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Effect of *Sorghum millet* (Jowar) on different water quality parameters for *Oreochromis niloticus* (Nile tilapia) (Linnaeus, 1758) fingerlings

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Abstract
The current study was conducted to determine the "Effect of *sorghum millet* (jowar) supplementary Diet on Growth and survival of *Oreochromis niloticus* (Nile tilapia) (Linnaeus, 1758) Fingerlings" The experiment was conducted for 60 days. In this study 20 plastic tanks of 225 liters were used for 5 treatments with each of four replication. Fisheries respectively were homogeneously distributed in each tank at the ratio of 10 fishes per tank. Four experimental diets without sorghum millet(SM) at the ratio of 5%, 10%, 15%, and 20% in T_0, T_1, T_2, T_3 & T_4. The important water quality parameters including air temperature, water temperature, pH, dissolved oxygen, electrical conductivity, total hardness, total alkalinity were analyzed and average air temperature (26.175 °C), water temperature (25.8 to26. 9 °C), pH (7.2 and 7.6), dissolved oxygen (6.1 and 6.750mg/l), electrical conductivity (146 and 162 ms/cm-1), total hardness (613 and 634.35 mg/l), total alkalinity (124 and 149mg/l) were noted in all treatments respectively during experimental period. The result shows that all water quality parameters in all treatments were existed within the permissible for aquaculture. On the basis of these result, it also concluded that aquatic environment was favorable for the fish survival and fish growth.

Keywords: *Sorghum millet* (Jowar), water quality parameters, *Oreochromis niloticus*

Introduction
Aquaculture has become the most promising sector that plays a crucial role in global food producing sector. It is the fastest growing component of agriculture sector. At the present the present the world's greatest challenges include how to feed more than 9 billion people by 2050 in a context of climate change, economic and financial uncertainty, and growing competition for natural resources. Global production of aquatic animals was estimated at 178 million tonnes in 2020, a slight decrease from the all-time record of 179 million tonnes in 2018. The amount destined for human consumption (Excluding algae) was 20.2kg capita. In 2020, global capture fisheries production (Excluding algae) was 90.3 million tonnes, with an estimated value of USD 141 billion, including 78.8 million tonnes from marine water and 11.5 million tonnes from inland water (SOFIA 2022)

The global fish production is estimated to have reached about 179 million tonnes in 2018. Aquaculture accounted 46 percent of the total and 52 percent of fish for human consumption. In 2018, the global capture fisheries production reached the highest level ever recorded at 96.40 million tonnes. The increasing in 2018 was mostly driven by marine capture fisheries, whose production increased to 84.40 million tonnes in 2018 (SOFIA 2020).

Presently, India is the second largest fish producing and aquaculture nation after china in the world. The total fish production during 2019-20 was 14.20 million metric tonnes (MMT) with a contribution of 10.30 MMT from inland sector and 3.72 MMT marine sector. Annual average growth rate of India was more than 10 percent in 2019-20. In aquaculture, more than 60 percent of the input cost of production is contributed by feed. (Handbook of fisheries statistics, 2022).

Oreochromis niloticus (Nile tilapia), occurs in a wide variety of freshwater habitats like rivers, lakes, sewage canals and irrigation channels. It is native to Africa and Middle east and has emerged from mere obscurity to one of the most productive and internationally traded food fish in the world. Nile tilapia is a tropical species that prefers to live in shallow water. It is an omnivore's gazer that feeds on phytoplankton, periphyton, aquatic plants, etc. It belongs to family Cichlid under order Perciformes. Nile tilapia was introduced to India during late 1970s. In 2005, River Yamuna harbored only negligible quantity of Nile tilapia, but in two years, the

proportion has increased to about 3.50 percent of total fish species in the river. Presently in the Ganges River system, proportion of tilapia is about 7 percent to the total fish species (NFDB Tilapia manual).

