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Research Article

Enhancing growth performance in *Labeo rohita*: a comparative study of water and feed probiotics

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The study is to investigate the effects of feed probiotics, water probiotics and a mixture of both on the body growth rate of *Labeo rohita*. Four treatment groups were formed for the Rohu population: Group I (control) received only the basal diet for 60 days; Group II received the basal diet plus water probiotics; Group III received 5 g/kg feed probiotics in addition to the basal diet; and Group IV received both water probiotics and 5 g/kg feed probiotics in addition to the basal diet. The parameters measured were feed consumption ratio, specific growth rate, monthly live weight and protein efficiency. Except for feed conversion ratio (FCR), which showed an opposite trend, the treatment groups performed better than the control group in terms of growth metrics after the 60-day feeding period. The control group in weight, FCR, protein consumption, and specific growth rate. These results show that supplementing *L. rohita* with probiotics can significantly improve its growth performance.

Keywords: *Labeo rohita, probiotics, growth, weight, water*

Introduction

The multi-billion-dollar aquaculture business is growing rapidly and is critical to the global seafood supply. Global fish stocks from marine fisheries and aquaculture amounted to over 104 million tonnes in 2004 (FAO, 2007). The three main Indian fishes *Labeo rohita*, *Catla catla*, and Mrigal accounted for 4,412,078 tonnes of the Asian total in 2010. By 2010, India alone produced 3,614,941 tonnes of freshwater fish annually (FAO, 2013). India contributed about one million tonnes of the approximately 1.2 million tonnes of *L. rohita* produced worldwide in 2005 (FAO, 2007). *Labeo rohita*, sometimes called Rohu, is very popular in aquaculture.

According to Talwar & Jhingran (1991), this species is endemic to the river in India. It plays a significant role in aquaculture. They have a variety of effects, including resistance to colonization, competition for nutrients and adhesion sites, improvement of immune response and disease resistance, and production of compounds that are antagonistic to pathogens. In addition, probiotics are associated with improvements in fish health, overall performance, feed conversion, digestibility and enzyme activity (Kesarcodi-Watson et al., 2008; Das et al., 2008). Because they can survive in aquatic conditions, aquatic probiotics are essential as they drive away pathogenic bacteria by out-competing them for food, causing the dangerous bacteria to starve. Better growth performance is the result of this control of microbial balance in water (Sahu et al., 2008). Although disease outbreaks in giant carp in India have resulted in significant economic losses, there is little research to find the right probiotics to successfully improve the health of these species. Therefore, to meet the demand for practical solutions in the aquaculture sector, this research investigates the effects of probiotic supplementation on the growth performance of Indian large carp.

Materials and Methods

Experimental condition

First, specimens of *L. rohita* appeared to be a healthy weight of 14g and were obtained from Thanjavur. The fish were housed in a large plastic tank measuring 100 × 50 × 30 cm. They were maintained in dechlorinated and aerated fresh water at a constant temperature of 22 °C ± 2 for 60 days. Her health was checked regularly. A glass thermometer was used to record daily water temperatures during the acclimatization phase and an electric digital pH meter was used to measure the pH of the water.

Fishdiet preparation

A basic diet was developed with the following ingredients: 39% rice bran, 34% peanut oil cake, 20% soybean meal, 5% fish meal and 2% combination of minerals and vitamins. Mineral-vitamin mixture per 250 g. Using the AOAC technique, a close-up examination of the feed revealed composition percentages of 9.4% crude fat, 12.3% ash and 37.8% crude protein. The basic diet of the group I served as the control diet. Probiotics were gradually added to the test meals (G-II, G-III and G-IV) using a mixer. Once the moisture content of the test food reached approximately 10%, it was allowed to air dry in a drying oven with an air fan set at 38°C. After the feed dried naturally, it was ground, sieved to obtain the correct size pellets and then stored at -200°C until use.

Probiotics

The standard fish meal was supplemented with a feed probiotic called Aqua Act and a commercial water probiotic called proxy was used.

The percentage breakdown of the baseline diet used in the hatchling Rohu research

S. No	Ingredients water with feed	Control	Water probiotics treated	Feed probiotics treated	Water with feed probiotics
1.	GOK	40	40	40	40
2.	RC	25	25	25	25
3.	FM	10	10	10	10
4.	SM	20	20	20	20
5.	VO	3	3	3	3
6.	Vitamin and mineral mixture	1.5	1.5	1.5	1.5
7.	Cellulose	0.5	0.5	0.5	0.5
8.	Test supplement	-	1.5 mL	5g/kg	5g/kg

Groundnut oil cake – GOK; Rice bran – RC; Fish Meal – FM; Soyabean meal – SM; Vegetable oil – VO
Growth parameters.

