**Biotika, 6(61), December 2024, ISSN 2410-9290 (Online)**
DOI https://doi.org/10.18551/biotika

UDC 639

# ASSESSMENT OF ECO ENZYME APPLICATION TO SELF-MADE FOOD FOR PATIN FISH (PANGASIUS SP.) PERFORMANCE

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## ABSTRACT
The addition of *eco enzyme* is proposed as a solution to improve the quality of self-made feed. The study aimed to analyze the nutritional content of self-made feed with the addition of *eco enzyme* on the growth performance of catfish. The research was conducted in the farmer ponds of Cindai Alus Village, West Martapura, South Kalimantan, and the analysis of feed nutrition was conducted at the Animal Nutrition and Diet Science Laboratory, Faculty of Agriculture, ULM. The research treatments included variations in feed composition with ikan rucah (40% in K and A, 30% in B, 20% in C), oil palm meal (20% in K and A, 30% in B, 40% in C), rice bran (40% in all treatments), and the addition of *eco enzyme* at 60 mL/kg in treatments A, B, and C. The addition of eco enzyme to the feed was done in all treatments. The addition of *eco enzyme* to self-made feed with different compositions did not show significant differences in nutritional content (proximate test). The addition of *eco enzyme* did not show significant differences in the growth of length and weight of catfish, but showed significant differences in protein retention of catfish fed with feed with the addition of *eco enzyme* and feed without the addition of *eco enzyme*. Protein in feed added with *eco enzyme* is absorbed better in the fish body than fish given feed without *eco enzyme*.

## KEY WORDS
Catfish, eco enzyme, nutrition, growth.

Catfish farming has become a popular activity in many parts of Indonesia, including Sumatra, Kalimantan and Java. Data from the Ministry of Maritime Affairs and Fisheries (KKP) in 2024, catfish production in South Kalimantan increased from 44,698.8 tons in 2020 to 46,282.00 tons in 2021. This increase reflects the high public interest in catfish farming, which means the demand for commercial feed is also growing to support optimal catfish production.

Feed plays an important role in catfish farming, contributing around 60-70% of total production costs (Hasnidar, 2022). The high price of commercial feed encourages farmers to look for more economical alternatives, such as producing their own feed. Self-made feed can use raw materials such as fishmeal, rice bran, and palm kernel meal which are relatively easy to obtain and cheap. Self-made feeds often fall short of the nutritional standards required for optimal growth of catfish.

Local raw materials such as ikan rucah, rice bran, and palm oil cake have potential nutritional content. Groundfish contains about 44% protein (Rahmaningsih, 2018), while rice bran provides high carbohydrates and energy that are important for fish (Sami, 2018). Oil palm meal is also rich in nutrients such as crude protein, crude fat, and crude fiber needed in feed. Self-contained feeds made with these ingredients contain protein, the protein levels achieved are often still below the needs of catfish, which require about 25% protein for optimal growth (Mahyuddin, 2010).

The addition of *eco enzyme* has been proposed as a solution to improve the quality of independent feed. *Eco enzyme* is the result of fermentation of sugar, fruit or vegetable residues, and water, producing enzymes with probiotic activity that help break down complex nutrients into simpler and easily absorbed components (Vama & Cherekar, 2020). The results showed that the addition of *eco enzyme* to feed can increase protein content and feed efficiency, thus helping patin fish grow more optimally (Fitriana *et al*., 2023).

*Eco enzyme* offers an economical and environmentally friendly solution to improve the nutritional quality of self-made feed for catfish. By adding *eco enzyme*, it is expected that the self-made feed can approach the quality of more expensive commercial feeds, providing a more sustainable and affordable option for farmers. This research is expected to make a significant contribution to the development of catfish farming through self-made feed with *eco enzyme*, improving the efficiency and sustainability of catfish farming in Indonesia. This study aims to analyze the nutritional content of self-made feed supplemented with *eco enzyme* on catfish growth performance and feed retention.

