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THE SUPPLEMENTATION OF SHRIMP SHELL BIOPROCESS RESULTS (SNC) IN FEED UPON THE GROWTH RATE OF CATFISH FINGERLINGS *(CLARIAS-GARIEPINUS)*

Kiki Haetami, Nadilla Okviannas, YuniarMulyani, Roffi grandiosa, Abun

Faculty of Fisheries and Marine Sciences, Padjadjaran University, Bandung – Sumedang KM.21 Jatinangor 45363, Indonesia
Author : kiki.haetami@unpad.ac.id
Co-author :nadillaokviannas97@gmail.com

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ABSTRACT

This study aims to determine the optimum dosage of SNC[BLS]shrimp shell bioprocess products in artificial feed that could increase the growth and survival of catfish *(Clarias gariepinus)* fingerlings. SNC[BLS]is a biological shrimp shell treatment using *Bacillus licheniformis,Lactobacillus* sp., and yeast in the form of *Saccharomyces cereviseae*. (Abun et al 2018). The method used was an experimental method using a Completely Randomized Design (CRD) with 4 treatments and 4 replications. Treatment A was without administration (SNC[BLS]) (control), treatment B (2%/100 grams of feed), treatment C (4%/100 grams of feed), and treatment D (6%/100 grams of feed). The parameters measured were growth rate, survival, feed efficiency and water quality. The results showed that giving 2% of the SNC[BLS] upon the feed was able to provide effective and efficient results that could increase feed efficiency by 34.14 ± 6.65%. in addition treatment C increased gave increased daily growth rate by 2.01 ± 0.05%, and survival rate as much as 93 ± 5%.

PREFACE

The high market demand for catfish in Indonesia encourages farmers to increase production. Catfish production in Indonesia in 2017 reached 1.77 million tonnes, an increase of 131 percent from 2016 (764,797 tonnes)[7].

states that feed is one of the components that reaches 60-70% of the total production costs and is one of the determinants of aquaculture business succes, hence the feed component requires effective and efficient management[11]. The strategy to overcome the limitation of cost factor from feed could be increased by utilizing feed supplement, one of which is SNC[BLS.]

SNC[BLS] is biological shrimp waste treatment with gradual fermentation techniques[2]. Fermentation of shrimp shell was carried out using the *bacteria Bacillus licheniformis, Lactobacilus* sp., and yeast *Saccharomyces cereviseae*. *Bacillus licheniformis* is a bacteria that has deproteination properties that will free some protein or nitrogen from the chitin bond because it has chitinase and the protease enzymes. *Lactobacilus* sp. has the function of breaking down glucose, sucrose, maltose, and lactose so that they experience mineral deposits. *Saccharomyces cereviseae* is a yeast that produces amylase, lipase, protease, and other enzymes that can aid the digestion of food substances in the digestive organs[2]. The nutrient content for shrimp shell bioprocess (SNC[BLS]) produced was 39.29% Protein, 7.03% Fat, 7.79% Fiber, 6.81% Calcium, 2.83% Phosphorus, 3.04% Lysin, and Methionine 1.46%[1].

This study aims to determine the optimum dosage of shrimp shell bioprocess products (SNC^{BLS}) in artificial feed that is able to increase the growth and efficiency of catfish fingerlings.

METHODOLOGY

The ingredient used in making feed was the SNC^{BLS} (Solid Nutrient Concentrate) as a research product by Dr. Abun from Padjajaran University, West Java, Indonesia[3]. Fish feed ingredients such as fish flour, soybean meal, bran, wheat pollard, corn flour, fish oil, topmix and tapioca were obtained from CV. Missouri Poultry, West Java, Indonesia.

The feed formulation was conducted using the percent square method. The feed used for this research was artificial feed by administrating shrimp shell from bioprocess with percentages of 0%, 2%, 4%, and 6%. The main feed ingredients used were fish meal, soybean meal, corn flour, bran, wheat pollard, topmix, water fish oil, and tapioca. The feed material was filtered first to produce a smooth texture, then the feed was weighed according to the formulation. Making feed starts with mixing feed ingredients such as shrimp waste concentrate, fish meal, soybean meal, corn flour, bran, wheat pollard, topmix and binder into the basin evenly, then adding fish oil and warm water to taste, and stirring to form solids . Furthermore, it was pelleted with a pellet machine and dried using sunlight to dry.