Sorghum (sorghum bicolor) is a crucial food crop, especially in the tropical arid and semi-arid regions. It is a crop with two uses; First is to provides a basic source of nutrition for people consumption (35%) and the second one is a remainder as food for livestock, alcohol production, and preparation of industrial goods. Sorghum is essential to the existence of many people in Asia and Africa. It produce a consistent and constant production during both the rainy and dry seasons because it is a drought-tolerant crop. It can be grown in some places where no other major cereal can be produced and can thrive with less rainfall than is required for rice and maize. Plants have well-known part in maintaining healthy health. These plants are a vast repository of many chemicals, many of which have therapeutic and nutritional qualities. The third most significant food grain in the world, also known as guinea corn or giant millet (Sorghum bicolor) is sorghum. Wheat and rice are the only other grains are more often used as food. Most of Africa, Asia, and South America eat as their main grain meal. Sorghum and guinea corn are both terms used in Nigeria. Sorghum grain's chemical male-up is remarkably similar to that of maize. Starch content ranges from 68 to 80%, protein ranges from 10 to 15%. Moisture ranges from 11 to 12%, fat ranges from3%, to 2% to ash ranges from 2%, and food energy ranges from 394 calories. Among cereal grains, it comes in second place to maize in terms of total energy available. (Jimoh, *et al.*, 2017) [8]

Material and Methods

The study was carried out for two- month period in twenty plastic tanks 225 liters capacity at wet lab of the Department of Aquaculture, College of fisheries, MPUAT, Udaipur. A homogenous stocks number of 110 Nile tilapia *(Oreochromis niloticus*) fingerling were obtained from Anand Krishi khamar Hatchery Kolkata, when seed collected from the unit the was in good health and free of any infection. Following a 7-day acclimatization phase. During acclimation, adequate oxygen was supplied employing an aerator and fish were fed on a basal diet. The Fingerlings of Nile tilapia 3 gm. were randomly distributed in experimented treatments with each of 4 replicates at a rate of 10 fishes per tank. All the tanks were disinfected and washed properly before introducing fishes. Water quality parameters such as Air Temperature (°C), Water Temperature (°C), Electrical Conductivity (µS/cm), pH, Dissolved Oxygen (mg/l), Total Alkalinity (mg/l), Total Hardness (mg/l) were analysed at fortnight interval in the laboratory following standard methods of American Public Health Association's Standard Procedures (2017).

Result and Discussion

Water quality parameters were observed during the experiment period are presented in (table 2.1) and figures (1.1 to 1.6) However in result of water quality parameters there were non significance difference (p>0.05) in treatments.

A good water quality is required in aquaculture production to produce a profitable product of high quality, which will reflect on human health by its role. Any deterioration in water quality will affect the development, growth, reproduction, or even cause the death of the cultivated species (Barker *et al*. 2009) [9].

Water quality parameters are major environmental factors which determine the growth rate and survival of fish to greater extent. According to Choudhary *et al*. (2018) [3] the range of temperature between 23.94 °C- 24.38 °C. In the current study the water temperature ranges 25.8 °C- 26.9 °C.

pH of water quality is as major parameter among water quality. During the present study ph range of water 7.2-7.65 slightly alkaline was found suitable for fish. The value of pH 6.73-7.45 was founded optimum by Setiadi *et al*. (2018) [7].

The range of temperature considered good for fish culture. The range of dissolved oxygen was varied from 5-10mg/l (Bhatnagar and Devi *et al*. 2013) [12]. In present study, the range of dissolved oxygen in different treatments was varied between from 6.4-6.750mg/l.

Electrical conductivity is also an important water quality parameter that determines the growth rate and survival. EC of water depends on the present ions in water. The optimum range of 100-2000µmS/cm favourable for fish growth (Stone and Thomforde, 2004) [6]. During current study range of electrical conductivity 146-161.5 µS/cm found suitable for *Oreochromis niloticus*.

Alkalinity is the capacity of water to neutralize acids without increasing ph of water. In present experiment the range of alkalinity between 124-149 mg/l shows suitable for oreochromis niloticus. According to Masabni, 2016) [4] the range of alkalinity is 50-150 mg/l.

Hardness is a measure of calcium and magnesium, but other ions such as aluminium, iron, manganese, strontium, zinc and hydrogen ions are also included. In present study the range of hardness between 613-634.75 is ideal for fish growth. According to Chaudhary and Sharma (2018) [3] the optimum range was 600-652 mg/l.

