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Impact of rohu (*Labeo rohita*) feeding probiotic (Proteus) on selected water quality parameters

Praveen Kumar and BK Sharma

Abstract

The study has been carried out to study the Impact of *Labeo rohita* (Hamilton) Fingerlings Feeding Probiotic (Proteus) on selected water quality parameters. For pursuing such type of research probiotic (Proteus) have been taken as growth promoting ingredients in the traditional carp feed i.e. rice bran, groundnut cake, fish meal and mineral mixture for the rohu (*Labeo rohita*) fingerlings. These above four feed ingredients have been mixed with conventional carp diet at 2g/kg of feed, 3g/kg of feed, 4 g/kg of feed and 5g/kg of feed levels respectively. During the experimental period of 60 days, the fingerlings of rohu (*Labeo rohita*) were fed @ 4 % of their body weight per day.

The experiment was conducted in rectangular plastic tanks with 225 liters containing bore-well water. During the study period water quality parameters such as water temperature (°C), pH, dissolved oxygen (mg/l) and total hardness (mg/l) were recorded.

The experimental water has shown a congenial water quality with average values of water temperature 25.3 °C to 29 °C, pH 8.23 to 8.80, dissolved oxygen 5.12 mg/l to 6.93 mg/l and hardness 459.75 mg/l to 462.83 mg/l.

Keywords: Probiotic, *Labeo rohita*, feeding, water quality, water temperature, pH, dissolved

1. Introduction

Fish is a principal animal source of protein for over half of the global population. In India, the major carps are the most preferred farm fishes because of their fast growth and higher acceptability to consumers. The rapid expansion and intensification of carp farming had led to the outbreaks of infectious diseases caused by viruses, bacteria and parasites, inflicting severe loss on fish production. The widespread use of broad-spectrum chemotherapeutants to control these diseases has led to the development of antibiotic-resistant bacterial strains and may cause water pollution in the aquaculture environment. Recently, attention has been focused on the use of probiotics with the demand for environment friendly aquaculture. Probiotic therapy helps to treat several gastro intestinal illnesses. Probiotics have already become a significant direction as an alternative to antibiotic treatment for aquaculture and have been commercially available as a feed or water additives in pond water [Moriarty (1997) [14], Boyd and Gross (1998) [3]; Verschuere *et al.* (2000) [21]; Wang *et al.* (2005) [22]. Probiotics may stimulate appetite and improve nutrition by the production of vitamins, detoxification of compounds in the diet and by the breakdown of indigestible components.

2. Materials and Methods

2.1 Experimental diet

Carp feed (with 24% protein) was formulated using groundnut cake, rice bran, fish meal and mineral mixture and a commercially available probiotic (Proteus). Probiotic was purchased from the Forever GENESIS Company at Nandanar Nagar, North Lallaguda, Secunderabad, Andhra Pradesh, India. The treatment tank (T_0) considered as a control which was without probiotic, while groups T_1, T_2, T_3 and T_4 was included with probiotic and added at @ 2g/kg, 3g/kg, 4 g/kg and 5g/kg of feed levels respectively. The dry ingredients (consisting of groundnut cake, rice bran, fish meal and minerals mixture) of the experimental diets were thoroughly mixed and made in a pellet form by the addition of boiled water. The paste was then extruded through a commercial pelletizing machine. The resulting spaghetti like diet (2.0 mm diameter) was air dried and stored in air tight containers for further use.

2.2 Water quality analysis
Water quality such as water temperature, pH, dissolved oxygen and hardness were analyzed on initial day and subsequently on 15th, 30th, 45th and 60th day of experimental period following APHA (2005) [1].

3. Result and Discussions
The results of this study indicated a significant increase in net weight gain, increase in length, specific growth rate, food conversion ratio and gross conversion efficiency of fingerlings fed with different probiotic mixed feed diet. The fingerlings of rohu (*Labeo rohita*) fed on probitic (Proteus) @ 4g/kg in the diet (T_3) the net weight gain was (4.902 g) and specific growth rate was (0. 521%). In this experimental diet (T_3) the lowest FCR i.e. (3.207) was reported as compared to all other diets. The gross conversion efficiency of this diet was (0.330). In the control diet the overall growth of the fish was relatively lower (Fig.1-3).