## METHODS OF RESEARCH

The research was conducted in the ponds of farmers of Cindai Alus Village RT.09, West Martapura, South Kalimantan, Indonesia, while the analysis of feed nutrient content in the Laboratory of Nutrition and Animal Food Science, Faculty of Agriculture, Lambung Mangkurat University, Indonesia. The maintenance media used 12 hapa with a size of 1 x 1 x 1 and black in color, hapa was cleaned first then dried in the sun and then installed hanging 70 cm deep in the pond. The test fish used in this study were catfish measuring 10-15 cm. This study uses self-made feed added with *eco enzyme*, the addition of *eco enzyme* is done by spraying the feed every 3 hours before giving it to the test fish. Feed that has been made according to the treatment and added *eco enzyme* is then tested proximate feed using SNI 01-2891-1992 AOAC method by determining the quality of nutrients in protein feed, fat, BETN, crude fiber, ash, and water in the test feed.

Table 1 – Research Treatments

| No. | Material | K | A | B | C |
|---|---|---|---|---|---|
| 1 | Groundfish | 40% | 40% | 30% | 20% |
| 2 | Oil palm meal | 20% | 20% | 30% | 40% |
| 3 | Rice bran | 40% | 40% | 40% | 40% |
| 4 | *Eco enzyme* | - | 60mL/kg | 60mL/kg | 60mL/kg |

Relative length and weight of growth was calculated using the Effendie (2002) formula. Protein Retention was calculated according to Watanabe *et al*. (2001).

## RESULTS AND DISCUSSION

The results of proximate tests on feed with different compositions and before and after adding *eco enzyme* liquid can be seen in Table 1.

Table 1 – Feed Proximate Value Results

| Proximate | Treatment | | | | | |
|---|---|---|---|---|---|---|
| | K/A | B | C | A* | B* | C* |
| Water Content (%) | 12,02 | 9,58 | 5,43 | 14 | 14,24 | 11,09 |
| Protein Content (%) | 24,28 | 19,71 | 19,82 | 24,56 | 20,83 | 22,08 |
| Ash Content (%) | 31,71 | 23,14 | 20,71 | 30,35 | 20,69 | 19,84 |
| Fat Content (%) | 6,97 | 7,07 | 5,84 | 6,85 | 6,47 | 5,38 |
| Fiber Content (%) | 3,37 | 4,52 | 8,67 | 3,39 | 3,87 | 8,67 |

*Data source: Primary Data (2024). Description: K/A - between K and A have the same composition; the * sign is the treatment after being given eco enzyme.*

The proximate test results showed differences in the nutritional composition of the feed before and after the addition of *eco enzyme.* It can be seen that the addition of *eco enzyme* slightly increased the water content in all treatments, namely K/A (14%), B (14.24%), and C (11.09%), compared to before the addition which ranged from 5.43% to 12.02%. This increase in moisture content may be due to the characteristics of the *eco enzyme* liquid which contains water-based components that increase the water content in the feed, while the maximum feed moisture content is 12% (SNI, 2009).

