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Effect of certain combination of millets on several water quality parameters for Nile tilapia, *Oreochromis niloticus* (Linnaeus, 1758) fingerlings

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Abstract

The present experiment was carried out to verify the “Effect of Certain Combination of Millets on several water quality parameters for Nile tilapia, *Oreochromis niloticus* (Linnaeus, 1758) Fingerlings”. The experiment was conducted for 60 days in the wet laboratory of Department of Aquaculture, COF, MPUAT, Udaipur (Rajasthan). A total number of 200 *Oreochromis niloticus* healthy fingerlings were used for the experiment, 20 FRP tanks of 225 litres capacity were used. Ten fishes were randomly distributed in five treatments (including control) with each of four replicates. The fingerlings were fed @ 4% body weight twice a day morning and evening for 60 days. For experiment, diets with pearl and sorghum millets in ratio of 1:1 at 5%, 10%, 15% and 20% in T0, T1, T2, T3 and T4 were used. The ratio was divided equally between the two feeding. The measurements for the study of water quality parameters as Air and water temperature (26.8 to 29.1 °C and 25 to 29.9 °C), pH (6.2 to 8.5), DO (6 to 8.4 mg/l), EC (150-180 µS/cm), Total alkalinity (87 to 153 mg/l), and Total hardness (380 to 620 mg/l) were monitored at fortnight period of interval. On the basis of these results, it can be concluded that sorghum millet & pearl millet in 1:1 ratio is safe for water quality and favourable for the growth of Nile tilapia (*Oreochromis niloticus*) fingerlings.

Keywords: Water quality parameters, growth of fingerlings, millets

1. Introduction

The total fisheries and aquaculture production reached an all-time record of 214 million tonnes in 2020, comprising 178 million tonnes of aquatic animals. Global aquaculture production in 2020 reached at record of 122.6 million tonnes, including 87.5 million tonnes of aquatic animals worth USD 264.8 billion (FAO, SOFIA, 2022) [8]. Fish is known as a best food due to its high protein content of high biological value and its exceptional richness in omega 3 polyunsaturated long fatty acids, specific vitamins, minerals and trace elements. Among the ingredients used in the formulation of fish foods, fish meal remains the best source of protein. However, fish meal is still expensive and its supply contributes in part to the depletion of natural fish stocks. Plant-based ingredients are increasingly explored and their ability to meet the nutritional needs of fish is studied (Kaushik, et al. 1995) [9].

In aquaculture more than 60% of the input cost of production is contributed by feed. Therefore, to achieve the ultimate goal of high profit using some cheaper feed ingredient without any compromise on growth of fish. Feed quality can be improved by adding some alternative ingredients in feed. So, alternative ingredients that can be used in feed are pearl millet and sorghum millet (Bajra & Jowar). Although Pearl millet has been successfully tested in several fish species and it is efficiently used by tilapia (*Oreochromis niloticus*). (Meurer, et al. 2004) [11].

Nile tilapia (*Oreochromis niloticus*), native to Africa and Middle east, occurs in a wide variety of freshwater habitats like rivers, lakes, sewage canals and irrigation channels. (NFDB Tilapia manual). Tilapia grow rapidly on formulated feeds with lower protein level and tolerate higher carbohydrate level than many carnivorous fish species. Omnivorous fish species like Nile tilapia and Common carp, which feeds at lower trophic levels, can efficiently utilize high levels of carbohydrates in comparison to the higher trophic level carnivorous fish species (Enes, et al. 2011) [7].

Looking to the importance of different carbohydrate sources as natural foods improve performance in fish nutrition.

Based on these results, the present experiment was carried out to verify the “Effect of Certain Combination of Millets on several water quality parameters for Nile tilapia, *Oreochromis niloticus* (Linnaeus, 1758) Fingerlings”.

2. Material and Methods

The experiment was conducted for 60 days in the wet laboratory of Department of Aquaculture, COF, MPUAT, Udaipur (Rajasthan). A total number of 200 *Oreochromis niloticus* healthy fingerlings were obtained from local farm of Chittorgarh. For the experiment, 20 FRP tanks of 225 litres capacity were used. The collected fingerlings were acclimatized for 7 days and fed on control diet. Ten fishes were randomly distributed in five treatments (including control) with each of four replicates. The weight of fingerlings was recorded before introducing in tanks. The volume of water in each tank was 200 litres. Each tank was filled with ground water until the desired level was reached and sufficient aeration was provided to each tank. The fingerlings were fed @ 4% body weight twice a day morning and evening for 60 days. The experimental basal diet (fish meal, soyabean meal, rice bran, wheat flour, vegetable oil and vitamins & mineral mixture in ratio 46:25:20:5:2:2) was arranged by using pearl millet & sorghum millet in 1:1 ratio. The ratio was divided equally between the two feeding. The measurements for the study of water quality parameters were monitored at fortnight period of interval.