After a day of fasting following the completion of treatment, fish were weighed every two weeks throughout the experimental period and their growth weight was recorded. Annet (1985), the method used to measure the weight of fish.25 selected fish morphological characteristics such as: their specific growth rate in % (expressed as weight gain per fish per day), were evaluated using the formula proposed by Pouomogne & Mbongblang (1993). The following formula was used to determine the percentage weight gain per fish per day: SGR %= (ln WT-lnWt)/ (T-t) X100.

Results

As part of our study, we conducted experiments where we administered different combinations of probiotics to the fish. Our goal was to evaluate various growth metrics of fish. This indicates a potential connection between body weight and the probiotic-enriched meal treatment. The findings can be found in Table 1.

Table 1. Growth parameters of *L. rohita* after (60 days)

Studied groups	Body weight(g)			Specific growth	FCR	PER
	Initial	Final	Weight gains			
Group I (Control)	2.37±0.75	2.56±0.11	0.25±0.07	25.81±0.16	166.66±4.74	0.64±0.2

GroupII	2.18±0.68	2.05±0.64	0.48±0.15	48.35±2.3	147.75±4.75	0.73±0.23
Group III	3.51±1.11	3.23±1.02	0.77±0.24	77.45±4.50	130.25±3.21	0.82±0.25
Group IV	2.97±0.93	3.06±0.06	0.82±0.25	82.38±6.06	51.63±16.33	0.90±0.28

The data is shown as the average of 25 samples ± SE
Significant value from ($P < 0.01$).

Discussion

The objective of this study was to shed light on different aspects of probiotic usage in Rohu, specifically examining growth rate and the immune response to pathogenic bacteria. Upon analyzing the animals that were provided with a standard diet and those that were given probiotics, it became evident that the latter group exhibited a noticeably enhanced growth rate. The study's findings highlight the impact of two commercial products on the growth performance of Rohu. One group demonstrates a higher growth rate compared to the control group, while two other groups show similar growth rates. This design and W.G.'s have a striking resemblance. There was a noticeable difference in the protein efficiency ratio (PER) observed among the various groups. It is interesting to mention that the groups that received probiotics showed higher rohu values. This aligns with previous studies conducted by other authors (Carnevali et al., 2006). A research article published by Jafaryan et al. (2008) presented significant findings on the effects of probiotics (Bacillus) on the diet of fish. The addition of probiotics resulted in notable improvements in weight, length, and SGR, surpassing the outcomes seen with the control diet that did not include probiotic supplementation. The FCR of Rohu given a baseline control was higher, highlighting the benefits of the probiotic-enriched diets. There is strong evidence suggesting that the inclusion of probiotics in diets can lead to improved feed conversion ratios (FCR). There is potential for a decrease in production costs as probiotics have shown promise in reducing the amount. Research articles published by Noh et al. (1994) and Bogut et al. (1998) have shed light on the diverse impacts of different probiotics on promoting growth and improving nutritional absorption in various fish species. A study conducted by Bagheri et al., 2008 revealed an interesting finding - the quantity of bacteria in a meal can have an impact on the rate at which bacteria colonize the digestive tract. Several research articles have highlighted the positive effects of probiotics on the immune system of freshwater fish, with a specific focus on *L. rohita*. Research conducted by Bolasina et al. (2006) and Shan et al. (2008) has revealed that the composition of food can cause significant variations in digestive enzyme activity, ultimately impacting the growth and health of the digestive system. Food and fish have a mutually influential relationship, where they both affect each other. In addition, bacteria can release proteases that have the capacity to break down the peptide bonds present in proteins. According to a study conducted by MacFarlane and Cummings in 1991, this process has the potential to improve the animal's nutritional condition by breaking down proteins into their basic components, such as monomers and free amino acids. It appears that increasing the amount of probiotic organisms in fish diets can improve their performance. These factors may have played a role in the significant improvements observed in weight gain, utilization, gut repair, specific growth rate, and food conversion. Past research has indicated that *Tilapia nilotica*, *L. rohita*, and *C. carpio* have yielded comparable results. Our research suggests that the improved adherence to specific microbes in the meal may have positively impacted fish development and nutrient utilization. Multiple research articles have demonstrated that a significant portion of probiotics establish themselves in the host's body and release various nutrients to support growth (Ahilan et al., 2004; Bagheri et al., 2008). Recent discoveries have revealed the remarkable benefits of incorporating live probiotic microorganisms into the diet of carp. This approach holds promise for improving growth and maximizing nutrient utilization, while also being mindful of cost-efficiency and promoting a balanced diet.

Conclusion

In conclusion evaluate the probiotics in treating fish diseases, further comprehensive investigations are necessary. Cutting-edge studies are conducted to evaluate the effectiveness of probiotics, improve overall health, and uncover the mechanisms by which probiotics impact the microbiota in fish intestines.

Author contributions

J. Babitha and R. Murugesan: original draft writing, methodology, software, investigation. T. Jayaseelan and P.K. Ramasamy: conceptualization, data curation. J. Babitha and R. Murugesan: investigation, formal analysis, methodology, Supervision, validation.

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