The experimental results of water quality parameters carried out during the experimental period are presented in (Table 1). It is apprehended from the results of the present study that the differences in water quality parameters were not significant in different treatments.

3.1 Physico-chemical parameters
The bore well water was used as source water during the whole experimental period. Physico-chemical parameters of water such as water temperature (°C), pH, dissolved oxygen (mg/l) and total hardness (mg/l) were recorded and the average values of all these parameters are presented in (Table 1and Fig. 4-7).

3.2 Temperature
The water temperature increased progressively. During the experiment, the average water temperature recorded was 27.9 °C. Further, the minimum water temperature of 25.3 °C was recorded in T_3 and T_4, whereas the maximum 29 °C was recorded in T_0, T_2 and T_4. However, the mean values of water temperature ranged between 27.17 °C to 27.92 °C (Table 1 and Fig. 4). All the values of the water temperature in different tanks were statistically non significant to each other at the 5% level of significance.

Backiel and Horoszewicz (1970) [2] found that the intensity of carp feeding increases with the rise in temperature from 28.0 °C to 29.0 °C. Hickling (1962) [7] reported that fall in temperature slow down the carp feeding activities. Jhingran (1983) [9] has suggested the optimum temperature range for major carp culture from 18.3-37.8 °C. Prinsloo and Schoonbee (1984) [16] observed a marked decline in fish production when the mean water temperature of ponds, was below 20 °C. In the present study, the temperature of water varied between 25.3 °C to 29 °C, with a mean of 27.17 °C to 27.92 °C in five experimental diets. It was quite favorable for fish growth and was very similar to the optimum temperature range given by Jhingran (1988) [10]. The results of our study are in accordance with the earlier findings of Kumar *et al*. (2007) [12] who in his study found that the temperature range of 19.8-29.0 °C is safe for growth and survival of another carp, *Cirrihinus mrigala*.

3.3 pH
During the experimental period, the water of plastic tanks remained alkaline. The values of pH ranged between 8.23 and 8.80. The minimum pH values 8.23 and maximum 8.80 was observed in T_3 and T_4 respectively. Whereas, the mean values of pH were in the range of 8.54 to 8.59 (Table1 and Fig.5) in different treatments. All the pH values during the study period were found to be statistically non- significant to each other.

Larger (1972) [13] considered water having pH range of 7.0 to 8.5 as favorable for fishes. The pH of pond water undergoes a wide fluctuation. In open waters the diurnal change in pH being most alkaline in afternoon and most acidic just before the day breaks. Swingle (1957) [19] reported the optimum growth of fish at pH ranging between 7.5 and 8.5. In the present experiment, the values of pH ranged from 8.23 to 8.80 in tanks and this could be considered congenial for fish growth. Thus, pH had not been a limiting factor for fish growth. The pH in aquatic system reflects an integration of several environmental conditions. Jhingaran (1991) [11] reported that pH is determined by the relationship between free carbon dioxide and carbonates. The pH can also affect fish health. Optimum pH level for carp culture is 7.5 to 8.5 (ICAR, 2011) [8].

3.4 Dissolved oxygen (DO)
During the experimental period narrow fluctuations in the levels of dissolved oxygen were recorded. The values of dissolved oxygen ranged between 5.12 mg/l to 6.93 mg/l. The minimum (5.12 mg/l) and maximum (6.93 mg/l) average values of dissolved oxygen were noticed lowest (5.45mg/l) in T_0 and highest (6.07) in T_3, respectively (Table 1 and Fig. 6). All the values obtained for dissolved oxygen during the experimental period was found to be statistically non-significant, among different tanks.

