 (25.80)	24.70-26.80 (25.77)	24.80- 26.80 (25.81)	24.80-26.80 (25.81)
pH	7.32- 8.32 (7.86)	7.35- 8.27 (7.84)	7.23- 8.15 (7.78)	7.24-8.25 (7.83)	7.26- 8.30 (7.80)
Dissolved oxygen (mg/l)	6.32- 8.83 (7.92)	6.50- 9.00 (7.96)	6.30-8.80 (7.77)	6.22- 8.85 (7.74)	6.45- 8.60 (7.66)
Total Alkalinity (mg/l)	75.50- 126.50 (102.16)	76.00- 127.00 (106.42)	74.50-132.50 (110.85)	76.75-131.00 (107.17)	75.50-126.87 (107.16)
Total Hardness (mg/l)	408.37- 435.50 (422.83)	319.12- 430.50 (386.42)	419.25- 442.50 (432.12)	453.62-468.00 (461.05)	442.50-457.62 (450.26)
EC (µS/cm)	1260.87- 1420.25 (1350.39)	1250.00-1420.37 (1350.53)	1230.75-1390.50 (1320.33)	1250.00-1410.00 (1340.31)	1230.75-1420.00 (1350.63)

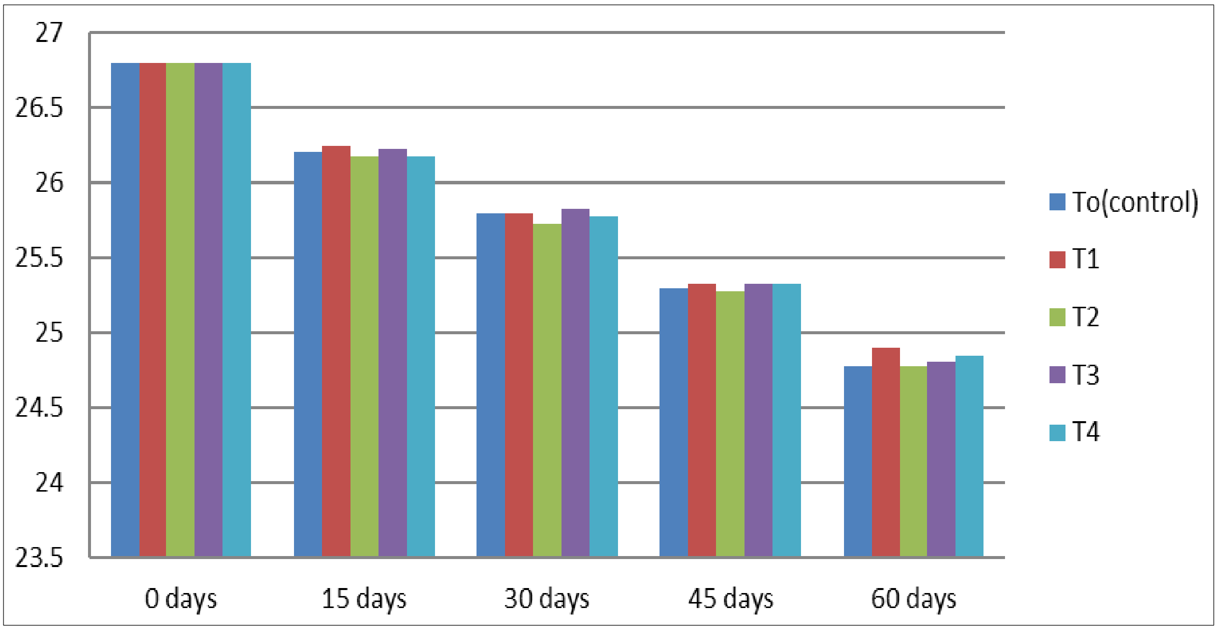

Fig 1: Water temperature during the experimental period in different treatments.

