



Utilization of enzyme hydrolysis from shrimp head to improve the quality of catfish

Untari^{1,*}, Evi hudriyah Hukom¹, Reni Permata³

¹ *Teknologi Laboratorium Medik, Sekolah Tinggi Ilmu Kesehatan Papua*

² *Ilmu Kesehatan Masyarakat, Sekolah Tinggi Ilmu Kesehatan Papua*

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ABSTRACT

Protein is one of the most important components supporting catfish growth and development. However, the price of a feed with high protein content is relatively expensive, and this is a big problem in farming. Shrimp head waste containing 42.16% - 49.8% of protein has not been utilized and is disposed of as waste. In this research, this waste was hydrolyzed to produce the shrimp soluble extract (S.S.E.) using a protease enzyme. Subsequently, it was given to catfish aged 14 days to support the addition of protein sources for growth. During the 1st month trial, there was a significant difference in growth results with the addition of 2% S.S.E. compared to the control. Its addition had an excellent effect on the weight, which was randomly distributed in a tank containing 50 catfish with an average initial weight of 0.6-0.8 grams. The provision of S.S.E. was performed simultaneously with the provision of standard fish feed three times daily. Furthermore, it can be used as an alternative supplement in the future because, in addition to lowering the level of pollution due to catfish waste, it was a breakthrough in fish production.

Introduction

Aquaculture is one of the fastest-growing food-producing industries, which supplies over 50% of global fish production (FAO, 2021). Therefore, catfish farming is gradually developing in Sorong Regency, West Papua in Indonesia. It serves as an alternative to increasing people's income, especially since the Covid-19 pandemic is endemic and widespread. Catfish farming has a very promising business opportunity to overcome the increasingly difficult economy and can create job opportunities. The cultivation process, which is still very basic, is the reason the cultivation results are still less than optimal. This was the motive for making improvements in feeding catfish. One of the obstacles is the cost of feed, hence must be an appropriate technique for feeding catfish to reduce costs while achieving optimum benefits. Catfish farmers only provide commercial feed and have

simple management. Therefore, increasing productivity should be prioritized by adding other high-protein foods. The technology that can be used to improve the quality and population of catfish can be performed through feed management by leveraging the hydrolysis of shrimp head waste enzymes to increase income. This served as an increase in income during this pandemic.

Hydrolysis of feed ingredients through the enzyme processes has been used as one of the important methods for the processing of Fisher by-Products (Bae et al., 2021). The processed feed is based on the local organic marine waste that is integrated with certain components such as shrimp head waste.

According to previous studies, protein hydrolysates derived from fishery products are beneficial ingredients in fish feed because of their nutritional, functional, and cost-effective properties

* Corresponding author.

Email address: untarykhumara4155@gmail.com

(Chalamaiah et al., 2012). Furthermore, the Utilization of shrimp head waste to increase growth performance served as an income source during the covid-19 pandemic in Sorong Regency, West Papua. The breakdown of enzymes in shrimp head waste produced Shrimp Soluble Extract (S.S.E), which has a high concentration of amino acids and active peptides that are easily digested and absorbed. (Jo et al., 2017). In this research, the protease enzyme was used because it can catalyze the breakdown of peptide bonds in polypeptides and using hydrolysis reactions into simpler molecules such as short-chain peptides and amino acids.

In this study, shrimp head waste was used because it contains 42.16% - 49.8% protein, hence it serves as an additional fish feed that significantly supports catfish quality (Hala yusafir et al., 2019). Enzymatic hydrolysis of shrimp head waste can be a concrete step toward converting useless waste into a beneficial product for catfish pond management. According to the research conducted by Hala yusafir et al. (2019), providing additional food increases weight gain in catfish. Therefore, this study aims to improve catfish quality in Sorong Regency, West Papua, in Indonesia by adding S.S.E. According to Jo et al. (2017), adding S.S.E has been used in aquafeed as a protein source. Likewise, Bui et al. (2014) reported that dietary Krill protein hydrolysate could improve disease resistance against *Edwardsiella tarda* in red sea bream. Leal et al. (2010) said that dietary shrimp protein hydrolysate could improve the growth performance of Nile tilapia. Aside from boosting the quality of catfish cultivation, supplementing with shrimp head waste can help to reduce environmental pollution caused by the accumulation of shrimp head waste, which can now be transformed into something valuable. The success of this research opens up business opportunities by producing large-scale products targeted at home-class breeders and cultivators.

