***Short Research Article***

## **Effects of *Moringa oleifera* leaves powder on growth performance of *Labeo rohita* (Hamilton,1822)**

## **Abstract**

The exploration of phytogenic feed additives has gained momentum as a strategy to enhance fish health and productivity while reducing dependency on synthetic inputs. *Moringa oleifera*, widely known as the miracle tree, contains bioactive phytochemicals flavonoids, phenolics, alkaloids that exhibit antioxidant, antimicrobial, and immunomodulatory properties. This study assessed the impact of powdered *Moringa oleifera* leaves on *Labeo rohita* fingerling growth performance. The study was carried out in Gorkapar village in Balod district, Chhattisgarh, India. The trial was conducted for 90 days. The experiment was designed as T0 (0g) T1 (2g), T2 (4g), and T3 (6g) and T4 (8g) moringa/kg feed. Growth parameters including net weight gain (NWG), percent weight gain (PWG), length gain (LG), specific growth rate (SGR), and feed conversion ratio (FCR) were recorded at 15 days. One-way ANOVA was used to statistically analyze the data at a 5% significance level, and SPSS software (version 21) was used to calculate mean differences using Duncan's multiple range test. The highest weight was observed in treatment T4 (58.55±0.39 g), while the control group had the lowest (38.19±0.12 g). Weight gain, specific growth rate (SGR), average daily gain (ADG), feed conversion ratio (FCR), and protein efficiency ratio (PER) all showed significant enhancement in the treatment groups compared to the control. The treatment T4 exhibited the highest weight gain (136.55±2.27%), SGR (1.30±0.00 %/day), and ADG (1.41±0.02 g/day), indicating superior growth. The most efficient FCR (1.89±0.01) was recorded in T4. The highest PER was observed in T2 (4.15±0.07), suggesting improved protein utilisation at moderate moringa inclusion. This study highlights the potential of *Moringa oleifera* as a natural, cost-effective, and sustainable growth promoter in aqua feed. *Moringa oleifera* holds strong potential as a natural growth promoter and immune booster in fish culture systems. Further research is encouraged to explore its pharmacological effects and applications in disease prevention and water quality management in aquaculture.

**Keywords**: Growth performance, Herbal, Feed additive, Flourishes and Dietary

## **Introduction**

## Aquaculture has emerged as a crucial sector for global food security, supplying over 185 million tonnes of aquatic products annually **(FAO, 2024)**. Uncontrolled intensification of aquaculture development poses a number of health problems to fish, including poor growth, infectious and non-infectious diseases. Antibiotics and chemotherapeutics are frequently used in aquaculture to combat those disease outbreaks but their use can lead to the emergence of antimicrobial-resistant bacteria, and have negative consequences for the aquatic environment and human health (Sharker et al., 2024). In India, inland aquaculture production constitutes a major portion of total fish yield, where Indian major carps such as *Labeo rohita* hold significant economic importance **(Handbook on Fisheries Statistics, 2023)**. *Labeo rohita* is one of the most important major carp species cultured in India on large scale. It is grown under poly-culture system with the other species of major and Chinese carps. It is the common inhabitant of the riverine system of northern and central India. Information on its culture is available only from the early part of the 20th century. Its high growth potential with excessive consumer preferences have accepted rohu as the most important cultivable freshwater species in India (Shabir et al., 2025). However, challenges persist in feed sustainability, particularly due to the high cost and ecological impact of fishmeal **(Hasan & Olsen, 2009)**. The exploration of phytogenic feed additives has gained momentum as a strategy to enhance fish health and productivity while reducing dependency on synthetic inputs. Phytotherapy in aquaculture, defined as the use of plant-derived compounds to improve fish health, has been shown to promote immunity and growth **(Chakraborty andHancz 2011; Harikrishnan *et al*., 2011)**. Moringa (*Moringa oleifera*) is renowned for its nutritional value, providing essential fibers, proteins, vitamins, minerals, and lipids. Moringa leaf extract has been employed in various studies to promote the growth, immune response, antioxidant activity, and disease protection of fishes at different life stages, including fry (Kamble et al., 2024). According to **Van Hai (2015)**, incorporating medicinal herbs such as *Moringa oleifera* into fish diets provides an eco-friendly and cost-effective alternative to antibiotics. *Moringa oleifera*, widely known as the miracle tree, contains bioactive phytochemicals flavonoids, phenolics, and alkaloids that exhibit antioxidant, antimicrobial, and immunomodulatory properties **(Sharma *et al.,* 2012; Shahzad *et al*., 2013)**. Prior research demonstrates that dietary supplementation with moringa leaf meal improves growth performance in *Nile tilapia* and common carp **(Afuang *et al*., 2003; Khalil andKorni, 2017).**