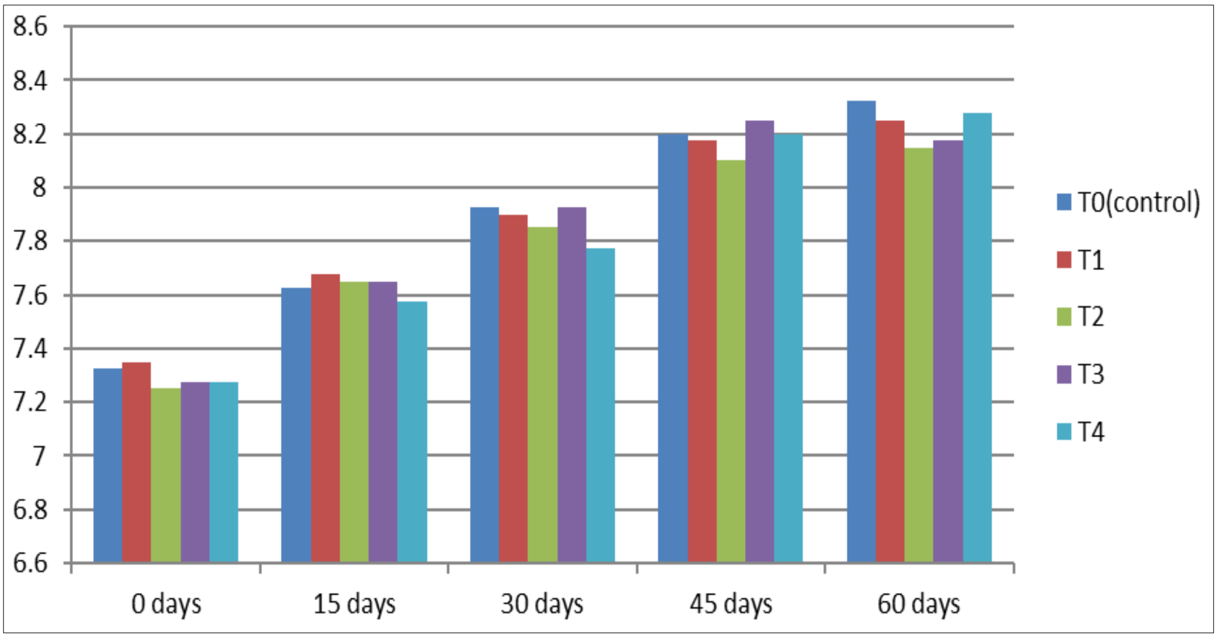

Fig 2: pH of water during the experimental period in different treatments.

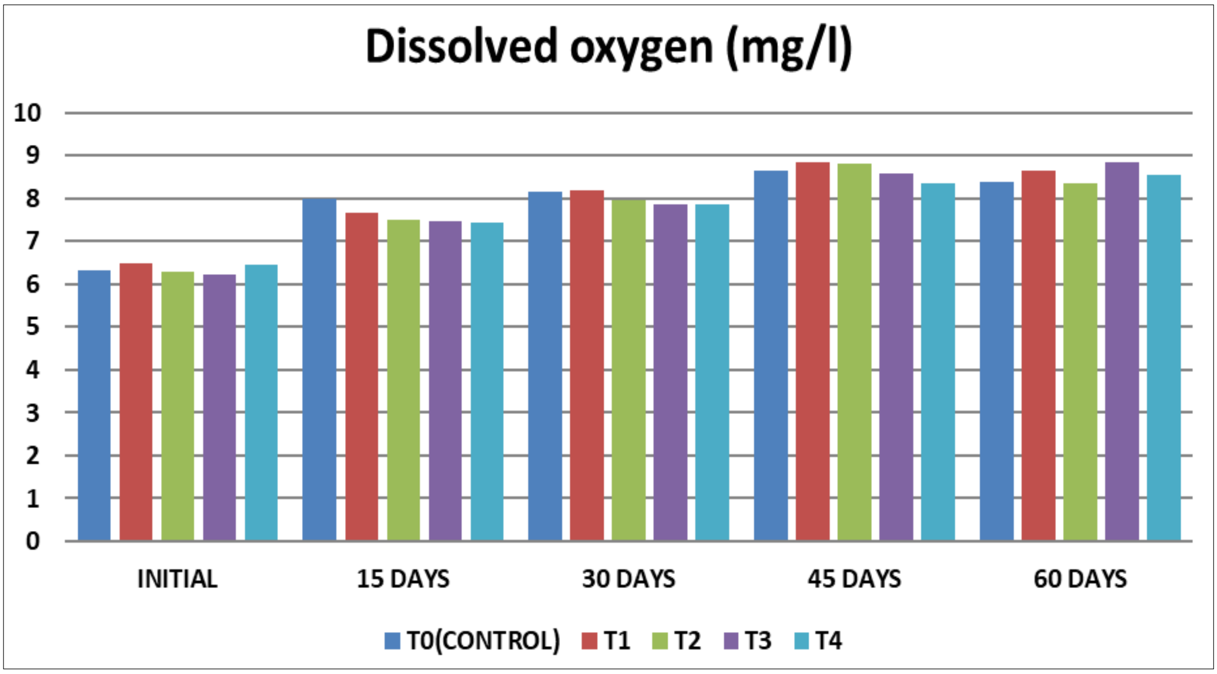

Fig 3: Dissolve oxygen in water during the experimental period in different treatments.