Based on the description of the problems above, this research was conducted to relate to the manufacture of supplements made from enzyme hydrolysis from shrimp head waste as food additives. This was used to increase catfish farming yields with a case study in the Klabilim village area, West Papua.

Materials and Methods

Location and time of research

This research was conducted at Papuan College of Health Sciences in Sorong district. The experimental method was used and was performed from June to July 2021. Furthermore, the S.S.E used was derived from shrimp head waste collected from the Sorong

district, and a commercial protease enzyme is utilized in the enzyme hydrolysis process.

Materials

Equipment used included pH meter, stainless steel blender, centrifuge and tube, balance OHAUS analytics, glassware, and equipment used in the catfish farming process. Meanwhile, the materials included catfish, shrimp head waste, protease enzymes, sodium benzoate, commercial fish feed, and aquadest.

Methods

1. Shrimp waste preparation stage

Shrimp head waste is collected from ponds. It was then washed to remove any dirt that was still attached. After getting the clean shrimp head waste, the shrimp head is chopped or mashed to get a small size.

2. Catfish preparation

In this research, 100 tails of 14-day-old catfish were used to control catfish growth. The catfish were then distributed randomly in 2 different containers with 50 catfish in each container.

3. The stage of making Supplementary S.S.E with an enzyme hydrolysis process was as follows:

- Shrimp head waste was mashed and placed in a receptacle.
- Protease enzymes were added in the concentrations of 2.1 units/gram and 2.8 units/gram.
- After adding the protease enzyme, it was heated at 55°C for approximately 3 hours to obtain a concentrated extract.
- After 3 hours, filtering was conducted to separate the extract from the shrimp head pulp.
- Supplements were ready to be added to catfish feed.

4. Testing of Supplementary S.S.E for Catfish Cultivation

- Three tanks containing catfish seeds were prepared.
- The weight of the catfish was measured every fifteen days to compare the progress of the control catfish (A0) with the catfish with additional S.S.E. treatment to fish feed A1 and A2.
- Fish weight checking was then performed for 60 days.

Results

The S.S.E. testing on catfish was performed randomly using two tanks containing 50 catfish each. The average catfish weighed about 0.8 g and was 14 days old (Fig 1).

Sorong is a developing city with many established shrimp ponds, and its products have been exported to several areas around the city. The shrimp heads were crushed, and 2.1 g/unit protease enzyme was added to make S.S.E.

Weighing is performed once a week to monitor the development of catfish. The average catfish gains 2 g in weight.

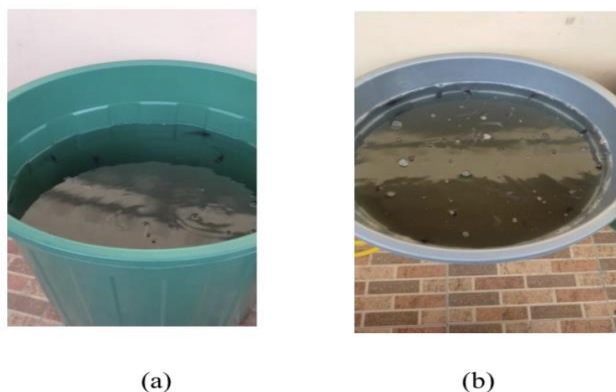


Figure 1. (a) Catfish treated with the addition of S.S.E. (b) catfish as a control.



Figure 2. Shrimp head waste as a source for making S.S.E.



Figure 3. Shrimp soluble extract (S.S.E.).

