Addition of Lemuru Fish Oil to Protein Retention and Feed Utilization Efficiency of silver barb *Rasbora argyrotaenia*

R Ayunda1, L Sulmartiwi2* and A S Mubarak3

1Aquaculture, Faculty of Fisheries and Marine, Universitas Airlangga, Kampus C Unair, Jl. Mulyorejo Surabaya 60115, East Java, Indonesia  
2Department of Marine, Faculty of Fisheries and Marine, Universitas Airlangga, Kampus C Unair, Jl. Mulyorejo Surabaya 60115, East Java, Indonesia  
3Department of Fish Health Management and Aquaculture, Faculty of Fisheries and Marine, Universitas Airlangga, Kampus C Unair, Jl. Mulyorejo Surabaya 60115, East Java, Indonesia  

*Corresponding Author: shofy.ua@gmail.com

**Abstract.** Silver barb *Rasbora argyrotaenia* is one of the local freshwater fish in Indonesia that has advantage of being a source of protein and also resistant to disease [1]. All this time, the feed used by farmers in fulfilling nutrients such as protein and fat is still lacking, so there is a need for additional food and additional nutrients for maximum fish growth [2].

Protein is an element that is needed by the body for growth and as energy. Proteins are complex organic compounds which are polymers of amino acid monomers that are connected to each other by peptide bonds. Concentration or amount of protein in feed ration ingredients greatly affect the addition of fish body weight. Protein is needed by fish bodies, both for body growth and for metabolism [3]. The ability of organisms to convert protein in feed into body protein stored in the body of a fish is called protein retention. Factors affecting protein retention are genetic, age and growth [4].

The minimum protein requirement for cyprinid fish is 28-44% which can support the growth of cyprinid fish optimally. Optimal protein requirements can be influenced by the composition of amino acids and can be seen from the level of feed efficiency in the body of the fish. Whereas the cyprinid fish fat requirement is around 4-18% [5]. One effort to accelerate growth, increase protein retention and increase the efficiency of feed utilization is by adding nutrients from essential fatty acids so that the energy needs of silver barb can be fulfilled.

1. **Introduction**

Silver barb *Rasbora argyrotaenia* is one of the local freshwater fish in Indonesia that has advantage of being a source of protein and also resistant to disease [1]. All this time, the feed used by farmers in fulfilling nutrients such as protein and fat is still lacking, so there is a need for additional food and additional nutrients for maximum fish growth [2].

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2. Materials and methods
This study was conducted in the Laboratory of the Faculty of Fisheries and Marine, Universitas Airlangga and Saraswanti Indo Genetech Laboratory, Bogor, West Java, Indonesia.

2.1 Test organisms
In this study, the observed fish were Silver barb 30-40 mm in size with a 0.49±0.01 g in average weight, from the Installation of Freshwater Aquaculture Umbulan, Pasuruan, East Java, Indonesia.

2.2 Test feed production
Commercial feed in this research contained 36.95% protein and 5.29% fat, feed diameter was 0.7-1.0 mm. Lemuru fish oil was added in the decided amount of concentration (0 %/ as control, 2 %, 4 %, 6 %, and 8 %) and mixed with 2 mL/ 100 g of egg white in feed [6]. Next, added 100mL of water to the composition for every 100 g of fish feed [3]. Mixed commercial fish feed and lemuru fish oil evenly by spraying. The mixed feed was dried in the oven at 60 °C in 48 hours [7]. The approximate analysis of feed results was presented in Table 1.

| Table 1. Proximate analysis of feed |
|------------------------------------|
| Proximate analysis | The concentration of lemuru fish oil addition (%) |
| | 0 | 2 | 4 | 6 | 8 |
| Protein (%) | 38.37 | 38.39 | 38.41 | 38.26 | 38.61 |
| Lipid (%) | 7.63 | 7.66 | 9.46 | 10.16 | 12.64 |

2.3 Fish rearing
The silver barb was reared in a 20 L volume aquarium at a density of 3 fish/L for each treatment. The fish fasted for twenty-four hours before the treatment was done. Water was replaced every 2-3 days about 25% of the volume of the treatment unit.

2.4 Treatment
This study employed a complete randomized design (CRD) as an experimental method with five treatments of lemuru fish oil concentration and four replications respectively. The concentration of Lemuru fish oil addition in the fish feed based on cyprinid fish fat requirement is 5-15%. The treatments were done through the addition of lemuru fish oil in the feed (0 %/ as control, 2 %, 4 %, 6 %, and 8 %) for 42 days. Feeding frequency was three times a day [8] for 4 % biomass weight according to Mukti’s method [9].

2.5 Observation result
Protein retention is carried out by analyzing the protein content of Rasbora argyrotaenia based on treatment using the formula [10]

\[
\text{Protein Retention} \% = \frac{\text{Amount of final body protein} - \text{Amount of initial body protein}}{\text{Amount of protein consumed}} \times 100\%
\]

\[
\text{Early protein (g)} = \frac{\text{Initial fish protein (g)}}{100} \times \text{Initial fish weight (g)}
\]

\[
\text{Final protein (g)} = \frac{\text{Initial fish protein (%)}}{100} \times \text{Final fish weight (g)}
\]

\[
\text{Feed Protein (g)} = \frac{\text{Level of feed protein (%)}}{100} \times \text{Amount of feed consumed (g)}
\]
For calculating Feed Efficiency on *Rasbora argyrotaenia* using formula [11],

\[
\text{Feed Efficiency} = \frac{(\text{Total weight fish final} + \text{Total weight dead fish}) - \text{total weight fish early})}{\text{Jumlah pakan yang dikonsumsi}} \times 100\%
\]

2.6 Data Analysis

Data obtained from the results of protein retention testing before and after treatment were analyzed using Analysis of Variance (ANOVA) to determine the effect of the treatment given. The treatment of adding lemuru oil to commercial feed which showed significant, then the calculation continued with Duncan's multiple range test.