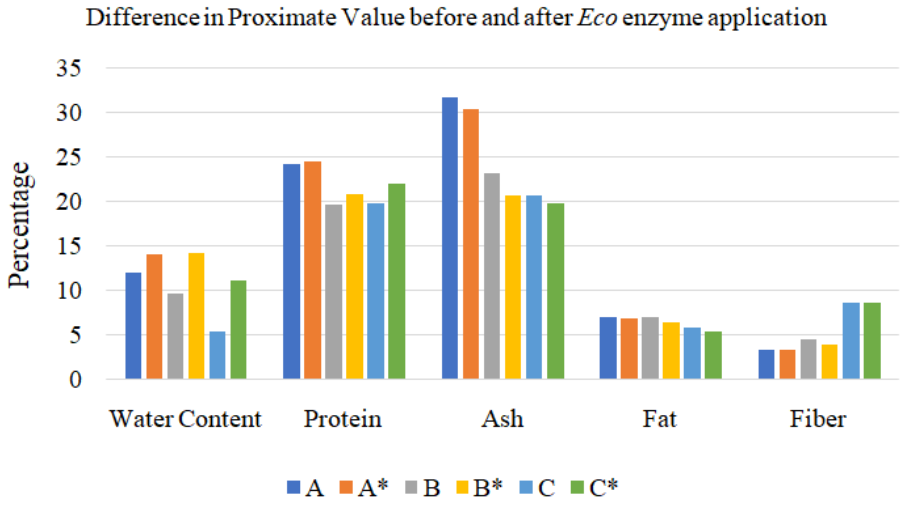


Figure 1 – Proximate graph of catfish feed

The protein content of the feed supplemented with *eco enzyme* showed an increase in several treatments, especially in treatment C, where the protein content increased from 19.82% to 22.08%. This shows that *eco enzyme* can increase the availability of protein in the feed, possibly due to the presence of protease *enzymes* in *eco enzyme* that break down protein into a form that is more easily absorbed. This increase can benefit fish growth, as more available protein can increase feed effectiveness (Ye *et al*, 2011).

The test results on ash, fat, and fiber content also showed changes after the addition of *eco enzyme*. Ash content decreased in each treatment after the addition of *eco enzyme*, such as in treatment B which decreased from 23.14% to 20.69% good for catfish. This condition is in accordance with Rahayu *et al.* (2022) The ash content of the feed represents the mineral content of the feed, the ideal ash content for fish feed in the enlargement phase is less than 15% and a maximum of 12% according to SNI (7548-2009), so the decrease in ash content in each treatment shows that the addition of *eco enzyme* is good for catfish feed and is able to improve the nutritional content of the feed. This decrease may be due to the *eco enzyme* reducing the insoluble mineral content in the feed. Meanwhile, the fat content ranged from 5.38% - 7.07%, which is in accordance with SNI (7548-2009) for catfish feed quality which states that the minimum fat content for enlargement is 5%, and the fiber content did not change significantly in treatment C, which was 8.67%, but this is still close to the fiber standard in accordance with SNI (7548-2009) which is 8%. Overall, the addition of *eco enzyme* affects the nutritional composition of feed, especially in terms of increasing protein content and decreasing ash content, which has the potential to improve feed quality for fish (Mahasu, 2016).

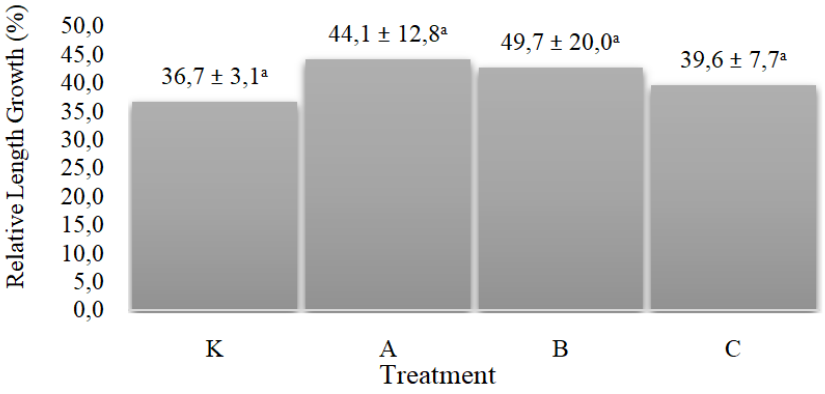


Figure 2 – Relative Length Growth of Patin Fish

The results of the study with the maintenance of 10 catfish / hapa for 60 days showed the highest average relative length in treatment A of 44.1% followed by treatment B of 42.7%, C of 39.6%, then K of 36.7%. All treatments given the addition of *eco enzyme* in this study showed relative length ranging from 36.7 - 39.6%. The results of the relative length analysis of fish as shown in Figure 2.