Dissolved oxygen concentration in water, plays a vital role during fish culture. The lowest limit of the dissolved oxygen for good fish production in pond has been suggested to be 5 mg /l (Dandraff and Dean, 1967) [4]. However, Smitherman and Boyd (1974) [17] considered dissolved oxygen level of about 2 mg/l, as favorable for proper health and growth of fish in normal pond condition. Jhingran (1983) [9] opined that the concentration of dissolved oxygen above 7 mg/l is suitable for productive pond water. Further, the high concentration of dissolved oxygen affects metabolic rate and consequently, the feeding of fish (Lovell, 1976) [15]. The dissolved oxygen content of the experimental water ranged between 5.12 mg/l to 6.93 mg/l. The aeration of water with the help of aerator (2 hrs daily during morning and evening hours) and periodical renewal of water probably helped to maintain higher dissolved oxygen levels throughout the experiment. Movement of fishes in the plastic tanks as revealed from the visual observations further affirmed the view that fish enjoyed favorable dissolved oxygen throughout the experiment. (Sharma and Jain 2000 [18]; ICAR, 2011) [8]. All the values obtained for dissolved oxygen during the experimental period were found to be statistically non-significant, among different tanks. Dissolved oxygen (DO) is considered as one of the most important aspect of aquaculture. It is a crucial factor in natural waters for the growth and survival of fishes. It is needed by fish to respire and perform metabolic activities. Thus, low levels of dissolved oxygen are often linked to fish kill incidents. On the other hand, optimum levels can result to good growth which in turn results in high production yield. The DO concentration of 5mg/l in pond water is considered optimum for growth and survival of fish (Das, 2000, 2001) [5, 6].

3.5 Hardness
The fluctuations in water hardness have been depicted in (Table 1 and Fig. 7). In general, hardness varied from 450

mg/l to 473.33 mg/l with lowest in T_3 and highest in T_2. The average values of water hardness were noticed (459.75 mg/l) lowest in T_3 and highest (462.83 mg/l) in T_0 (Table 1). All the values obtained for hardness during the experimental period was found to be statistically non-significant, among different tanks.

Swingle (1967) [19] has suggested a hardness from 150 ppm or above as satisfactory for the growth of fish and do not require the addition of lime. The levels of hardness in experimental water clearly indicated that the experimental water was hard with an average hardness of 459.75 mg/l to 462.83 mg/l.

4. Conclusion

On the basis of the results obtained in the present experiment, it can be concluded that the probiotic supplement Proteus has paramount importance in enhancing the growth performance of *Labeo rohita*. The incorporation of Proteus in fish diet does not show adverse impact on the health of *Labeo rohita* and it is environment friendly.

5. Acknowledgement

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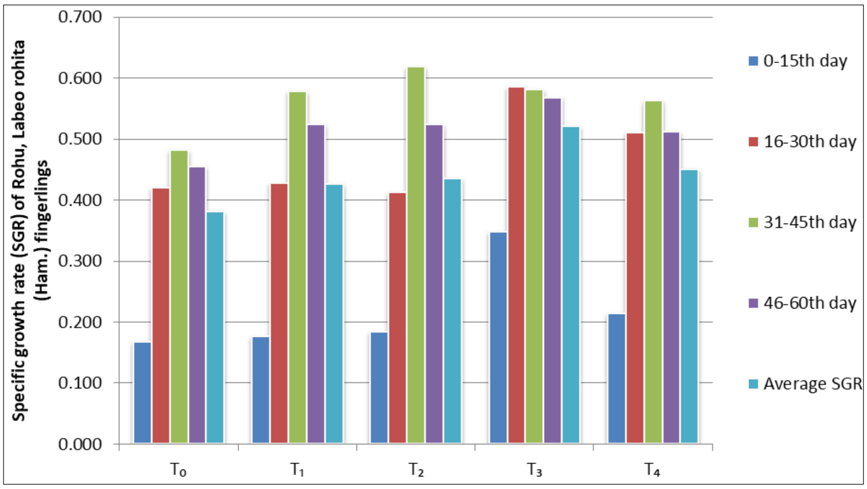

