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Growth Performance and Protein Retention in Gourami Fish Given Additional Moringa Leaves Formulated in Feed

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ABSTRACT

The purpose of this study was to address the effect of using Moringa leaves as a source of feed protein on the growth and protein retention of gourami fish (*Osphronemus gouramy*). The treatment included five different substitutions of Moringa leaves (*Moringa oleifera*) for artificial feed, namely 0; 25; 50; 75 and 100 (%). The experimental design used was a completely randomized design with 5 treatments and 3 replications. Data analysis using quantitative methods included survival rate, specific growth rate and protein retention. The data were analyzed using analysis of variance (ANOVA) to test the effect of treatment, followed by Tukey's test for multiple comparisons. Ten fish were used per treatment group, with an average initial weight of 19.09 ± 0.39 g. The results indicated that the optimal addition of Moringa leaf flour was a 50% substitution of pellet feed, based on a survival rate of 83.33%, a specific growth rate of 0.66 ± 0.03% per day, and protein retention of 16.25 ± 0.17%.

INTRODUCTION

Gurami fish is one type of freshwater fish that is favored by the community. Gourami fish (*Osphronemus goramy*) in Indonesia is one of the main freshwater commodities that is economically important due to its high price and local demand **(Nurhayati *et al.*, 2021)**. With its tendency to consume plant feed, gourami fish is a valuable candidate for low-input aquaculture **(FAO, 2019)**. Rearing is carried out in ponds that are specifically dedicated to gourami fish or shared with other species **(Kristanto *et al.*, 2020)**. **Slembrouck *et al.* (2018)** highlighted Azolla as the best candidate among five floating macrophyte species for ecological intensification of small-scale fish farming in tropical areas. Recently, a study highlighted the feasibility of combining the production of floating macrophytes *Azolla filiculoides* in giant gourami ponds **(Caruso *et al.*, 2021)**, with macrophytes used as alternative fish feed.

However, the growth of this fish is relatively slow, therefore it requires a solution to shorten the fish maintenance period **(Nurhayati *et al.*, 2021)**. The demand for consumption of gurami fish continues to increase. However, it is not balanced with an increase in production because of its slow growth. Slow fish growth can be caused by external and internal factors. One external factor that affects growth is feed. Feed plays an important role in intensive cultivation activities. In general, feed costs reach 60-80% of total operational costs **(Manik & Silaban, 2021)**.

The high cost of feed requires other alternatives to reduce feed costs so that the profits obtained by farmers are relatively high. The addition of moringa leaves to feed is thought to be a solution to increase the growth of gurami fish so that the maintenance period is shorter **(Ajo *et al.*, 2020)**.

Today there has been a shift in the pattern of providing raw materials for feed in efforts to find alternative materials as a substitute for conventional feed raw materials. An alternative solution that can be attempted is to make homemade feed through simple techniques by utilizing relatively cheap raw material sources. The raw material used as a source of vegetable protein in the preparation of feed rations is moringa leaf flour. A material that can be used as a raw material for feed must meet certain requirements, namely having high nutritional value, being available in large quantities and continuously, and not having high economic value **(Helmiati *et al.*, 2020)**. Moringa leaves (*Moringa oleifera*) are one source of vegetable protein that contains 30.3% protein and has 19 types of amino acids **(Moyo *et al.*, 2011)**, vitamins B, C, K, beta carotene and other minerals **(Mandala *et al.*, 2013)**. Moringa leaves have high energy and phenolics, especially flavonoids and phenolic acids as sources of natural antioxidants.

MATERIALS AND METHODS

Research tools and materials

The equipment used in this study were 15 aquariums measuring 50cm x 50cm, a flouring machine, a feed printing machine, a digital scale, a ruler, a basin, a measuring cup, a jar, a net, stationery and a camera. The materials used in this study included: The test fish used in this study had an average initial weight of 19.09 ± 0.39g. The feed used was artificial feed (commercial pellets Hi-Pro-Vite 781-1) mixed with moringa leaf flour with a nutritional composition of protein content of 31-33%, fat min 4%, fiber max 5%, ash content max 13% and water content max 12%, which has advantages because the amount of protein is in accordance with the needs of fish growth.