The results of the Lilifors normality test of fish relative length show $L_{maks}$ (0.162) < $L_{table}$ 5% (0.242) so it can be concluded that the data spread normally. Variety homogeneity test shows that the data is homogeneous where $_{X2}$ count (2.416) < $X2_{tabel}$ 5% (7.81) The results of ANOVA diversity analysis of fish relative length $_{Fcount}$ values (0.499 & 0.183) < $F_{tabel}$ 5% (5.143 & 4.757) and 1% (10.925 & 9.78) show the results do not significantly affect so that the treatment of feed with different compositions and the addition of *eco enzyme* liquid shows the value of relative length that does not significantly affect the control feed that does not get the addition of *eco enzyme*. The highest relative length of this study was in treatment B (30% ground fish, 30% oil palm meal, 40% rice bran and 60mL/kg feed of *eco enzyme*) with a relative length value of 7.1%.

The treatment given the addition of *eco enzyme* in this study gave a relative length ranging from 36.7 - 44.1%. The length of catfish in this study was higher than the length of catfish with different stocking densities given the addition of bromelain enzyme to the feed which ranged from 0.13 - 0.40% which was maintained for 35 days (Novita., 2017). The addition of *eco enzyme* to artificial feed used in the study produced proteins ranging from 20.83 - 24.56% although still below the protein standard for 25% enlargement (SNI, 2009) but the protein contained in the feed was able to be used optimally for the growth of catfish length during 60 days of maintenance. Zaidi *et al* (2021) Patin fish can still experience changes in growth rates at protein levels of 18% to 28%. Artificial feed with a protein content of around 20% can be used for Patin fish farming. The low protein level of about 20% compared to the use of high protein feed and also has no effect on the stress level of catfish.

Handayani *et al*, (2014) showed that the length growth of catfish given a combination feed with high protein increased in length growth. The results of this study indicate that the higher the content of nutrients such as protein in feed, the more optimal the growth of fish. Fitriana (2023) the addition of *eco enzyme* in commercial catfish feed provides relative length growth ranging from 93%-72% Hartiyaningsih (2022), The effect of giving *eco enzyme* in aquaponic systems on survival and growth of catfish with the highest average growth is in treatment 2 (giving *eco enzyme* 1.5 ml / L water) obtained results with an average length of 19.49 cm during the 90-day maintenance period.

The results of the study with the maintenance of 10 catfish / hapa for 60 days showed the results of the relative weight of fish in the highest average in treatment A of 176.1% followed by treatment B of 138.4%, C of 120.3%, then K of 108%. The results of the analysis of the relative weight (Wr) of fish during the study can be seen in the graph below Figure 3.

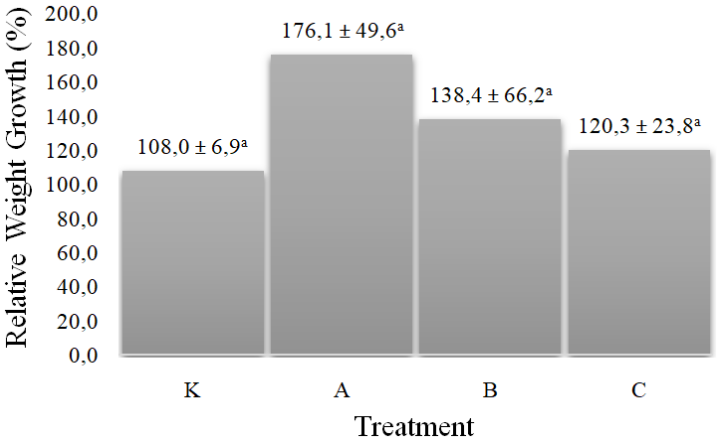


Figure 3 – Relative weight growth of catfish (%)

The results of the Lilifors normality test of fish relative weight show $L_{maks}$ (0.221) < $L_{tabel}$ 5% (0.242) so it can be concluded that the data spread normally. Variety homogeneity test shows that $X^2_{Count}$ (3.232) < $X^2_{Tabel}$ 5% (7.81) indicates that the data is homogeneous. The results of ANOVA diversity analysis of fish relative weight with the value of $F_{count}$ (0.116 & 1.107) < $_{Ftable}$ 5% (5.143 & 4.757) and 1% (10.925 & 9.28) results have no real effect between feed with the addition of *eco enzyme* with feed without the addition of *eco enzyme*. The highest relative weight in this study was treatment A (ikan rucah 40%, palm oil cake 20%, rice bran 40% and *eco enzyme* 60mL/kg feed) with a relative weight value of 66.4%.