Table 1. Chemical and Biological Value of Solid Nutrient Concentrate (SNC)

Nutrient	Content (%)
Protein	39,29
Fat	7,03
Fiber	7,79
Calcium	6,81
Phosphor	2,83
Lysin	3,04
Methionine	1,46
Digestibility	72,91
Organic acids	1,66
Gross Energy (GE) (Kkal/Kg)	3379
Metabolism Energy (ME) (Kkal/Kg)	2614

Sumber : Abun et al. 2017

Table 2. The composition of feed ingredients

Feed ingredients	Treatment (%)			
	A(gram)	B(gram)	C(gram)	D(gram)
Shrimp waste concentrate	0	2	4	6
Fish flour	28	27,20	26,41	25,61
Soybean meal	28	27,20	26,41	25,61
Corn flour	12,32	12,19	12,05	11,92
Bran	12,32	12,19	12,05	11,92
Wheat Pollard	12,31	12,19	12,05	11,92
Topmix	1	1	1	1
Tapioca	5	5	5	5
Fish oil	1	1	1	1
Total	**100**	**100**	**100**	**100**
Protein	**30**	**30**	**30**	**30**

A feeding experiment with the duration of the study of 30 days with observations were made with a span of 7 days. Further, treatments was assigned upon catfish culture where treatment A was without administration (SNC^{BLS}) (control), treatment B (2% / 100 grams of feed), treatment C (4% / 100 grams of feed), and treatment D (6% / 100 grams of feed). The catfish used for testing was catfish fingerlings with a length of 5-7 cm and weights between 3-4 grams and 10 animals in one aquarium, with a density of 1 fish in 2 liters of water. Test feed preparation was carried out by weighing 5% of the weight of the test fish. Feeding is carried out 3 times in one day (08.00, 12.00, and 16.00 WIB). Additional equipments used in the study include pelletizers, aerators, thermometers, pH meters, DO meters, scales, milimeter blocks, and ammonia tes kits.

Growth rates were observed using the calculation of the daily growth rate of fish fingerlings according to Effendie (2002) as follows:

$$SGR = \frac{\ln Wt - \ln Wo}{t} \times 100\%$$

Information :
SGR = Specific growth rate / daily growth rate (%)
Wt = Weight of fish fingerlings at the end of observation (g)
Wo = Weight of fish fingerlings at the beginning of the observation (g)

Feed efficiency were calculated using the formula[4] as follows:

$$EP = \frac{(Wt + D) - Wo}{F} \times 100\%$$

Information :
EP = Feed Efficiency (%)
Wt = Weight of catfish fingerlings at the end of observation (g)

Wo = Weight of fingerlings of catfish at the beginning of the observation (g)
D = Weight of fingerlings of catfish that died during observation (g)

Survival rates were observed using the calculation of survival rate parameters according to Effendie (2002) as follows:

KH = $\frac{Nt}{No}$ x 100%

Information :
KH = Survival (%)
Nt = number of fish fingerlings that lived at the end of the observation (tail)
No = Number of fish fingerlings at the beginning of the observation (tail)

The observation of water quality includes the degree of acidity (pH), temperature, and dissolved oxygen (DO). Measurements of pH, DO and temperature were carried out during observations every 7 days.

RESULT AND DISCUSSION

The research obtained daily growth rate of catfish fingerlings which can be seen in Figure 1 .:

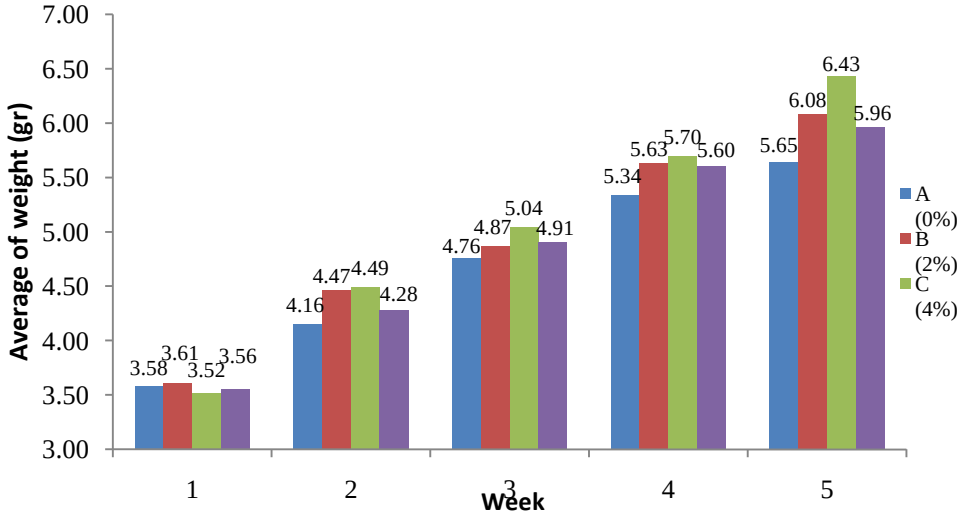

Figure 1. Average weight of catfish fingerlings each week.

The average weekly growth of catfish fingerlings showed an increase along with the time of maintenance. The increasing weight of catfish fingerlings showed that catfish fingerlings were able to adapt to the treatment of shrimp shell bioprocess supplementation results. In general, all treatments experienced an increase in average weight. The highest average weight in treatment C (4%) that is 6.43 grams, while the lowest average weight is in treatment A (0%) at 5.65 grams at the end of the study.

The results of the daily growth rate of catfish fingerlings showed that the feed given feed supplement from shrimp shell bioprocess has a better daily growth rate value compared to treatments without supplementation. The results of shrimp shell bioprocess had a high nutritional value and mineral content so it supports the growth of fish. Increased mineral content in feed was very effective in increasing feed consumption so that weight gain was optimized[15].

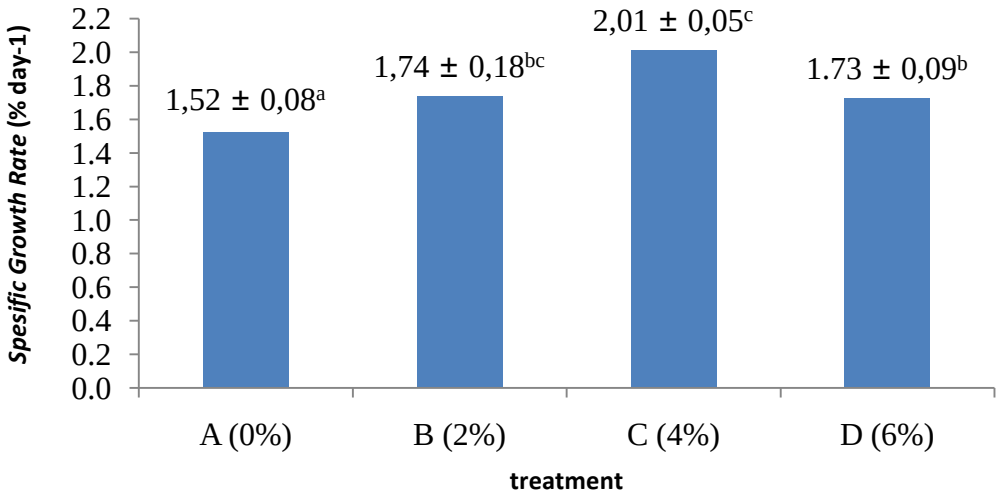

Figure 2. Growth rate of catfish fingerlings

Statistical analysis showed that there were differences between the supplementation treatment of shrimp shell bioprocess results upon the daily growth rate. Treatment A (0%) had a daily growth rate value of 1.52 ± 0.08%, lower than SNC^{LBS} supplementation treatment, namely treatment B (2%) with a daily growth rate value of 1.74 ± 0.18%, treatment C (4%) was 2.01 ± 0.05%, and treatment D (6%) was 1.73 ± 0.09%.

The increase of daily growth rate or weight along with the supplementation content of shrimp shell bioprocessing resulted in optimal nutrient content. The greater addition of shrimp shell bioprocess results was followed by an increase in the number of microbes and mineral content. The highest growth rate of catfish fingerlings is in treatment C (4%) which was 2.01 ± 0.05% and the lowest was in treatment A (0%) that was 1.52 ± 0.08%. Treatment B (2%) showed the value of daily growth rate that was significantly different from treatment C (4%), so this was quite effective. This indicates that the catfish fingerlings in treatment C (4%) had the nutritional requirements and the supplementation in feed was quite effective.