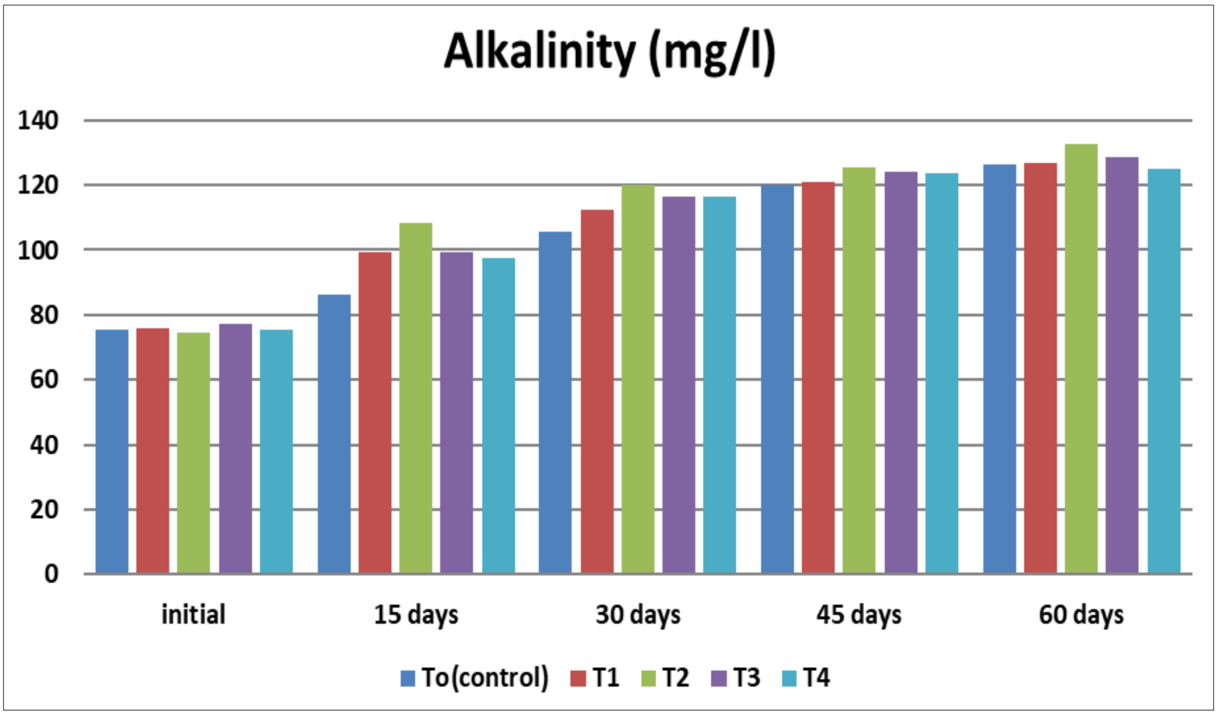

Fig 4: Alkalinity of water during the experimental period in different treatments.