The relative weight of fish in this study showed the highest average result in treatment A of 176.1% followed by treatment B of 138.4%, C of 120.3%, then K of 108%. All treatments that were given the addition of *eco enzyme* in this study showed relative weights ranging from 108 - 176.1%, although in this study the weight of catfish given feed with the addition of *eco enzyme* and feed without the addition of *eco enzyme* showed results that were not significantly different, but the weight results in this study were higher than Fitrina (2023) who used *eco enzyme* on low protein commercial feed (15%) for catfish which produced relative weights ranging from 22 - 23%.

The unreal effect on the growth of weights fed with self-made feed added with *eco enzyme* and artificial feed not added with *eco enzyme* shows that at certain times if the main raw material for self-made feed, namely dried fish, is difficult to obtain, we can reduce the amount of dried fish usage by increasing the use of palm oil cake flour in the feed formulation used and then adding *eco enzyme* liquid to help increase protein in feed that uses less dried fish. This of course aims to help increase growth in feeds that use only a small amount of dried fish. Jusadi *et al*. (2004) conducted a study with probiotic *Bacillus* sp. in commercial feed given to catfish larvae measuring 1.859 g with a dose of 15 ml / 1 kg of feed can provide an additional final daily weight rate of 2.00 g. Protein is a building *block* of muscle tissue and muscle tissue. Protein is a substance that builds muscle tissue and meat, as well as hormones and enzymes that play a role in the growth process. Protein requirements will decrease with increasing weight and age of fish (Arnason *et al*., 2010).

Growth is the process of increasing the length and weight of an organism that can be seen from changes in length and weight in units of time. Fermentation of *eco enzyme* liquid that occurs can change complex compounds into simpler ones and the presence of papain *enzyme* activity in *eco enzyme* liquid is a protease *enzyme* that is proteolytic, can break down protein molecules into micro particles, namely amino acids into dissolved nutrients that allow it to be absorbed by the intestinal walls which will then be flowed throughout the body of catfish Gatesoupe (1999) states that enzyme activity in digestion will change rapidly if there are enzymes that enter through feed or water which causes a change in the balance of enzymes that already exist in the intestine with incoming bacteria. Muchlisin *et al*. (2016) stated that the addition of papain 2.75% in artificial feed can increase the growth rate. This is in line with the research that the addition of *eco enzyme* to catfish feed, can help and accelerate the digestive process so that the nutrients obtained are fulfilled for the growth and survival of catfish given *eco enzyme*.

The results of the study with the maintenance of 10 catfish / hapa for 60 days showed the results of protein retention with the highest average in treatment B of 5.5%, followed by treatment C of 5.2%, A of 3.6%, then K of -5.3%. All treatments given the addition of *eco enzyme* in this study showed protein retention ranging from 3.6 - 5.5%. The results of fish protein retention analysis can be seen as shown in Figure 4.

The results of the normality test of catfish protein retention with a value of $L_{maks}$ (0.153) < $L_{tabel}$ 5% (0.242) indicate that the data spread normally (Appendix 23). Then proceed with the Homogeneity test with the value of $X^2_{Count}$ (2.864) < $X^2_{Tabel}$ 5% (21.03) indicates that the data is homogeneous. The results of the ANOVA test of protein retention in fish meat with the value of $_{Fcount}$ (3.088 & 14.647) > $F_{tabel}$ 5% (5.143 & 4.757) and) means that the results have a significant effect, the highest protein retention in catfish meat in this study is treatment B (30% ground fish, 30% oil palm meal, 40% rice bran and *eco enzyme* 60mL/kg feed) with a protein retention value of 5.5%. Treatment B, which consisted of a combination of 30% ikan rucah, 30% oil palm meal, 40% rice bran, and 60mL/kg feed of *eco enzyme*, produced the

highest protein retention of 5.5%. This indicates that the combination of feed and the addition of *eco enzyme* has a significant effect in increasing protein retention efficiency in catfish.