Making moringa leaf flour

Moringa leaves were separated from their stems, then the leaves were dried in an oven at a temperature of 60°C for 6-8 hours. The dried leaves were ground, sieved using

a sieve with a mesh size of 1mm and put in an airtight plastic bag and stored in a refrigerator at a temperature of 5°C.

Research design

The design used in this research was a Completely Randomized Design (CRD) which consisted of 5 treatments, and each treatment was repeated three times. The treatments were as follows:

A : Without moringa leaves
B : Substitution of 25% moringa leaves for artificial feed
C : Substitution of 50% moringa leaves for artificial feed
D : Substitution of 75% moringa leaves for artificial feed
E : Substitution of 100% moringa leaves for artificial feed

The Completely Randomized Design (CRD) model used was as follows:

$$Yij = \mu + \sigma i + \sum ij$$

Where:

Yij : Observation value of feeding with different percentages of moringa leaf flour to-i on the growth of gourami fish in the jth replication
I : Treatment
J : Replication
μ : Effect of feeding with different percentages of moringa leaf flour to-i on the growth of gourami fish
Σij : Effect of experimental error in feeding with different percentages of moringa leaf flour to-i on the growth of gourami fish in the jth replication

Research procedure

Preparation

The preparation of the research carried out included making moringa leaf flour, making feed, preparing containers and media, and preparing test fish.

1. **Implementation**

   The fish were placed in a 50cm x 50cm aquarium as many as 10 fish with an initial average weight of 19.09 ± 0.39g. Maintenance was carried out for 60 days with a feeding frequency of 3 times a day at 08.00, 12.00 and 17.00 WIB with a feeding rate of 5%. Sampling was carried out every 20 days.

2. **Observation**

   During the study, the parameters observed were:

   2.1 Survival rate (SR)

   $$SR = Nt/No \times 100\ \%$$

   Where:

   N0 = Number of eels at the beginning of the study (tail)

Nt = Number of eels at the end of the study (tail)
SR = Survival rate (%)

2.2 Specific growth rate

$$SGR = \frac{(\ln Wt - \ln W0)}{\Delta t} \times 100\%$$

Where:
W0 = Average weight of eels at the beginning of the study (g)
Wt = Average weight of eels at the end of the study (g)
Δt = Maintenance period (days)
SGR = Specific growth rate

2.3 Protein retention

$$RP = \frac{\sum Pt - \sum P0}{\sum PP} \times 100\ \%$$

Where:
RP = Protein retention (%)
∑P0 = Initial body protein amount of the study (g)
∑Pt = Final body protein amount of the study (g)
∑PP = Total feed protein amount (g)

3. Data analysis

Data analysis using quantitative methods included survival rate, specific growth rate and protein retention. The test was analyzed using analysis of variance (ANOVA), the analysis tested for the effect of treatment, followed by the Tukey test.

RESULTS

The results of the research on gourami fish feed (Oshpronemus gouramy) using a mixture of moringa leaves can be seen in Table (1).

Table 1. Research results on the use of moringa in gourami fish feed (*Oshpronemus gouramy*)

No	Parameter	Treatment				
		A	B	C	D	E
1.	Survival (%)	83,33 ± 5,77[a]	83,33 ± 5,77 [a]	80,00 ± 10,00 [a]	83,33 ± 5,77 [a]	83,33 ± 11,55 [a]
2.	Spesific growth rate (%/weight/day)	0,43±0,05[b]	0,44 ± 0,03[b]	0,66 ± 0,03[d]	0,53 ± 0,04[c]	0,33 ± 0,02[a]
3	Protein retention (%)	10,43 ± 0,33[b]	12,27 ± 0,16[c]	16,25 ± 0,17[d]	13,19 ± 0,06[c]	8,77 ± 0,73[a]

1. Survival rate

The survival rate of gourami fry for 60 days ranged from 80-83.33% (Table 1). From the statistical analysis of variance (ANOVA) at a 95% confidence interval (P<0.05), it was found that control and treatment had no significant effect on the survival rate of gourami fry.