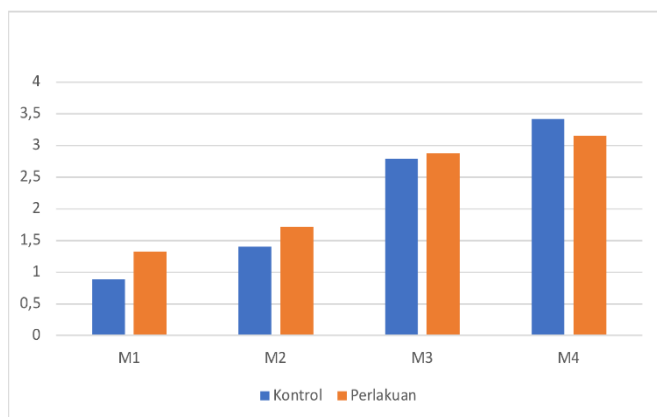


Figure 4. Shows the difference in body weight gain in catfish with and without S.S.E.

Discussion

Fish Meal is one of the main ingredients used in Aquafeed. It is a high-quality source of protein and desirable for the rich essential amino acid profile (Anderson et al., 2016). The S.S.E. produced is tested on catfish to observe its growth development. According to the results, catfish with S.S.E. weighed more compared to those without.

From the results of the weight analysis, there is a significant increase in catfish weight because the protein content in S.S.E. supports the acceleration of catfish growth. Shrimp heads contain a reasonably high protein complex that can be used for fish growth. The shrimp head waste that has not been utilized is mashed and added with protease enzymes capable of hydrolyzing peptide bonds in proteins.

According to Hung (2014), S.S.E. may contain large amounts of free amino acids that act as a feed attractant collected from the shrimp industry. Khosravi et al. (2015) reported that dietary shrimp hydrolysates could S.O.D. activity in low-fish meal diets

Heu et al. (2003) stated that using S.S.E. could reduce enduro mental problems caused by the improper of the inedible parts of shrimp, such as the head, Shell, and tail. According to Zhu et al. (2011), mixed protein sources showed better growth performances in fish. Protein is a chemical compound needed by the fish body as a source of energy, growth, maintenance of body tissues, formation of enzymes, and steroid hormones. For fish, protein is the primary source of energy, and at appropriate levels will increase fish growth.

Moniruzzaman et al. (2018) reported that dietary supplementation of S.S.E. positively affects growth and immune responses in freshwater fish. Also, 5% of a diet be dietary shrimp protein hydrolysate could improve serum lysozyme activity (Gisbert et al., 2018). S.S.E. effects are mainly due to their bioactive peptide contents with antioxidative, antimicrobial, and immunomodulatory activities (He et al., 2013). The use of mixed protein sources showed better growth performances in fish (Kader and Koshio, 2012). On the other hand, Kader et al. (2012) reported that some additives such as fish soluble extract, Krill meal, and squid meal could attract and balance the amino acids.

Conclusion

The addition of S.S.E. in farming contributes to the development of catfish with a more significant weight than those without it.