## **2.0 Materials and Methods**

**2.1 Experimental site and Location**

### The study was carried out in Gorkapar village in Chhattisgarh's Balod district over the course of ninety days.

### **2.2 Experimental Setup**

### *Labeo rohita* fingerlings (mean weight 9.27 ± 0.01 g) were purchased from a private fish farm in Arjunda, Balod, and acclimated for a week in aeration-equipped FRP tanks after being treated with KMnO₄. The leaves of *Moringa oleifera* were gathered locally, cleaned, soaked in purified water, allowed to dry in the shade for seven days, and then ground into a fine powder and kept in airtight containers. Moringa leaf powder (MLP) was added to experimental diets consisting of groundnut oil cake, rice bran, wheat flour, fish meal, tapioca, vegetable oil, and vitamin premix in varying amounts: 0 g (T1, control), 2 g (T2), 4 g (T3), and 6 g (T4) per 100 g feed. After combining the ingredients, they were conditioned into dough, steamed, pelletized (2 mm), and dried until the moisture content was less than 10%.Table1.

Table 1 : Experimental set up

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Ingredient (g)** | **Treatments (Diet g/100g)** | | | | |
| **Control** | **T1** | **T2** | **T3** | **T4** |
| **Fish meal** | 10 | 10 | 10 | 10 | 10 |
| **GOC** | 30 | 28 | 26 | 24 | 22 |
| **Rice bran** | 32 | 32 | 32 | 32 | 32 |
| **Wheat flour** | 20 | 20 | 20 | 20 | 20 |
| **Tapioca** | 5 | 5 | 5 | 5 | 5 |
| **Vegetable oil** | 2 | 2 | 2 | 2 | 2 |
| **Vitamin premix** | 1 | 1 | 1 | 1 | 1 |
| ***Moringa oleifera* leaf powder** | 0 | 2 | 4 | 6 | 8 |

### The 120 fingerlings were divided into 12 glass tanks (0.6 × 0.3 × 0.45 m; 120 L capacity) at random in a fully randomized design, with three replications of each treatment. Tanks were routinely cleaned with siphoning to remove waste, and fish were fed twice a day at 9:00 AM and 4:00 PM. Temperature, pH, dissolved oxygen, alkalinity, and total hardness were among the water quality parameters that were measured every two weeks using standard protocols, such as Winkler's method for DO and titration techniques for alkalinity and hardness.

**2.3 Water Quality Parameters**

The water quality parameters were calculated on 15 15-day basis. The selected water quality parameters like Temp. pH, D.O and alkalinity were measured by according to **Yadav *et al.,* 2023.**

**2.4 Growth Parameters**

Fish were weighed on 15 days gap on routine basis were adjusted the ration weight accordingly. Growth parameters were determined the following formula (**Yadav *et al.,* 2023).**

**2.4.1 Weight gain (%)** = [Final weight (g) - Initial weight (g)] / Initial weight (g) × 100

**2.4.2 Specific Growth Rate (SGR) (%)** = [ln Final weight (g) – ln Initial weight (g)] / Culture period (days) × 100

**2.4.3 Average Daily Growth (ADG) (g/day)** = [Final weight (g) – Initial weight (g)] / Culture period (days)

**2.4.4 Feed Conversion Ratio (FCR)** = Dry feed intake (g) / Wet weight gain (g)

**2.4.5 Protein Efficiency Ratio (PER)** = Wet weight gain (g) / Protein intake (g)

### **2.5 Statistical analysis**

### The percentage of weight gain, specific growth rate (SGR), feed conversion ratio (FCR), protein efficiency ratio (PER), and average daily gain (ADG) were used to evaluate growth performance every two weeks. One-way ANOVA was used to statistically analyse the data at a 5% significance level, and SPSS software (version 21) was used to calculate mean differences using Duncan's multiple range test.