2. Specific growth rate

The specific growth rate of gourami fry reared for 60 days ranged from 0.33 – 0.66 (%/weight/day) (Table 1). The highest value in the 50% substitution treatment was 0.66 ± 0.03 (%/weight/day) and the lowest value in the 100% substitution treatment was 0.33 ± 0.02 (%/weight/day). From the statistical analysis of variance (ANOVA) at a 95% confidence interval (P<0.05), the results showed that control and treatment had a significant effect on the specific growth rate of gourami fish seeds.

3. Protein retention

Protein retention of gourami fish seeds maintained for 60 days ranged from 8.77 - 16.25 (%) (Table 1). The highest value in the 50% substitution treatment was 16.25 ± 0.17 (%), and the lowest value in the 100% substitution treatment was 8.77 ± 0.73 (%). From the statistical analysis of variance (ANOVA) at a 95% confidence interval (P<0.05), the results showed that control and treatment had a significant effect on the specific growth rate of gourami fish seeds.

DISCUSSION

Feeding with the addition of moringa leaf flour showed results that did not significantly affect the survival rate of fish; this condition shows that giving moringa leaves is still relatively safe and non-toxic. Moringa leaves are herbal plants that have the potential to reduce the mortality rate of animal embryos **(Mafruchati *et al.*, 2024)**. The activity of vitamin E in *Moringa oleifera* oil and seed samples was 78.71 and 62.08mg/ kg, respectively. The most abundant isomer, α-tocopherol, was found in oil and seeds at 75.71 and 59.06mg/ kg, respectively. However, the second most abundant *Moringa oleifera* isomer, α-tocopherol, showed a higher content in seeds (17.86 mg/kg) compared to oil (15.35mg/ kg) **(Pluháčková *et al.*, 2023)**. Alpha-tocopherol, one of the eight isoforms of vitamin E, is the most potent fat-soluble antioxidant known in nature. For many years, α-tocopherol was thought to function only as a scavenger of lipid peroxyl radicals, especially oxidized low-density lipoprotein (oxLDL), thus serving as a major antioxidant for the prevention of atherosclerosis. In recent years, many roles of α-

tocopherol have been revealed, including not only antioxidant functions, but also pro-oxidant functions, cell signaling, and gene regulation **(Tuckera & Townsend, 2005)**.

The Specific Growth Rate of gourami fry reared for 60 days ranged from 0.33 to 0.66 (%/weight/day). Specific growth rate is defined as the rate of increase in cell population biomass per unit biomass concentration. Moringa leaves (*Moringa oleifera* Lam.) have 19 types of amino acids and are one of the sources of vegetable protein containing 30.3% protein **(Su & Chen., 2020)**, vitamin B which functions as a breaker of nutrients that enter the fish's body and converts them into energy, vitamin C functions to accelerate wound healing in fish, K as blood clotting and beta carotene as an increase in fish color and acceleration of fish growth rate **(Pirmansyah *et al.*, 2024)**. Gourami fish are herbivorous fish, so in artificial feed gourami fish must contain more vegetable protein than animal protein.

Protein retention of gourami fish seeds raised for 60 days ranges from 8.77 - 16.25%. Protein retention is a reflection of the amount of protein given, and which can be absorbed and utilized by fish to build or repair damaged cells, and utilized by the fish's body as daily metabolism **(Buwono *et al.*, 2024)**. Moringa leaf protein concentrate has a protein content of 65.51% with the highest essential amino acid leucine (67.50mg/ g protein), while non-essential amino acids are aspartic acid, glutamine, and glycine (67.90; 79.00; 73.60mg/ g protein) with a digestibility of 70.48%. This study shows that the tested moringa leaf protein concentrate can be a source of protein for feed ingredients equivalent to soybean meal **(Rimbawanto *et al.*, 2022)**. This study produced higher protein retention, namely in treatment C (50% substitution) resulting in 16.25% protein retention, when compared to research **(Kurniawan *et al.*, 2019)** with 15% substitution resulting in 15.82% protein retention.

CONCLUSION

The best addition of moringa leaf flour was a 50% substitution of pellet feed seen from the survival response of 83.33%, specific growth rate of 0.66 ± 0.03 (%/weight/day) and protein retention of 16.25 ± 0.17%.

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