References

- Anderson, A.D., M.S. Alam, W.O. Watanabe, P.M. Carroll, T.C. Wedegaertner, M.K. Dowd. 2016. Full replacement of manhaden Fish Meal protein by low-gossypol cottonseed flour protein in the diet of juvenile Black sea bass, *Centropristis striata*. *Aquaculture*. 464:18- 28
- Bui, H.T.D., S. Khosravi, V. Fournier, M. Herault, K.J. Lee. 2014. Growth performance, feed utilization, innate immunity, digestibility and disease resistance of juvenile red seabream (*Pagrus major*) fed diets supplemented with protein hydrolysates. *Aquaculture*, 418: 11-16.
- Chalamaiah, M., B.D. Kumar, R. Hemalatha. T. Jyothirmayi. 2012. Fish protein hydrolysate: Proximate composition, amino acid composition, antioxidant activities and applications: A review. *Food Chem*, 135: 3020-3038.
- FAO. *Food and Agriculture Organization FISHSTAT Plus*; Universitas Software for Fishery statistical time series; Food and Agriculture Organization, United Nations; Rome, Italy, 2021.
- Gilbert, E., V. Fournier, M. Solovyev, A. Skalli, K.B. Andree. 2018. Diets containing shrimp protein hydrolysates provide protection to European sea bass (*Dicentrarchus labrax*) affected by a vibrio pelagius natural infection outbreak. *Aquaculture*. 495: 136-143
- Hasan, S. 2012. *Hijauan pakan tropik*, IPB Press, Bogor, Jawa Barat.
- Hala, Y., I. Raya. 2019. formulasi pakan unggul berbasis bioteknologi limbah organik lokal untuk ikan lele organik kualitas ekspor. *jurnal kovalen*, 5(2): 197-206.
- Jo, H., S. Lee, H. Yun, J. Hong, M. Moniruzzaman, S.C. Bai, G. Park, S. Chee, T.-E. Jeon, 2017. Evaluation of Dietary Fishmeal Analogue with Addition of Shrimp Soluble Extract on Growth and Nonspecific Immune Response of Rainbow Trout, *Oncorhynchus mykiss*. *J World Aquacult Soc*, 48: 583-591. <https://doi.org/10.1111/jwas.12355>
- He, S., Franco, W. Zhang. 2013. Functions, application and production of protein hydrolysates from fish processing co-products (FPCP). *Food research international* 50:289-297.
- Heu, M.S., J.S. Kim, F. Shahid. 2003. Components and nutritional quality of shrimp processing by-products. *Food Chemistry* 82:235-242
- Hung, L.T. 2014. Shrimp soluble extract-novel feed attractant for Aquaculture. *Glob. Aquac. Advocate*, 17:81-82.
- Bae, J., Y. Song, M. Moniruzzaman, A. Hamidoghli, S. Lee, H. Je, S.C. Bai. 2021. Evaluation of dietary soluble extract hydrolysates with or without supplementation of inosine monophosphate based on growth, hematology, non-specific immune responses and disease resistance in juvenile Nile Tilapia *Oreochromis niloticus*. *Animals*, 11(4), 1107.
- Jo, H; Lee, S; Yun, H; Hong, J.W.; Moniruzzaman, M; Bai, S.C; Park, G; Chem, S; Jeon, T.E. 2017. Evaluation of dietary fishmeal analogue with addition of shrimp soluble extract on growth and nonspecific immune response of rainbow trout, *Oncorhynchus mykiss*. *J. World Aquacult. Soc.* 2017, 48, 583-591.
- Kader, M.A., S. Koshio. 2012. Effect of composite mixture of seafood by-products and soybean proteins in replacement of fishmeal on the performance of red sea bream, *pagrus major*. *Aquaculture* 368-369:95-102.
- Kader, M.A., M. Bulbul, S. Koshio, M. Ishak wa, S. Yokohama, B.T. Nguyen, C.F. Komikus. 2012. Effect of complete replacement of fishmeal by dehulled soybean Meal with Crude attractant supplementation in diets for red bream, *Pagrus major*. *Aquaculture* 350-353: 109-116.
- Khosravi, S., H.T.D. Bui, S. Rahimnejad, M. Herault, V. Fournier, J.B. Jeong, K.J. Lee, 2015. Effect of dietary hydrolysate supplementation on growth performance, non specific immune response and disease resistance of Oliver flounder (*paralichthys olivaceus*) challenged with *edwardsiella tarda*. *Aqua.nutr*, 21: 321-331
- Leal, A.L.G., P.F. de Castro, J.P.V. de lima, E. de Souza Correia, R. de Souza Bezerra. 2010. Use Of shrimp protein hydrolysate in Nile tilapia (*Oreochromis niloticus*, L.) feeds. *Aquacult. Int*, 18: 635-646.
- Moniruzzaman, M., J.H. Bae, S.H. Won, S.J. Cho, K.H. Chang, S.C. Bai. 2018. Evaluation of solid-state fermented protein concentrates as a fish Meal replacer in the diets of Juvenile Rainbow trout, *oncorhynchus mykiss*. *Aquacult. Nutr*, 24:1198- 1212.
- Zhu, H., G. Gong, J. Wang, X. Wu, M. Xue, C. Niu, L. Guo, Y. Yu. 2011. Replacement of fish Meal with blend of rendered animal protein in diets for Siberian sturgeon (*Acipenser baerii brandt*), result in performance equal to fish Meal fed fish. *Aquaculture Nutrition* 17:389-395.

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