3. Water quality analysis

Water quality such as air and water temperature, pH, Dissolved oxygen, Total alkalinity, Total hardness and Electrical conductivity were analysed on every 15 days of the experimental period by following standard methods of APHA (2017) [3].

4. Results and Discussion

4.1 Air Temperature

During 60 days of experimental period average of air temperature was recorded 27.96 °C and the range of air temperature varied from 26.8 to 29.1 °C. (Table 1 & Figure 1).

4.2 Water Temperature

The measured water temperature in current study was ranged 25 to 29.9 °C. The lowest mean value of water temperature was recorded 26.38 °C in T₄ and highest mean value of water temperature was recorded 26.70 °C in T₀. (Table 1 & Figure 2) Water is essential for the survival of all aquatic organisms for reproduction, development, growth or management of fish in any manner. (Boyd 2003) [5]. The majority of research on tilapia temperature tolerance showed an ideal temperature range of 24-32 °C depending on species and size, for example, Nile tilapia retain their best performance around 27-30 °C. (Beamish 1970) [4].

4.3 pH

In the present experiment pH of water was slightly alkaline in nature. The range of water pH was recorded between 6.2 to 8.5. The maximum mean value of water pH 7.04 was recorded in treatment T₄ and minimum was 6.63 recorded in T₀. (Table 1 and Fig.3) pH is an important water quality parameter in aquaculture systems because it influences the toxicity of other substances to fish such as ammonia and chlorine. (Alam and Al-Hafedh, 2006) [2]. According to Chaudhary and Sharma (2018) [6] the values of pH ranged between 8.03 and 8.50.

4.4 Electrical conductivity

EC is the capacity of water to conducts electrical current in water due to presence of ions in it. Electrical conductivity was fluctuating during experiment. The observed values of EC ranged between 150-180 µS/cm in the experiment. The mean value of EC maximum in T₄ (163.57 µS/cm) and minimum in T₀ (160.96 µS/cm) as shown in (Table 1 & Fig. 4) Electrical conductivity (EC) is an important water quality parameter that impacts the growth and digestibility of fish. Sanvriya, *et al.* (2022) [12] discovered a range of 189 to 213.4 µS/cm EC is suitable for the growth of *Labeo rohita* fingerlings.

4.5 Dissolved oxygen

The range of dissolved oxygen in experiment was observed between 6 to 8.4 mg/l. The highest mean value of DO (7.09 mg/l) was found in T₄ and the lowest mean value 7.04 mg/l was found in T₃. (Table 1 & Fig. 5) Dissolved oxygen is he most crucial component of water quality in aquatic environment. It is essential for the metabolic activity. It has a direct influence on aquatic life. According to Agano, *et al.* (2017), the ideal range of DO between 4.86-10.53 mg/l is suitable for Nile tilapia. Adeyemi, (2011) reported the ideal range of DO for aquaculture is between 5.67 to 9.85 mg/l.

4.6 Total Alkalinity

The total alkalinity in current experiment was observed in range 87 to 153 mg/l. The maximum mean value of alkalinity (141.99 mg/l) was observed in T₄ whereas the minimum (122.40 mg/l) was observed in T₂. (Table 1 & Fig. 6). According to Stone and Thomforde (2004) the ideal alkalinity level for development and digestive metabolism as CaCO₃ observed by the range was 50-150 mg/l.

4.7 Total Hardness

In present study the range of hardness between 380 to 620 mg/l is ideal for fish growth. The maximum mean value of total hardness (495.49/l) was observed in T₀ whereas the minimum value (450.58 mg/l) was observed in T₂. (Table 1 & Fig. 7) Hardness is a measure of calcium and magnesium, but it contains additional ions such as aluminium, iron, manganese, strontium, zinc, and hydrogen ions which is also present in water. According to Chaudhary and Sharma (2018) [6] the optimum range was 600-652 mg/l.