Fig 1: Specific growth rate (SGR) of Rohu, *Labeo rohita* (Ham.) fingerlings fed with varying levels of Probiotic (Proteus) mixed diet

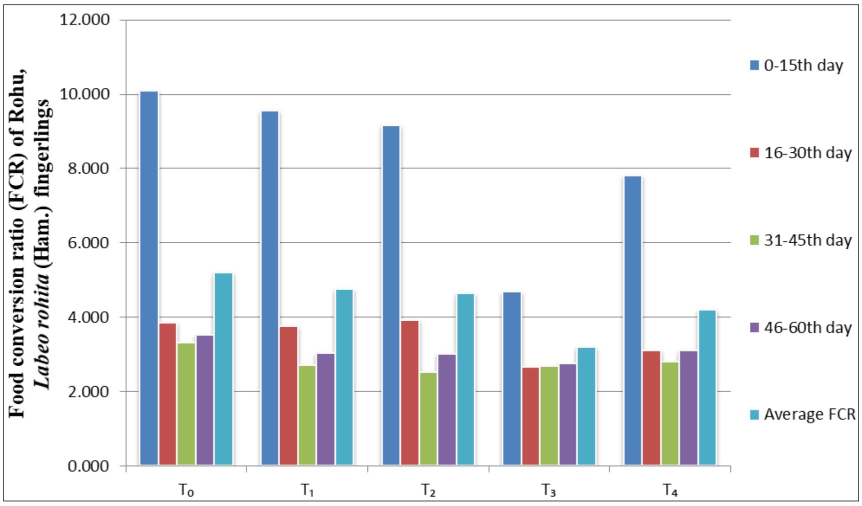

Fig 2: Food conversion ratio (FCR) of Rohu, *Labeo rohita* (Ham.) fingerlings fed with varying levels of Probiotic (Proteus) mixed diet

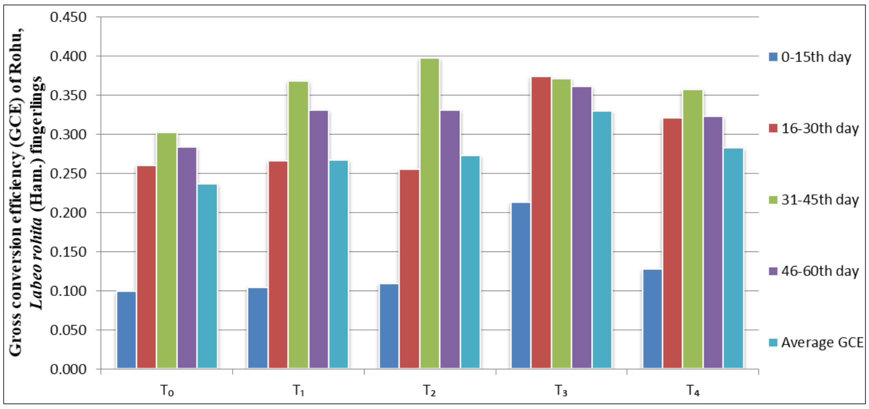

Fig 3: Gross conversion efficiency (GCE) of Rohu, *Labeo rohita* (Ham.) fingerlings fed with varying levels of Probiotic (Proteus) mixed diet

Table 1: Water quality parameters (minimum-maximum) values during the experimental period in different treatments values in parenthesis are mean value with SEm±).

Parameters	Control	T_1	T_2	T_3	T_4
Temperature (ºC)	26.67-29.00 (27.92±0.95)	26.33-28.00 (27.33±0.71)	26.33-29.00 (27.75±1.26)	25.33-28.67 (27.17±1.28)	25.33-29.00 (27.42±1.62)
pH	8.27-8.77 (8.54±0.18)	8.27-8.77 (8.55±0.18)	8.33-8.70 (8.57±0.14)	8.23-8.77 (8.59±0.21)	8.27-8.80 (8.55±0.21)
Dissolved oxygen (mg/l)	5.12-5.76 (5.45±0.47)	5.14-6.53 (5.67±0.76)	5.17-6.67 (5.68±0.68)	5.18-6.93 (6.07±0.70)	5.17-6.93 (6.06±0.78)
Total Hardness (mg/l)	453.33-472.00 (462.83±7.49)	454.33-471.33 (461.42±9.39)	453.33-473.33 (461.50±11.02)	450.00-473.00 (459.75±8.44)	454.00-472.00 (461.17±7.51)