Table 1: Ranges of selected water quality parameters. In parentheses mean (Minimum-maximum) values during the experimental period in different treatments.

parameters	T_0	T_1	T_2	T_3	T_4
Air temperature (°C)	25.1-27.1 (26.2)				
Water temperature (°C)	25.9-26.9 (26.26)	25.9-26.9 (26.33)	25.8-26.9 (26.34)	25.8-26.9 (26.35)	25.9-26.9 (26.26)
Electrical conductivity (mS/cm^{-1})	146-162.25 (135.46)	146-161 (156.67)	146-161 (156.61)	146-161.5 (156.6)	146-162 (156.48)
Alkalinity (mg/l)	124-147.75 (135.36)	124-147 (135.04)	124-149 (135.42)	124-146.5 (136.37)	124-148 (134.7)
pH	7.2-7.51 (7.38)	7.2-7.57 (7.40)	7.2-7.65 (7.41)	7.2-7.55 (7.42)	7.2-7.55 (7.40)
Dissolve oxygen (mg/l)	6.4-6.699 (6.699)	6.4-6.750 (6.750)	6.4-6.52 (6.523)	6.4-6.63 (6.636)	6.4-6.62 (6.621)
Hardness (mg/l)	613-634.71 (627.85)	613-634 (627.46)	613-634.75 (627.99)	613-634.25 (627.95)	613-634.5 (627.73)