Table 1: Ranges of water quality parameters during experimental period in different treatments

Parameters	T ₀	T ₁	T ₂	T ₃	T ₄
Air Temperature (°C)	26.8-29.1 (27.96)				
Water Temperature (°C)	25-29.9 (26.70)	25-28.4 (26.50)	24.8-28.1 (26.40)	25-28.9 (26.426)	24.9-28.2 (26.38)
Electrical conductivity (µS/cm)	150-175 (160.96)	150-178 (161.25)	152-175 (161.99)	152-180 (162.62)	157-179 (163.57)
pH	6.2-7.4 (6.63)	6.2-8.5 (7.01)	6.3-7.6 (6.89)	6.1-8.2 (6.95)	6-8.3 (7.04)
Dissolved oxygen (mg/l)	6-8.7 (7.03)	6-8.3 (7.08)	6.2-8.3 (7.27)	6-8.2 (7.04)	6-8.4 (7.09)
Total Alkalinity (mg/l)	110-152 (132.99)	114-151 (136.47)	87-146 (122.40)	116-153 (135.63)	118-153 (141.99)
Total Hardness (mg/l)	420-620 (495.49)	430-520 (462.21)	380-506 (450.58)	400-500 (460.61)	380-508 (454.83)

Note: Figure in bracket shows average values

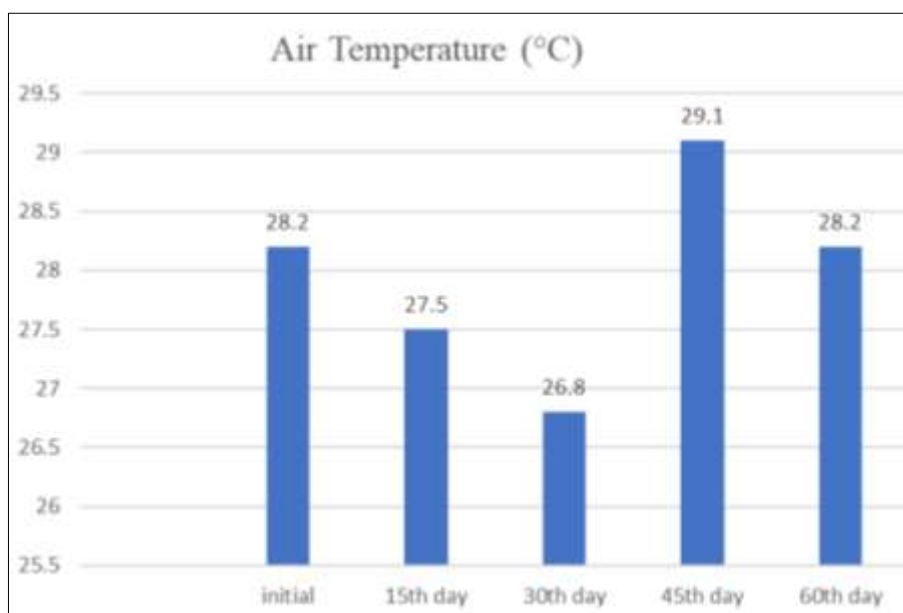


Fig 1: Air temperature during the experimental period.

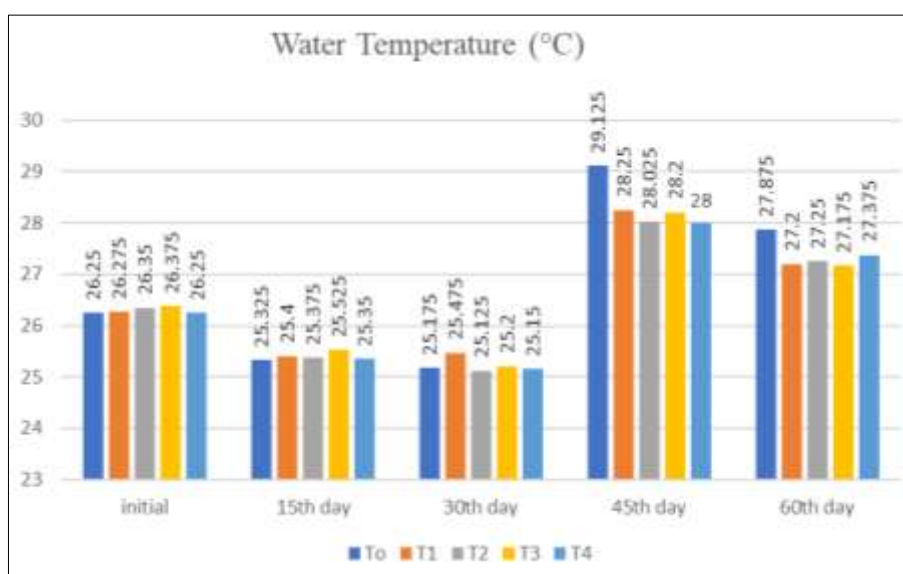


Fig 2: Water temperature during the experimental period in different treatments.