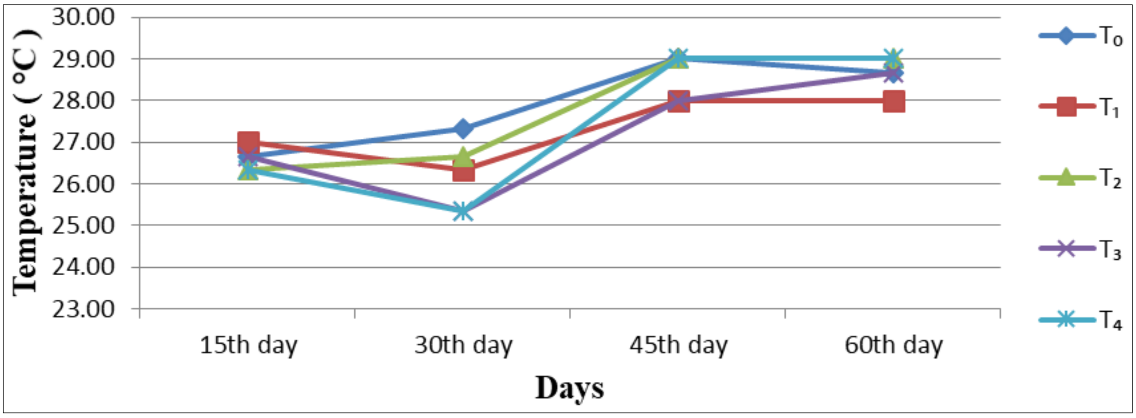

Fig 4: Water temperatures during the experimental period in different treatments.

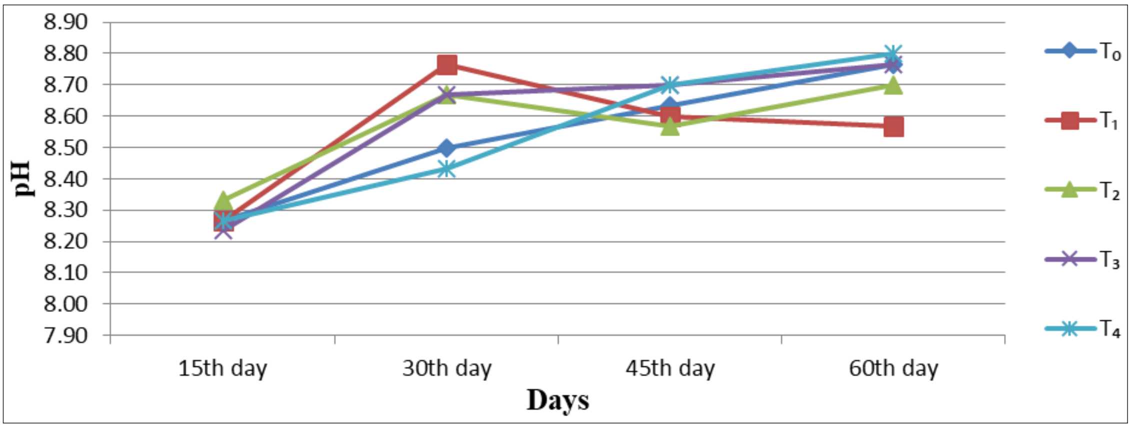

Fig 5: Water pH during the experimental period in different treatments.