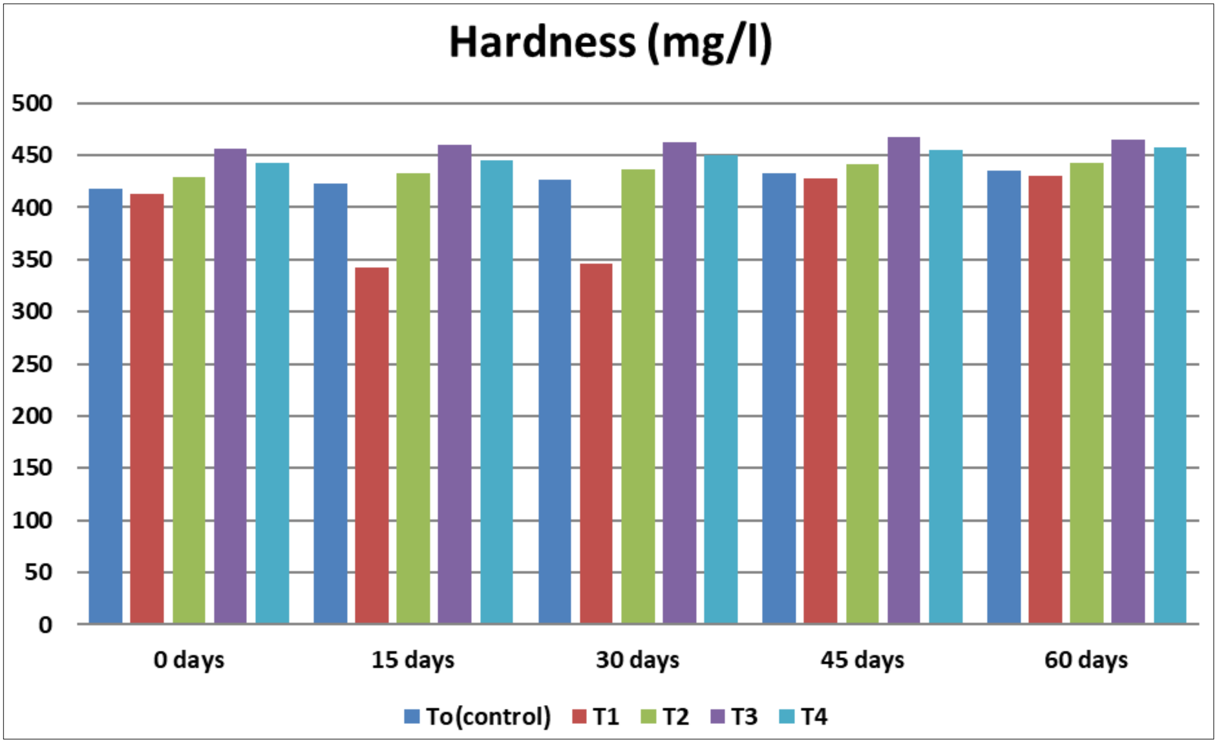

Fig 5: Hardness of water during the experimental period in different treatments.

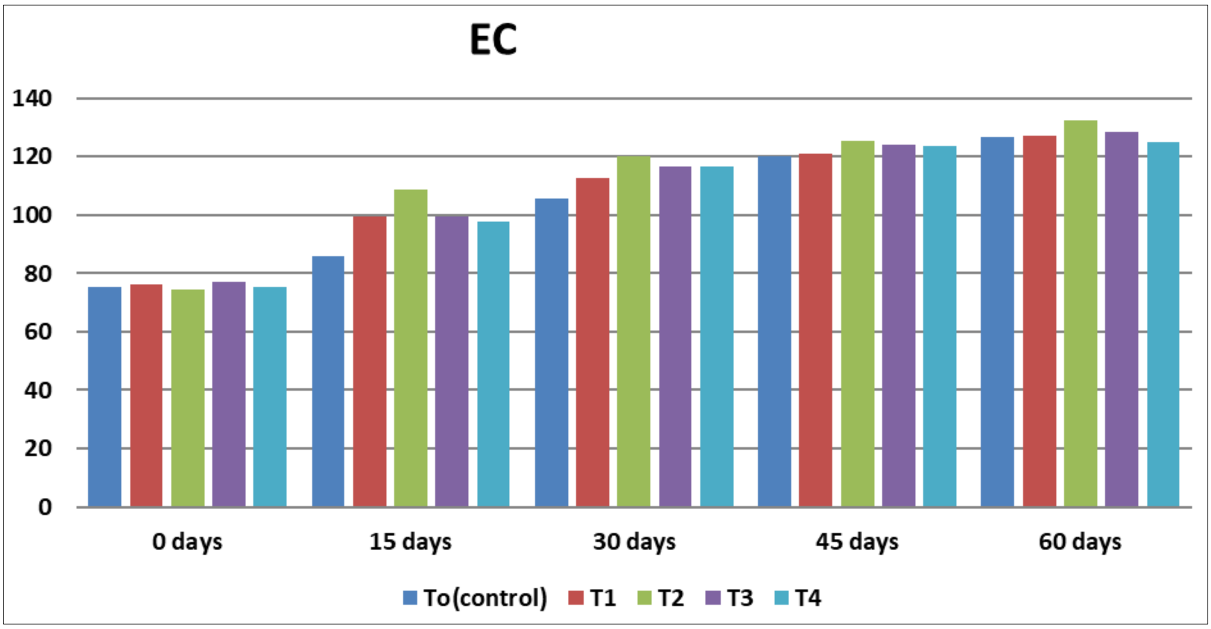

Fig 6: Electrical conductivity of water during the experimental period in different treatments.

Conclusion

Water quality parameters including temperature, pH, DO, electrical conductivity, total alkalinity, and total hardness were remained suitable during experimental period and were suitable for fish growth and survival in water used in experimental period. By this study we can conclude that by added Tulsi powder in the diet with suitable water quality parameters had shown positive impact on fish growth and survival.

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