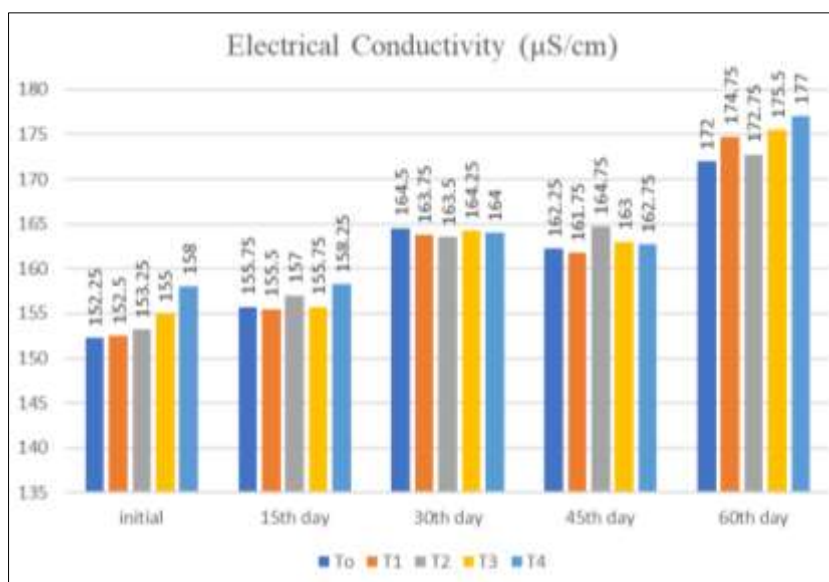


Fig 3: Electrical conductivity of water during the experiment in different treatments