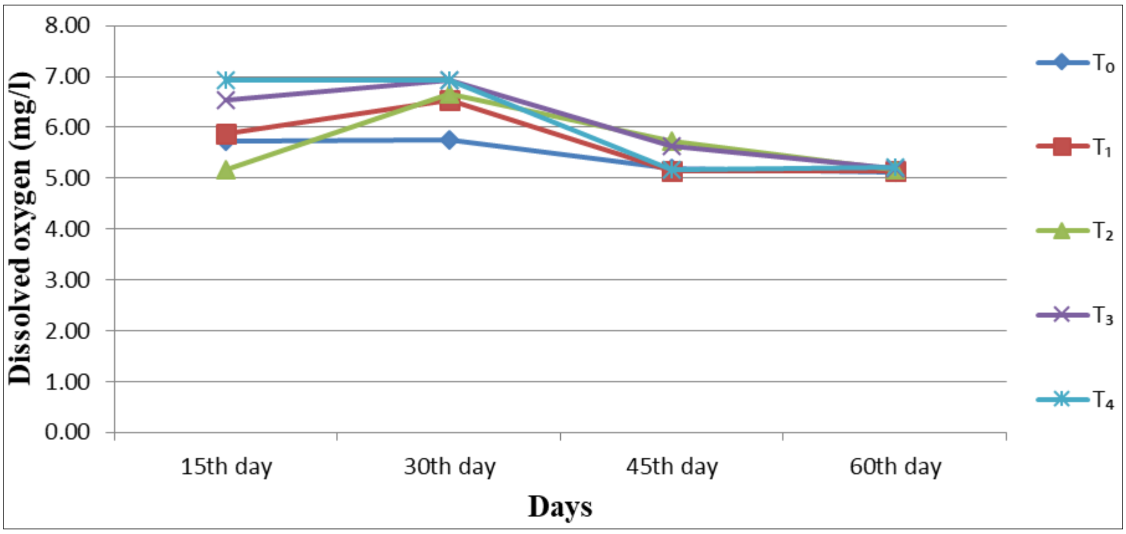

Fig 6: Dissolved oxygen (mg/l) during the experimental period in different treatments.

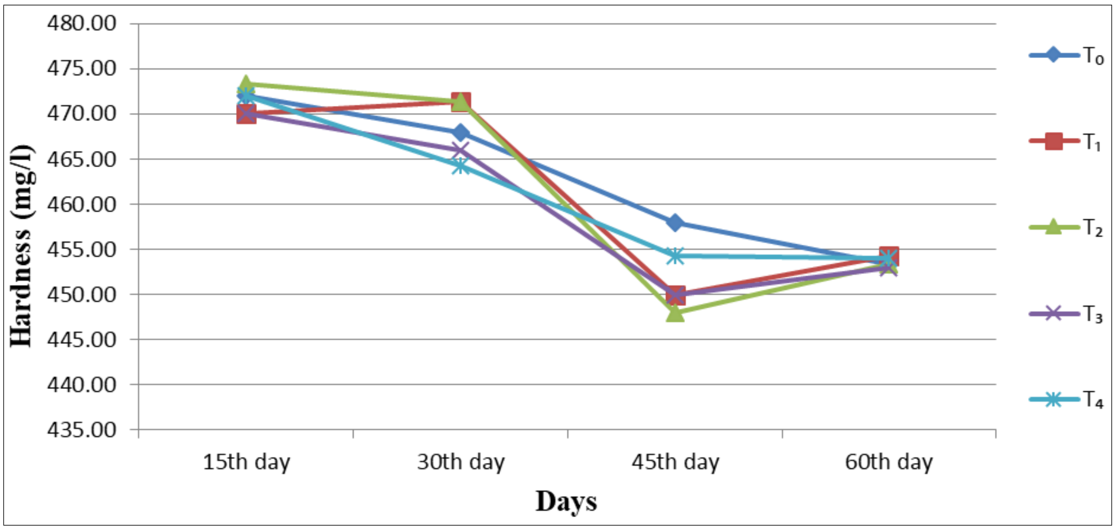

Fig 7: Water Hardness (mg/l) during the experimental period in different treatments.

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