**3.0 Result**

**3.1 Water Quality Parameters**

Throughout the 90-day experiment, water quality parameters such as temperature, pH, dissolved oxygen, alkalinity, and hardness remained within acceptable ranges for aquaculture. Temperature ranged from 24.0°C to 29.3°C, aligning with the optimal growth range for *Labeo rohita*. pH levels varied from 6.5 to 8.1, suitable for carp culture, while dissolved oxygen levels ranged from 5.1 to 7.1 mg/L, sufficient for healthy fish growth. Alkalinity and hardness were also within favourable limits, ranging from 118–135 mg/L and 102–127 mg/L, respectively, indicating stable water conditions across treatments.

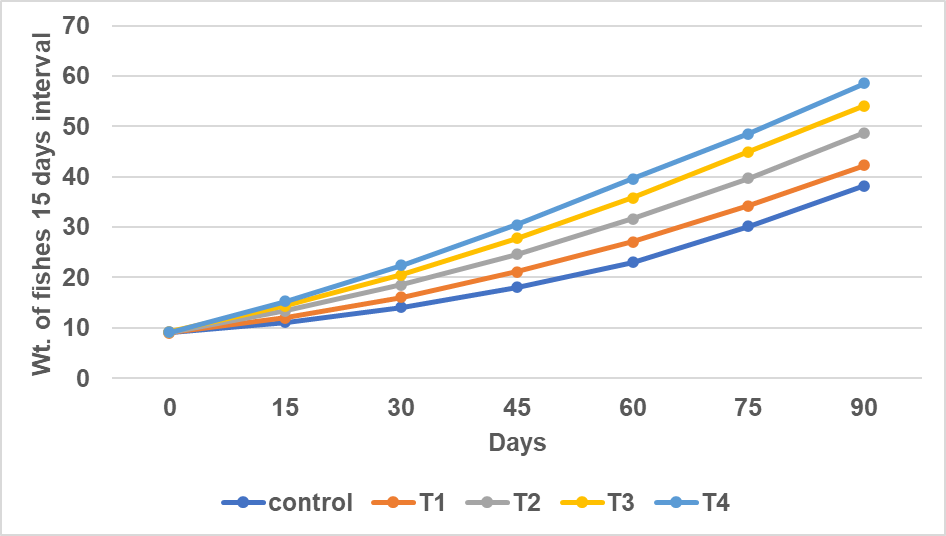


Figure 1 Growth pattern *Labeo rohita* on different experimental diets.

**3.2 Growth Parameters**

Significant improvements in growth performance were observed in *Labeo rohita* fingerlings supplemented with *Moringa oleifera* leaf powder. Final body weights increased with higher moringa inclusion, with the T4 group (8% MLP) achieving the highest average weight (58.55±0.39 g), while the control group had the lowest (38.19±0.12 g). Weight gain, specific growth rate (SGR), average daily gain (ADG), feed conversion ratio (FCR), and protein efficiency ratio (PER) all showed significant enhancement in the treatment groups compared to the control. T4 exhibited the highest weight gain (136.55±2.27%), SGR (1.30±0.00 %/day), and ADG (1.41±0.02 g/day), indicating superior growth. The most efficient FCR (1.89±0.01) was recorded in T1, although T4 also performed well (1.93±0.00). The highest PER was observed in T2 (4.15±0.07), suggesting improved protein utilisation at moderate moringa inclusion.

These results demonstrate that dietary supplementation with *Moringa oleifera* leaf powder significantly enhances the growth performance of *Labeo rohita* fingerlings without adversely affecting water quality, supporting its potential as a sustainable and natural feed additive in aquaculture.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameters** | **Treatments** | | | | |
| **Control**  (MOLP0%) | **T1**  (MOLP2%) | **T2**  (MOLP4%) | **T3**  (MOLP6%) | **T4**  (MOLP8%) |
| IW(g) | 9.13±0.01 | 9.06±0.03 | 9.14±0.03 | 9.27±0.01 | 9.15±0.02 |
| FW(g) | 38.19±0.12 | 42.29±0.20 | 48.76±0.17 | 54.08±0.21 | 58.55±0.39 |
| WG (g) | 77.53±2.09 | 95.63±3.21 | 106.09±3.60 | 115.44±3.40 | 136.55±2.27 |
| SGR(%/day) | 1.03±0.01 | 1.13±0.01 | 1.18±0.01 | 1.21±0.01 | 1.30±0.00 |
| ADG (g) | 0.75±0.02 | 0.96±0.03 | 1.07±0.03 | 1.17±0.03 | 1.41±0.02 |
| FCR | 1.90±0.00 | 1.89±0.01 | 1.95±0.00 | 1.94±0.00 | 1.93±0.00 |
| PER | 3.75±0.05 | 3.72±0.02 | 4.15±0.07 | 4.13±0.08 | 4.03±0.02 |
| Growth performance values are expressed as mean ± SD of three replicates per treatment (n=4) and values with differrent superscript letters are significantly different (p<0.05) among treatments.  IW: Initial weight; FW: Final weight; WG: Weight gain; SGR: Specific growth rate; ADG: Average daily growth; FCR: Food conversion ratio; PER: Protein Efficiency ratio. | | | | | |

Table 2: Growth response and feed efficiency of *Labeo rohita* fingerling.