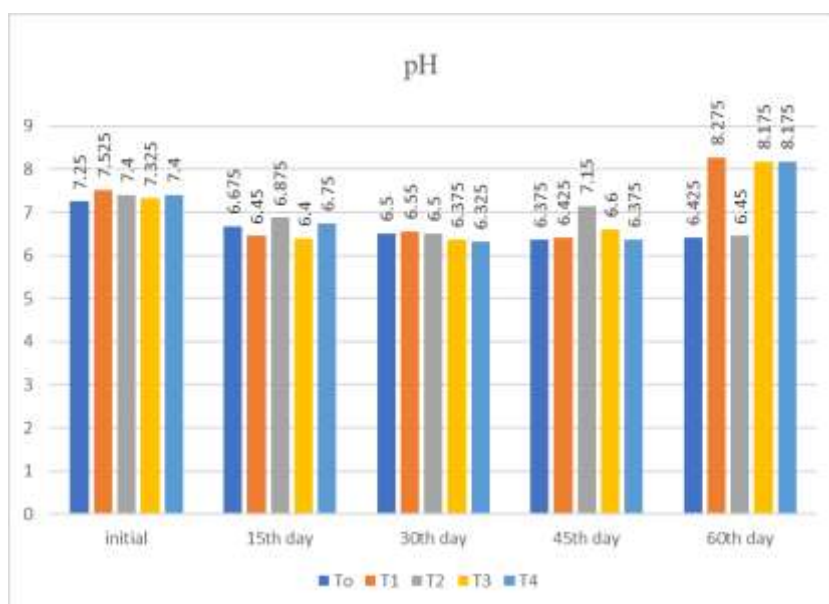


Fig 4: pH of water during the experiment in different treatments

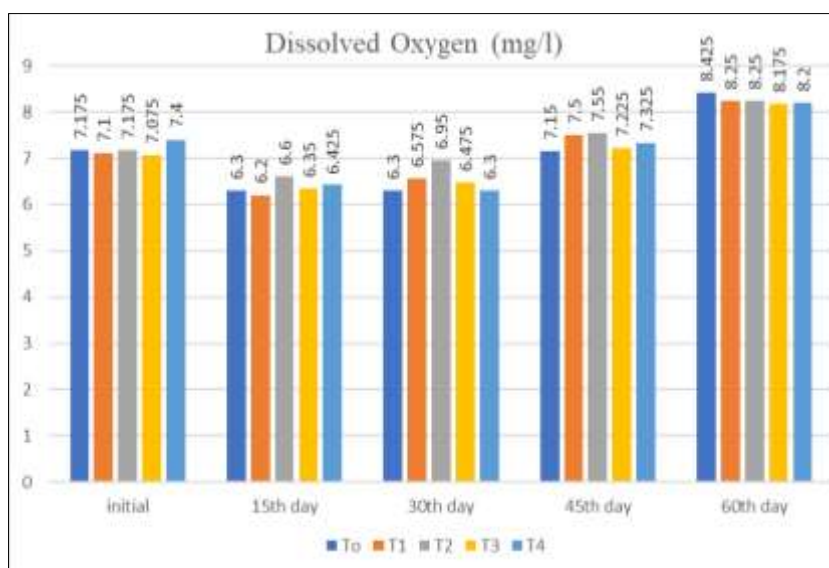


Fig 5: Dissolve oxygen in water during the experiment in different treatment

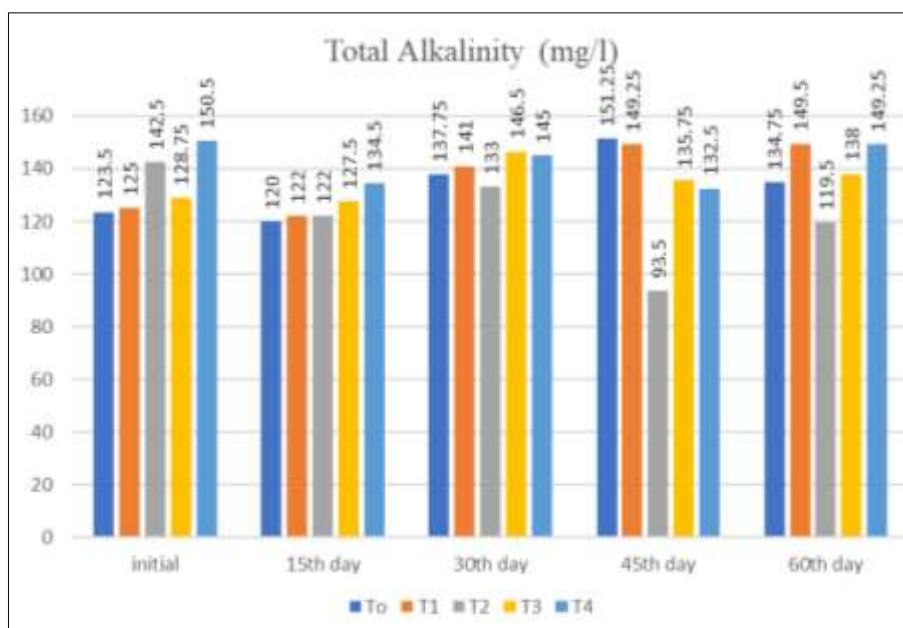


Fig 6: Alkalinity of water during the experiment in different treatments

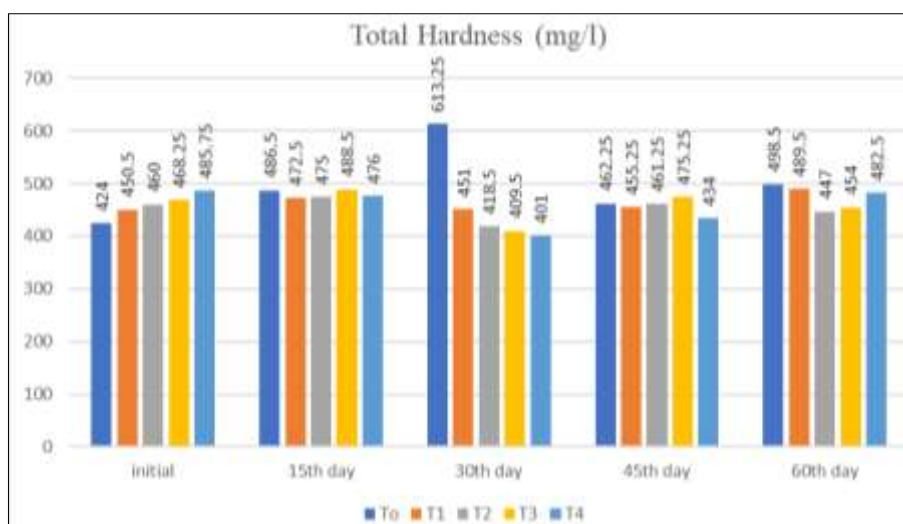


Fig 7: Hardness of water during the experiment in different treatments

5. Conclusion

It can be concluded from the present study that air and water temperature, EC, Total alkalinity, pH, DO and Total hardness was recorded in optimum range and does not show any adverse effect among all treatments on the growth of fish. So, it can be concluded that sorghum millet & pearl millet in 1:1 ratio is safe and favourable for water quality & growth of Nile tilapia (*Oreochromis niloticus*) fingerlings and this ratio of the millets in diet can be used for the fish.

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