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THE EFFECTS OF SHRIMP SHELL EXTRACT ADDITION IN FEED TO GROWTH AND SURVIVAL RATE OF SANGKURIANG CATFISH (*CLARIAS GARIEPINUS*)

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Shrimp shell extract, Growth, Survival rate, Sangkuriang catfish.

ABSTRACT

The availability of feed ingredients, such as fish meal and soybean meal, is increasingly limited. Feed makers then use various methods to deal with this, one of which is through the addition of synthetic amino acids or alternative materials to feed, both as source of protein in feed ingredients or as feed additives. Shrimp shell extract from the bio-processed microbes (*Bacillus licheniformis*, *Lactobacillus* sp., and *Sacharomyces sereviseae*) is one of the materials that can be used as feed additive because it can improve protein quality in feed. The purpose of this research was to determine the optimal dose of shrimp shell extract addition to feed by observing the use of it on the growth and survival rate of Sangkuriang catfish (*Clarias gariepinus*). The research was conducted in April – May 2021. The research was carried out at the Education Laboratory, Faculty of Fisheries and Marine Sciences, Padjadjaran University, Jatinangor. The method used was experimental method of Completely Randomized Design with four treatments and three replications, analyzed using Analysis of Variance (Anova), and as significant difference was found, then proceeded with the Duncan's Test at a level of 5%. The results showed that the addition of shrimp shell extract showed a significant difference ($p<0.05$) on the growth rate. All treatments resulted in a survival rate of 100%, the highest growth with the addition of shrimp shell extract at a dose of 5ml/kg was 4.63 ± 0.05% and the lowest was in the control (commercial feed without the addition of shrimp shell extract) 4.4 ± 0, 08%. Based on the research results, it can be concluded that the addition of shrimp shell extract at 5 ml/kg to the feed can increase the growth of Sangkuriang catfish (*Clarias gariepinus*).

INTRODUCTION

Sangkuriang catfish (*Clarias gariepinus*) is a type of freshwater fish that is favored by the community and has good nutritional value (Rejeki et al., 2016). The high consumption rate opens up a wide market share, so that significant catfish production is required through an intensive maintenance process. Intensive maintenance requires quality feed, such as commercial feed. Commercial feed produced by the factory has guaranteed quality and quantity. However, the price of commercial feed which is increasing day by day has worried the cultivators. The increase in production costs is due to the dependence of feed mills on imported raw materials which causes feed prices to become expensive (Diana et al., 2014). One of the efforts to increase the use value of feed is through the use of additives (Madinawati, 2011). The use of these additives is carried out in order to reduce the price of feed by improving the use value of the feed.

Improving the use value of feed can be done, one of which is by adding additional feed ingredients in a form of feed additives. Feed additives as an alternative protein source must be made of materials that are cheap, easy to obtain, abundantly available, and contain protein, one example is shrimp waste. Each year, the shrimp waste produced can reach 203,403 – 325,000 tons, which could be a potential protein source (Abun et al. 2019). However, shrimp waste in a form of shells cannot be used directly because it has a limiting factor.

The limiting factor for shrimp shell waste is the presence of chitin which binds proteins and minerals so that it will be difficult to digest (Abun et al. 2019). Chitin needs to be degraded so that shrimp waste can be used as chitosan. In this degradation process, liquid waste is produced. This liquid has the potential to be used as feed additive because its degradation process uses microbes that contain enzymes (Abun et al. 2021). One way to convert liquid waste into shrimp shell extract so that it can be used and has better nutritional value is through microbial bio-processing. Microbial bio-processing is done through deproteinization using *Bacillus licheniformis*, then demineralization using *Lactobacillus* sp., and finally fermentation of *Saccharomyces cerevisiae* to produce a product called nutrient concentrate (Abun et al. 2019).

Shrimp shell extract from this nutrient concentrate contains enzymes such as proteases, chitinases, and carbohydrases produced by microbes that can increase the digestibility of deproteinized and demineralized components (Abun et al. 2016). The nutrient concentrate content includes crude protein, crude fat, calcium, and phosphorus respectively 48.5%, 7.81%, 7.57%, and 3.14%, in chicken feed can have a protein digestibility value of >70% (Abun et al. al. 2016). Furthermore, it is stated that this shrimp shell extract can meet the needs of essential amino acids in the body as tissue forming, so that it can optimize growth because its addition to feed can improve feed quality. This shrimp shell extract product from nutrient concentrate in liquid form is called LNC^{BLS} (Abun et al. 2019).