The growth of fish feed with an addition of shrimp waste concentrate shows the role of microbial *Bacillus licheniformis, Lactobacilus sp., Saccharomyces cerevisae* since minerals were obtained from the gradual fermentation process. Daily growth rate values end to be greater from fish fed with shrimp shell bioprocess hence it can be used as a complement to improve nutritional content in feed. Supplementation of the shrimp shell bioprocess can also increase feed utilization since the presence of three types of microbes provides exogenous enzymes and minerals essential to support growth. Intestines of African catfish fingerlings (*Clarias garipienus)* were likely to harbor *Lactobacillus* and *Bacillus* sp.[5]. Several studies have found that the addition of *Bacillus subtilis* can digest food well[9]. *Bacillus licheniformis* as one of the commonly found bacteria was known to produce relatively high amounts of protease[16], so that metabolites (enzymes, amino acids, vitamins and oganic minerals) could be obtained from the presence of bacteria hence beneficial for fish growth and nutrition. *Lactobacillus* sp. was knoen capable to break down glucose, sucrose, maltose and lactose into lactic acid so that mineral deposits occur[2]. Increase mineral content of feed resulted an increase of feed consumption hence weight gain was [15].

A comparably lower growth rate was found in treatment D (6%) increasing number of microbes that live in the digestive tract of test fish causes the accumulation of metabolites (lactic acid, peroxidants and bacteriocin) produced by microbes as a defense mechanism due to being pressured by the high number of bacteria wich then can eventually inhibit growth[18]. The high accumulation of bacteria may case the bacteria to quickly sporulate (forming spores) so that the function and activity of the bacteria may not be optimal[14].

Feed Efficiency

Feed efficiency is the ratio between the resulting weight gain and the amount of feed consumed. The efficiency of feed used by fish shows the percentage value of food that was converted into meat by the metabolism the fish[13]. Based on the results of the study the feed efficiency value from each treatments were obtained (Figure 5).

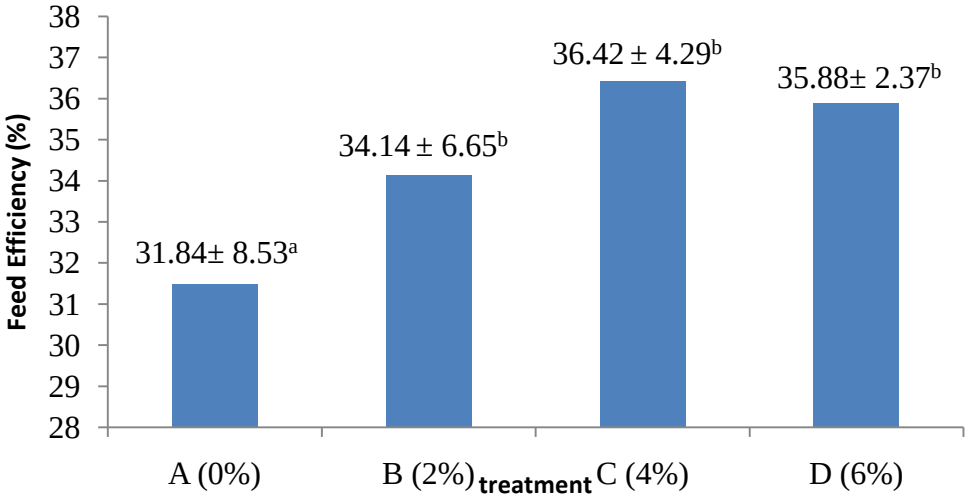

Figure 3. Graph of catfish fingerlings feed efficiency

Treatment A (0%) had the lowest value of feed efficiency that was 31.84 ± 8.53%, treatment C (4%) obtained the most optimal efficiency value (36.42 ± 4.29%) while treatment B (2%) and treatment D (6%) had feed efficiency values of 34.14 ± 6.65% and 35.88 ± 2.37%, respectively. The value of overall feed efficiency obtained from the results of this study was not too high, this was because of the remaining food in the aquarium that were not consumed.

The results showed that supplementation of shrimp shell bioprocess results in feed had better feed efficiency values compared to control feed. In addition supplementation increased palatability of feed. *Bacillus licheniformis* is a bacterial species that is able to produce proteases in relatively high amounts[6]. The amount of protease enzyme content may affect the digestibility value in fish since the digestibility value from the addition of feed supplements reached 72.91%. The presence of enzymes in artificial feed was known to help and speed up the digestion process so that sufficient nutrients are available for fish growth and survival[12].