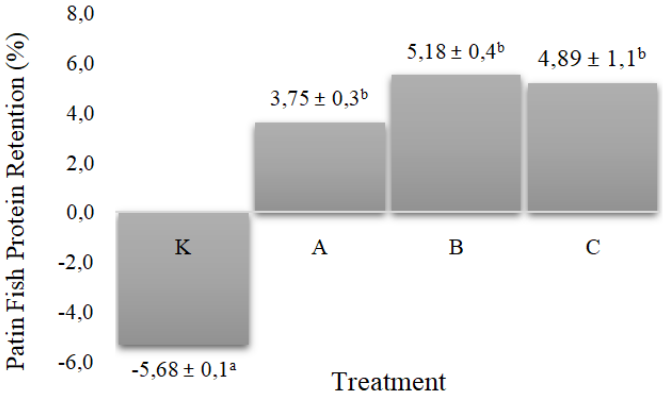


Figure 4 – Catfish Protein Retention (%)

Protein retention in fish is strongly influenced by feed composition, especially protein content and the quality of feed constituents. According to Tahapari *et al*. (2014), catfish require protein levels of around 38-40% in feed to support optimal growth and efficient protein retention. In addition, a study by Salam *et al*. (2020) also showed that the addition of enzymes such as papain or *eco enzyme* can improve digestion efficiency, so that the protein in the feed can be utilized better by fish, which contributes to increased protein retention.

Retention in catfish is strongly influenced by the amount and quality of the ration given and the availability of energy sources used for metabolism. Research conducted, on catfish about the highest protein specific growth rate (6.69%) showed that feeding rations with higher protein levels can increase protein retention. Machiels (1987) reported protein retention of 60% is related to how protein is used in the fish body. Kaushik et al. (1995) found protein retention of 54%. The utilization of protein as the main energy source in these studies, without optimally utilizing other energy sources. If non-protein energy sources are used more efficiently, protein will be more focused on growth, not energy metabolism, thus increasing overall protein retention (Suhendra *et al.,* 2004).

Protein retention is used as an indicator of feed effectiveness (Viola and Rappaport, 1979). Catfish feed with 30% and 35% protein content gave protein retention values that were not different but significantly different from the retention values obtained in feed with 40% protein content. The effect of feed protein content on protein retention gave a quadratic response. The increase in feed protein content, protein retention tends to increase and reach a maximum point in catfish (Suhendra *et al.,* 2004). The addition of probiotics in feed has no effect on catfish growth and survival in all treatments, but can increase feed efficiency and protein retention of catfish (Setiawati *et al.*, 2013). Research with the addition of *eco enzyme* in self-made feed produced protein retention with the highest average in treatment B of 5.5%, followed by treatment C of 5.2%, A of 3.6%, while treatment K -5.68%, this indicates that the addition of *eco enzyme* is able to increase protein retention in catfish reared, so there is a positive effect of the use of *eco enzyme* in improving feed quality and efficiency of nutrient use by catfish.

## CONCLUSION

The addition of *eco enzyme* to self-made feed with different compositions showed an increase in feed nutrient content (proximate test). The addition of *eco enzyme* showed no significant difference in the growth of length and weight of catfish, but showed a significant difference in protein retention between catfish given feed with the addition of *eco enzyme* and feed without the addition of *eco enzyme*. This shows that the protein in the feed given the addition of *eco enzyme* is absorbed better in the fish body than fish given feed without the addition of *eco enzyme*.

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