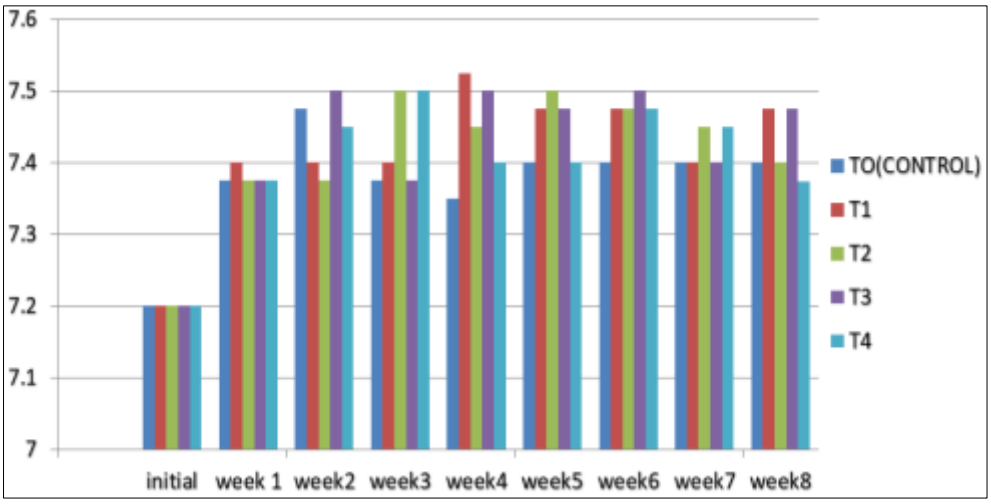

Fig 1: Water pH during experiment in different treatments

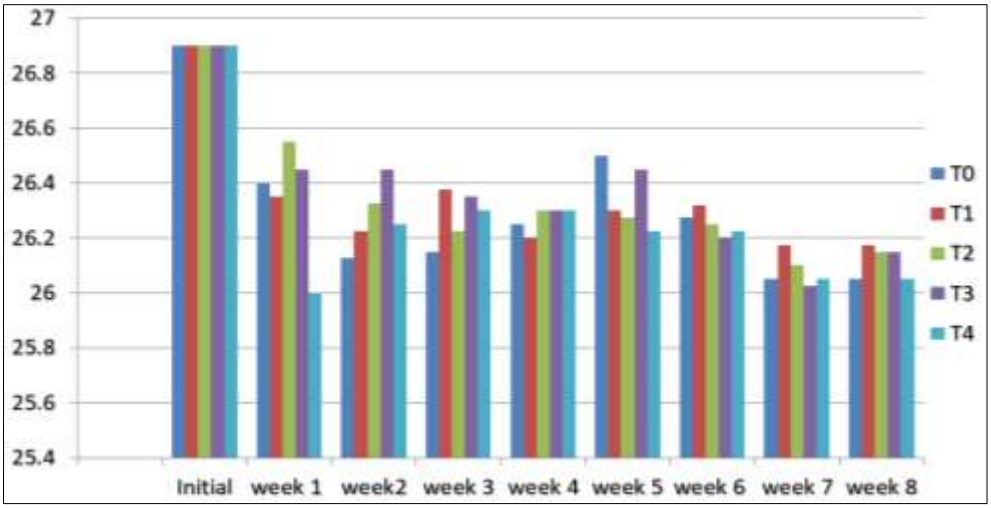

Fig 2: Water temperatures during research time in different treatments

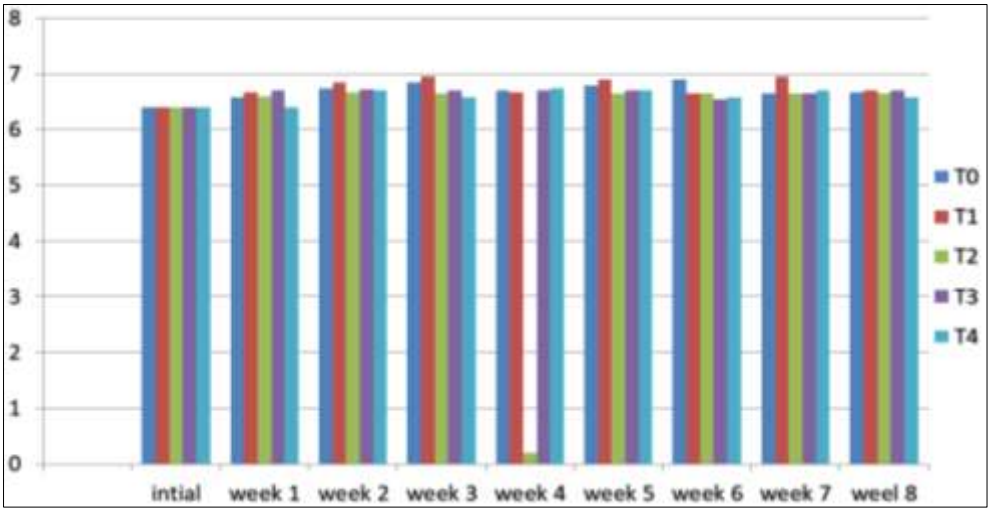

Fig 3: Dissolved oxygen during research time in different treatments

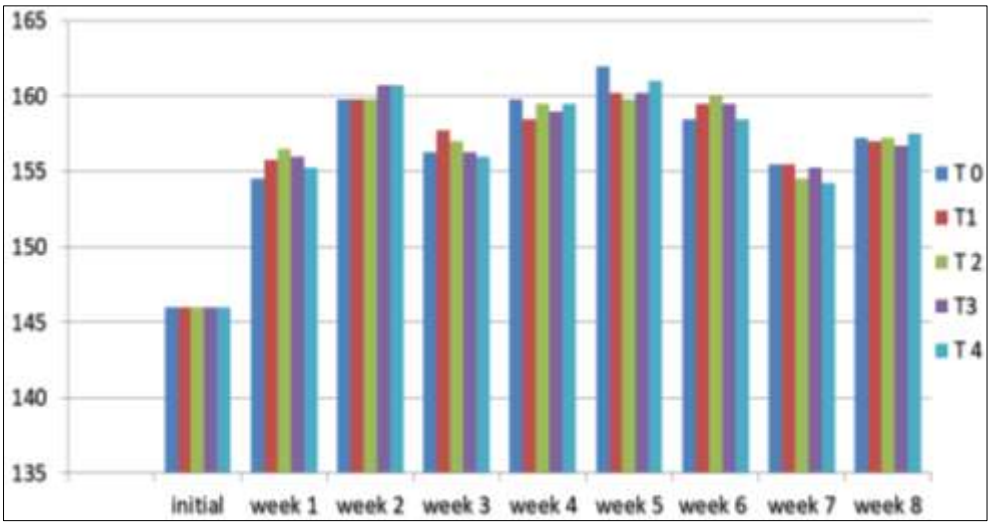

Fig 4: Electrical conductivity during research time in different treatments

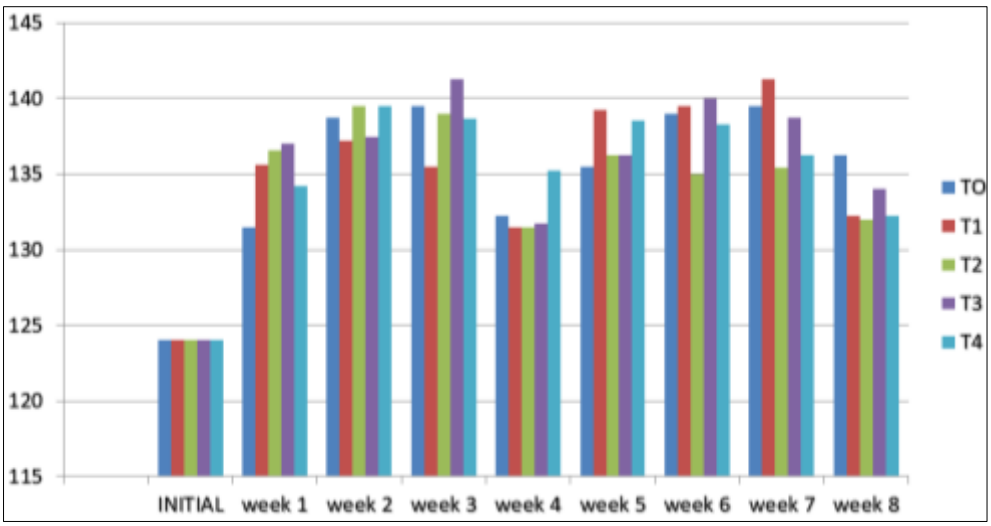