Research on the use of shrimp shell extract has been applied to poultry rearing, for example, the addition of 1.5% Prebiotics^{BLS} in chicken feed can increase the growth rate and feed efficiency (Abun, 2019), but research that specifically discusses the use of shrimp shell extract in fish has not been done a lot. Similar research on fish is in the addition of probiotics containing the same microbes. The results of the addition of liquid probiotics containing *Bacillus* sp., *Lactobacillus* sp., and *S. cerevisiae* to feed showed better growth than the treatment without probiotics (Arief et al. 2014). The results of the addition of liquid probiotics containing *Bacillus* sp. to feed can increase the weight of catfish at harvest when compared to treatment without probiotics (Dewi and Tahapari, 2017). Shrimp shell extract from nutrient concentrate in liquid form (LNC^{BLS} (Liquid Nutrient Concentrate)) at a certain dose is expected to increase the growth rate of Sangkuriang catfish (*Clarias gariepinus*).

MATERIAL AND METHODS

This research was conducted at the Laboratory of the Faculty of Fisheries and Marine Sciences, Padjadjaran University, Jatinangor. This research was conducted for 40 days from April 2021 to May 2021.

The equipment used in this study include 12 aquariums measuring 40x25 x25 cm, 1 fiber tub measuring 1x1x1, aerators, aeration hoses and 13 aeration stones for oxygen supply, digital scales for weighing fish and feed, hoses for siphon, scoop for taking fish, 0.01 precision syringe for measuring the volume of shrimp shell extract, spray bottle for spraying shrimp shell extract on feed, tray for mixing feed, plastic bag for storing feed, thermometer for measuring temperature, pH meter for measuring degree of acidity, and DO meter to measure dissolved oxygen levels.

The ingredients used in this study were shrimp shell extract named LNC^{BLS} (Liquid Nutrient Concentrate), which is an extract of shrimp waste resulting from the bioprocess of microbes *Bacillus licheniformis*, *Lactobaccilus* sp., and *Sacharomyces sereviseae*, Sangkuriang catfish (*Clarias gariepinus*) weighing ±5 grams per head totaling 200 heads, and commercial feed Hi Pro Vite FF-999 containing 35% protein, 2% fat, 3% fiber, 13% ash, and 12% water.

This study used an experimental method of Completely Randomized Design consisting of four treatments and three replications. The treatment that will be tested is the addition of shrimp shell extract to commercial feed:

Treatment A: Commercial feed (control)
Treatment B: Feed with the addition of shrimp shell extract doses 3 ml/kg of feed
Treatment C: Feed with the addition of shrimp shell extract doses 5 ml/kg of feed
Treatment D: Feed with the addition of shrimp shell extract doses 7 ml/kg of feed

This research procedure was divided into three stages, the first was preparation, the second was maintenance and the last was observation.

Preparation

Preparation begun with preparing the aquarium and the fiber tub, washing them clean with soap and drying them in the sun to dry. Next, fill fiber tub with water until full, then deposit it until it is clear. For the aquarium, fill it with clear water from the water tank as much as 20 L, then deposit it at least one night. The next step for the aquarium and fiber tub was aeration. Fiber tub was filled with 200 fish, weighed and then sorted into a size of 5 grams per head, the rest is for stock, and finally the aquarium was filled with fish with a density of one fish / two liters or 10 fish per aquarium.

Maintenance

Fish rearing was carried out for 40 days. The rearing begun with feed preparation. 50 g of feed was weighed for each treatment, then the shrimp shell extract was taken with a syringe according to the dose of each treatment then diluted and put in a spray bottle, then the feed was sprayed with shrimp shell extract which has been diluted according to each treatment, then dried until completely dry. Feed with shrimp shell extract can be given after drying and has been made sure was in good condition, not moldy, and has to be remade after it's been completely used up. Feed with shrimp shell extract was given to fish at 3%/fish weight/day. The aquarium was siphoned clean once every three days or when it got dirty, and then refilled, to the same volume as it was in the beginning, with clear water.