**Discussion**

Growth performance of *Labeo rohita* fingerlings showed significant improvement with increasing levels of *Moringa oleifera* leaf powder supplementation. Final average body weights varied from 38.19 g in the control group to 58.55 g in the group receiving 8% MLP (T4). Weight gain and specific growth rate (SGR) were significantly higher in moringa-supplemented groups, particularly T4, which showed the highest weight gain (136.55 g) and SGR (1.30%/day), while the control group recorded the lowest (77.53 g and 1.03%/day, respectively). Average daily gain also increased with higher MLP inclusion, peaking at 1.41 g/day in T4. The feed conversion ratio (FCR) varied significantly across treatments, with the best FCR observed in T2 (1.95), indicating efficient feed utilisation at 4% MLP supplementation. Interestingly, T1 showed a slightly poorer FCR despite lower MLP inclusion. The protein efficiency ratio (PER) followed a similar trend, with the highest value recorded in T2 (4.15), suggesting enhanced protein utilisation at moderate MLP levels. These results suggest that MLP supplementation not only enhances growth but also improves feed efficiency and protein utilisation in *Labeo rohita* culture. This study demonstrated that *Moringa oleifera* leaf powder significantly enhances the growth performance of *Labeo rohita*, consistent with prior findings in other aquaculture species. For example, **Afuang *et al*. (2003)** reported that solvent-extracted moringa leaves could replace 30% of fishmeal in *Nile tilapia* diets without adverse effects. Similarly**, Khalil andKorni (2017)** observed improved growth and immunity in *Cyprinus carpio* fed moringa-based diets. In our study, fish receiving 8% moringa supplementation showed the highest weight gain and specific growth rate, supporting the hypothesis that moringa’s rich nutritional profile and bioactive compounds contribute to enhanced feed utilization. These results align with the observations of **Sherif *et al*. (2014)**, who found improved growth efficiency in tilapia fed moringa leaves up to 25%, and with **Masood *et al*. (2020)**, who noted that moringa supplementation improves body composition in *Labeo rohita*. The presence of flavonoids and antioxidants in moringa likely reduces oxidative stress and supports metabolic functions essential for growth **(Chakraborty andHancz 2011)**. Additionally, the improved protein efficiency ratio suggests better nutrient assimilation, corroborating findings by **Idowu *et al*. (2017) and Arsalan *et al*. (2016).**

Overall, dietary inclusion of *Moringa oleifera* leaf powder had a positive influence on growth performance and feed efficiency without adversely affecting water quality. Among all treatments, 8% MLP (T4) demonstrated the most promising results in terms of growth parameters, although 4% MLP (T2) showed optimal feed and protein utilisation efficiency. The evidence supports the incorporation of Moringa oleifera leaf powder as a sustainable, plant-based growth promoter in freshwater carp diets.

**Conclusions**

The findings of this study demonstrate that *Moringa oleifera* leaf powder is an effective, eco-friendly feed additive for enhancing the growth performance of *Labeo rohita* fingerlings. Dietary inclusion of moringa, particularly at 8%, significantly improved weight gain, specific growth rate, and average daily gain without adversely affecting water quality parameters. The feed was well tolerated by the fish, and no negative effects on water conditions were observed, indicating its suitability for sustainable aquaculture practices. Given its local availability, low cost, and bioactive properties, *Moringa oleifera* holds strong potential as a natural growth promoter and immune booster in fish culture systems. Further research is encouraged to explore its pharmacological effects and applications in disease prevention and water quality management in aquaculture.

**Availability of data and Materials**

The data will be provided upon request to the journal.

**Ethical Statement:**

In the present study, *Labeo rohita* were collected from the School of School, Sanjeev Agrawal Global Educational (SAGE) University, and Bhopal India). Ethical approval, specimen collection, and maintenance were performed in strict agreement with all the recommendations India.

**Disclaimer (Artificial Intelligence)**

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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