3. Result and Discussion

3.1 Result

ANOVA (Analysis of Variant) statistical analysis results showed that the addition of lemuru fish oil in the feed affected the retention of stingray wader protein (P < 0.05). The concentration of adding lemuru fish oil in feed by 4% resulted in the highest protein retention of 16.95%. While the concentration of adding lemuru fish oil in feed by 8% produces the lowest protein retention of 10.58%, which is not significantly different from the addition of lemuru fish oil at a concentration of 6% with protein retention of 11.85%. The results of silver barb protein retention are presented in Table 2.

| Concentration of lemuru fish oil (%) | Protein retention ± SD |
|-------------------------------------|------------------------|
| 0                                   | 13.98 ± 0.85           |
| 2                                   | 15.04 ± 0.91           |
| 4                                   | 16.95 ± 0.98           |
| 6                                   | 11.85 ± 0.90           |
| 8                                   | 10.58 ± 0.89           |

The results of ANOVA (Analysis of Variant) statistical analysis showed that the addition of lemuru fish oil in the feed affected the efficiency of the utilization of Silver barb feed (P < 0.05). The concentration of adding lemuru fish oil in feed by 4% resulted in the highest utilization efficiency of 57.93%. While the concentration of the addition of lemuru fish oil in feed by 8% produces the lowest feed utilization efficiency of 45.68%. Efficiency of Silver barb feed can be seen in Table 3.

| Concentration of lemuru fish oil (%) | Feed efficiency ± SD |
|-------------------------------------|----------------------|
| 0                                   | 53.34 ± 1.47         |
| 2                                   | 57.66 ± 2.63         |
| 4                                   | 57.93 ± 3.49         |
| 6                                   | 47.99 ± 3.04         |
| 8                                   | 45.68 ± 4.32         |

3.2 Discussion

The addition of lemuru fish oil in feed can increase protein retention, feed utilization efficiency, specific growth rate and survival rate of Silver barb compared without the addition of lemuru fish oil in feed. Increased protein retention, feed utilization efficiency, specific growth rate and fish survival rate because nutrients in the feed are well absorbed. This is supported by Mukti's statement [9] that, lemuru fish oil is very potential to be used as feed ingredients because it contains high EPA and DHA energy sources and omega-3 fatty acid content in lemuru fish oil which functions in increasing the growth rate and development of Silver barb (*Rasbora argyrotaenia*). The content of omega-3 fatty
Acids found in lemuru fish oil plays an important role in the balance of nutrients in the feed, where the fat is stored in subcutaneous tissue and has a function as a body protector, energy source, essential source of fatty acids and as a protein saver (protein sparing effect) [12].

The concentration of adding 4% lemuru fish oil in the feed produced the highest protein retention of 16.95%. This was allegedly due to the correct concentration of adding lemuru fish oil, so the nutrients in the feed were well absorbed to form new tissues or cells in the process of silver barb growth. [13] showed that, balanced nutritional needs with the provision of appropriate protein feed, it will produce energy and the ability of new cells or tissue to increase fish growth. The concentration of addition of Lemuru fish oil was 8%, resulting in the lowest protein retention of 10.58%. This is due to the higher concentration of lemuru fish oil, the contained protein feed cannot work optimally. Nutrients in feed are not well absorbed to form metabolism or body cells as starch silver barb fish growth. Bwono [14] said, if the protein content in the feed is low, it will produce slow growth. Feed containing energy and protein balanced with the right amount of nutrients will produce the feed is well absorbed [15]. The concentration of the addition of lemuru fish oil in silver barb feed was 4%, resulting in the highest utilization efficiency of feed which was 57.93%. The results of high utilization of feed efficiency, the efficiency of feed used for metabolism in the growth of silver barb will be maximized. [16] shows the high value of feed efficiency can be interpreted that food had enters the body of the fish is well digested. The concentration of adding lemuru fish oil to silver barb feed by 8% produces the lowest feed utilization efficiency of 45.68%, with a low efficiency value it will have an impact on waste of feeding. The lower the value of the efficiency of feed utilization, the feed provided is not efficient [17].

The addition of lemuru fish oil in feed with a concentration of 4% shows the specific growth rate with the highest yield of 2.17% per day, this can be interpreted that silver barb are able to utilize the feed provided to the maximum. [9] shows that the addition of fish oil by 5% produced the highest eel growth rate that served to increase the rate of growth and development of fish. The addition of 8% lemuru fish oil in the feed produced the lowest specific growth rate of 1.69% per day. This is because the nutrients in the feed cannot be absorbed by the body of the fish and are wasted through feces, so that the resulting growth rate is low [18]. The addition of lemuru fish oil in feed showed a 100% survival rate for silver barb. [19] shows that, the survival rate of fish is influenced by feed quality and water quality. The results of proximate analysis of feed showed that the feed used in this study contained 36.95% protein and 5.29% fat. This can be interpreted that the Silver barb is not affected by the addition of lemuru fish oil in the feed in each treatment and does not cause toxic to the maintenance media of Silver barb. With the addition of lemuru fish oil in the right feed, no harmful particles can damage the fish's immune system [8].

4. Conclusions
Based on research that has been done about the addition of lemuru fish oil to protein retention and the efficiency of *Rasbora argyrotaenia* (silver barb) feed utilization, it can be concluded that the addition of lemuru fish oil in feed has an effect on feed influences protein retention and the efficient utilization of *Rasbora argyrotaenia* (silver barb).

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