Observation

Observations were made by measuring the weight of the fish every 10 days to obtain daily growth rate data and counting the number of fish every day to determine survival (SR). The daily growth rate (G) was calculated using the formula (Effendie 1997).

$$G = \left(\frac{\ln W_t - \ln W_0}{t}\right) \text{ x } 100\%$$

Information:

G = Daily growth rate (%)

Wt = Fish weight at the end of rearing (g)

W0 = Fish weight at the beginning of rearing (g)

t = Maintenance time (days)

Calculation of survival rate (SR) is obtained by the formula (Effendie, 1997).

$$SR = (Nt / N0) \text{ x } 100\%$$

Information:

SR = Fish survival rate (%)

N0 = Number of fish at the beginning of the study (tails)

Nt = Number of fish at the end of the study (tails)

In addition to the daily growth rate and survival parameters, observations were also made on water quality parameters. Water quality parameters include temperature, degree of acidity (pH) and dissolved oxygen (DO). This parameter was carried out at the beginning of the study and every 10 days during the study period.

The data obtained from the calculation of the daily growth rate and survival of fish were analyzed using Analysis of Variance (Anova). To determine the specific differences between treatments, Duncan's multiple spacing test was performed at the 5% level. Water quality data were analyzed descriptively compared to SNI.

RESULTS AND DISCUSSION

Growth Rate

The results of the calculation of the growth rate using Analysis of Variance showed that the administration of shrimp shell extract with different doses resulted in a significantly different growth rate of Sangkuriang catfish fry (p<0.05). The results of the analysis with Duncan's test at 5% level showed the best treatment with the highest value in treatment C and the lowest in treatment A.

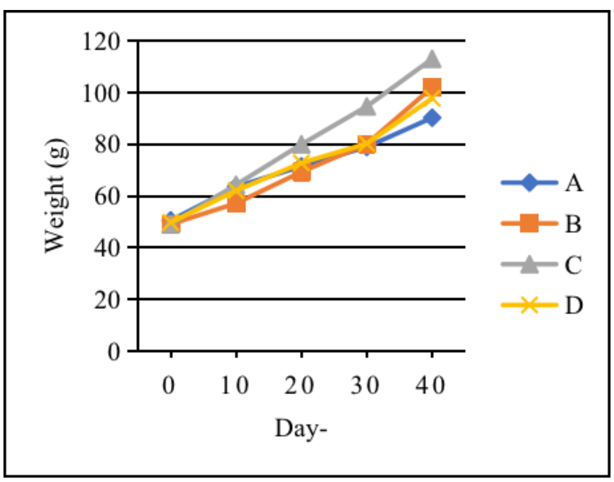

Figure 1. Biomass of Sangkuriang Catfish

Table 1. Growth of Sangkuriang Catfish

Treatment (ml/kg)	G ± SD (%)
A (0)	4,40a ± 0,08
B (3)	4,53abc ± 0,06

C (5)	4,63c ± 0,05
D (7)	4,48ab ± 0,08

During those 40 days, Sangkuriang catfish showed increase in their biomass weight (Figure 1). The results (Table 1) showed that treatment C (5ml/kg) produced the highest daily growth rate (4.63 ± 0.05%) which was significantly different from the control treatment (4.40 ± 0.08%).

The results showed that the addition of 5ml/kg to the feed (treatment C) resulted in the highest daily growth rate. Shrimp shell extract which was made from shrimp waste that contains chitin, an organic compound, which then extracted to liquid, can be a new product that is useful and has good nutritional value because it was carried out through a bio-process by microbes (Abun et al. 2021). Treatment C is the right dose because the protein in shrimp shell extract with essential amino acids in it can be utilized by Sangkuriang catfish. This essential amino acid is obtained from the high protein content of shrimp shell extract which is obtained from the release of protein bonds with chitin by the help of proteinase and chitinase enzymes. These enzymes are produced by three microbes in the shrimp waste bio-process. In accordance with the statement of Abun et al. (2019), it was proven that nutrient concentrate improves protein quality by complementing and balancing essential amino acids. The higher growth of fish in the addition of 5ml/kg shrimp shell extract showed how the bio-process was beneficial in a way it produces microbial enzymes that increase feed value and digestibility, thus optimal growth was achieved, seen from the formation of body tissue cells that can be used for growth. Abun et al. (2019) stated, bio-process done by three types of microbes produces amylase, lipase, protease, chitinase, and other enzymes are beneficial to achieve optimal growth. Ahmadi et al (2012) added that the test feed with the addition of probiotic bacteria will grow and colonize the fish body, creating an acidic atmosphere in the fish's digestion, then the enzyme secretion will work faster and increase the fish digestibility level.