Based on the Post Hoc Duncan's multiple range test analysis, treatment B (2%) showed the value of effective feed efficiency that was not significantly different from treatment C (4%). Shrimp shell bioprocess was mediated by the bacterial microorganisms *Bacillus licheniformis, Lactobacillus* sp., and yeast *Saccharomyces cereviseae.* These organisms may initiate protein detachment from the chitin commonly found in shrimp shell it was found useful as a nutrient supplement.

Survival

The survival rate of catfish fingerlings in each treatment with a maintenance period of 30 days shows values ranging from 83% - 90% (Figure 4.)

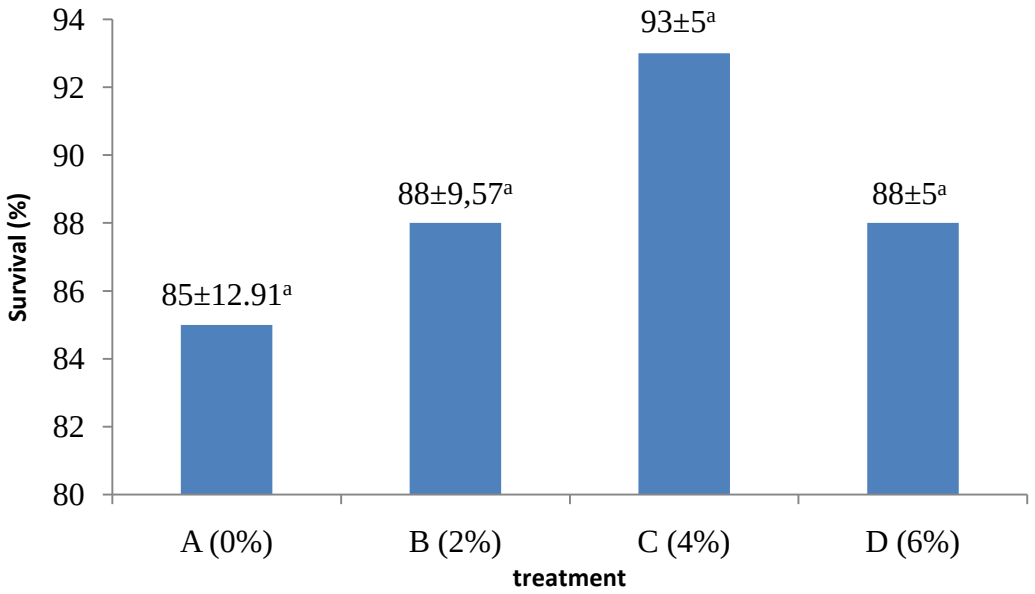

Figure 4. Graph of catfish fingerlings survive

Treatment A (0%) had the lowest survival rate of 85 ± 12.91%, treatment C (4%) with the highest survival rate of 93 ± 5%, treatment B (2%) and treatment D (6%) with a survival rate of 88 ± 9.57% and 88 ± 5%, respectively. The addition of shrimp waste concentrate to feed produced a standard survival quality value that is classified as a good quality standard value in accordance with SNI (2009) which is above 75%[17].

Water quality

Measurement data on water quality obtained the results of water quality parameters that indicate favorable quality of maintenance media during the study which is within the optimum range for the growth of catfish. The average temperature in the maintenance media was in the range of 29,45°C - 29,05°C, pH in the range of 6.80 - 6.86 and DO in the range of 5.35 mg / L - 5.65 mg / L.

Table 4. Average parameters of water quality during the observation

	Water quality parameters		
Treatment	pH	DO (mg/L)	Temperature
A (0%)	6.80	5.35	29.45
B (2%)	6.79	5.38	28.7
C (4%)	6.76	5.11	29.85
D (6%)	6.86	5.65	29.05
SNI (2014)	6.5 - 8	≥3	25-30

.

CONCLUSION

Based on the results it can be concluded that supplementation of bioprocess results of shrimp shells 2% - 4% in feed gave effective and efficient results with a daily growth rate of 2.01 ± 0.05%, feed efficiency of 34.14 ± 6.65% and survival rate of 93 ± 5%. Shrimp waste concentrate could be used as a feed supplement in catfish with a dose of 2% - 4% in fish feed.

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