Fig 5: Alkalinity during research time in different treatment

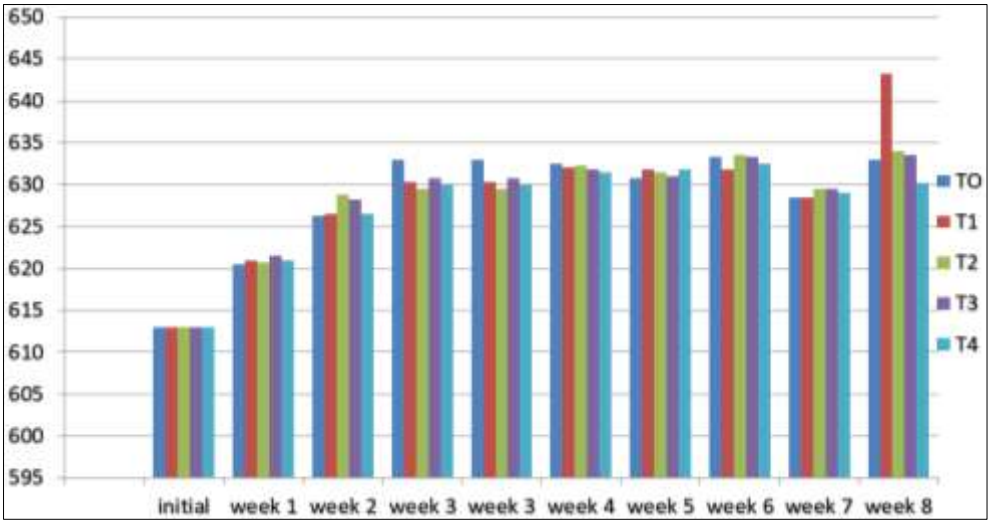

Fig 6: Hardness during research time in different treatment

Conclusion

The findings of the present study on water quality parameters in treatments of sorghum millet was noted optimum and it can be concluded that the aquatic environment of is conducive and favorable for fish and growth.

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