The lowest daily growth rate in the control was 4.40 ± 0.08%, this was presumably due to the absence of shrimp shell extract as a complementary material. The macro-nutrient content such as protein, fat, and carbohydrates from the control feed, although it had met the needs of fish, but from the results of this study, the addition of shrimp waste extract resulted in significantly higher growth ($p<0.05$). This is in line with the results of research by Chilmawati et al (2018), that supplementation of bio-processed products in the form of liquid probiotics and other liquid extracts can complement amino acids and other enzymes so that Sangkuriang catfish fed without the addition of bio-processed extracts only utilized nutrients contained in the feed only, while other treatments can utilize nutrients from shrimp shell extract. The enzymes contained in the control treatment were also not as good as other treatments, so that the digestibility of feed in fish was less than optimal. Ahmadi et al. (2012) stated that the digestibility of fish can be increased by the secretion of enzymes from the addition of probiotics to the feed.

The addition of a dose of 7 ml/kg (treatment D) showed a decrease in the daily growth rate (4.48 ± 0.08%). This was occur because the 7ml/kg dose contains more microbes from the bioprocess of shrimp shell processing, resulting in competition between microbes in obtaining nutrients. The number of bacteria that is too high creates competition in the utilization of nutrients (Suprianto et al., 2019). The results of the study using shrimp shell extract at a dose of 7 ml/kg including an excess dose to be used as an additional feed ingredient for sangkuriang catfish.

Survival Rate

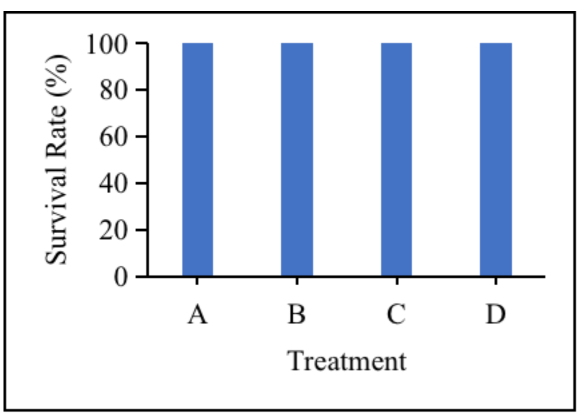

Figure 2. Survival Rate of Sangkuriang Catfish

The results of the calculation of Survival Rate (SR) obtained from the observations showed that the SR for all treatments was very high at 100%. This shows that the mixed feed of shrimp shell extract did not adversely affect Survival Rate. This was including the Hi-Pro Vite, a commercial feed, which actually was quite good for Sangkuriang catfish, as it has gone through a sorting process judging from its uniformed size and healthy condition in the beginning of the observation. Thus, the results of this study showed shrimp shell extract as an additional feed ingredient did not interfere with survival at a certain dose.

Water quality

The results of observations on the average temperature of each treatment during the study were stable, showing the numbers 24.3 – 25.5 ºC. The temperature measured was still fairly good for the Sangkuriang catfish environment. Sangkuriang catfish have life tolerances at temperatures ranging from 25 – 30 ºC (SNI 2014), and temperatures of 23 – 33 ºC still meet the feasibility for catfish growth (Hermawan et al. 2012). The degree of acidity (pH) during the study ranged from 6.4 to 6.8. This is in accordance with SNI (2014) that a good pH value for the growth of Sangkuriang catfish fry ranges from 6.5 – 8, and a pH range of 6 – 9 still meets the feasibility (Hermawan et al. 2012). Dissolved oxygen in the study ranged from 5.5 – 6.1 mg/L. This value is suitable for Sangkuriang catfish because Sangkuriang catfish is able to live at DO >3mg/L (SNI 2014).

CONCLUSION

Based on the results of the research conducted, it can be concluded that the addition of shrimp shell extract in Sangkuriang catfish feed (*Clarias gariepinus*) has an effect on growth but has no effect on survival. The use of shrimp shell extract in feed at a dose of 5 ml/kg resulted in the highest daily growth rate, which was 4.63 ± 0.05%, significantly different from the control treatment of 4.4 ± 0.08%. The addition of shrimp shell extract in Sangkuriang catfish feed also did not adversely affect water quality

References

[1] Abun., Widjastuti, T., dan Haetami, K. 2016. Effect of Time Processing at Steps of Bioprocess Shrimp Waste by Three Microbes on Protein Digestibility and Metabolizable Energy Products of Native Chicken. *AgroLife Scientific Journal:* Vol. 5 No 1, 209-213.

[2] Abun., Rusmana, D., Widjastuti, T., dan Haetami, K. 2019. Effect of Use of Prebiotics^{bls} (*Bacillus licheniformis, Lactobacillus Sp.* And *Saccharomyces cerevisiae*) Based on Shrimp Waste on Protein Efficiency Ratio in Indonesia Local Chicken. *Scientific Papers*. Series D. *Animal Science*. Vol. LXII, No. 2, 37-43.

[3] Abun., Rusmana, D., Widjastuti, T, dan Haetami, K. 2021. Prebiotics^{BLS} from encapsulated of extract of shrimp waste bioconversion on feed supplement quality and its implication of metabolizable energy and digestibility at Indonesia local Chicken. *Journal of Applied Animal Research,* 49:1, 295-303.

[4] Ahmadi, H., Iskandar., Kurniawati, N. 2012. Pemberian Probiotik dalam Pakan terhadap Pertumbuhan Lele Sangkuriang (*Clarias gariepinus*) pada Pendederan II. *Jurnal Perikanan dan Kelautan*: Vol.3 No.4 99-107.

[5] Badan Standardisasi Nasional. 2014. SNI 6484.4:2014, Ikan lele dumbo (*Clarias* sp.) Bagian 4: Produksi Benih. Jakarta: Badan Standardisasi Nasional.

[6] Chilmawati, D., Swastawati, F., Wijayanti, I., Ambaryanto., dan Cahyono, B. 2018. Penggunaan Probiotik Guna Peningkatan Pertumbuhan, Efisiensi Pakan, Tingkat Kelulushidupan dan Nilai Nutrisi Ikan Bandeng (*Chanos chanos*). *Saintek Perikanan* Vol.12 No.2 119-125.

[7] Dewi, R.R.S.P.S. dan Tahapari, E. 2017. Pemanfaatan Probiotik Komersial pada Pembesaran Ikan Lele (*Clarias gariepinus*). *Jurnal Riset Akuakultur*, 12(3), 275-281.

[8] Diana., I., dan Erniati. 2014. Penggunaan Dedak yang Difermentasi dengan Bahan yang Berbeda sebagai Pakan Tambahan Ikan Patin (*Pangasius pangasius*). *Acta Acuatic Vol.1 No.1*, 2014: 39-45.

[9] Effendie. 1997. *Biologi Perikanan.* Yogyakarta: Yayasan Pustaka Nusatama.

[10] Hermawan, A.T., Iskandar., dan Subhan, U. 2012. Pengaruh Padat Tebar terhadap Kelangsungan Hidup Pertumbuhan Lele Dumbo (*Clarias gariepinus* Burch.) di Kolam Kali Menir Indramayu. *Jurnal Perikanan dan Kelautan*: Vol. 3 No. 3: 85-93.

[11] Madinawati, N.S. dan Yoel. 2011. Pemberian Pakan yang Berbeda terhadap Pertumbuhan dan Kelangsungan Hidup Benih Ikan Lele Dumbo (*Clarias gariepinus*). *Jurnal Untad Media Litbang Sulteng Vol.4 No.2*, 2011: 83-87.

[12] Rejeki, S., Triyanto., dan Murwantoko. 2016. Isolasi dan Identifikasi Aeromonas sp. dari Lele Dumbo (*Clarias* sp.) Sakit di Kabupaten Ngawi. *Jurnal Perikanan Universitas Gadjah Mada 18 (2)*, 2016: 55-60.

[13] Suprianto., Endah, S.R., dan Dadiono, M. S. 2019. Optimalisasi Dosis Probiotik terhadap Laju Pertumbuhan dan Kelangsungan Hidup Ikan Nila (*Oreochromis niloticus*) pada Sistem Bioflok. *Journal of Aquaculture and Fish Health* Vol. 8 No.2.