Original Research Article

NILEM CARP FISH (*Osteochilus hasselti*) PERFORMANCE IN VARIOUS FEED ENERGY-PROTEIN RATIOS

ABSTRACT

This study aimed to understand the effects of various energy-protein ratios of feed on nilem carp fish (*Osteochilus hasselti*) growth. This study was conducted from September to October 2017 at the Laboratory of Building 4, Faculty of Fisheries and Marine Sciences, Universitas Padjajaran. The average size of the test fish was ± 7 cm with an average weight of 3 grams. This was a Completely Randomized Design (CRD) experimental study consisting of 5 treatments and 3 repetition. The treatments given were 5 feed formulas based on different feed protein energy ratios, i.e. treatment A (31% protein, ratio 10), treatment B (31% protein, ratio 8), treatment C (28% protein, ratio 10), D (28% protein, ratio 8), and E (30% protein commercial feed/control). Feed, 5% of the test fish total weight, was provided 3 times a day. Parameters observed were daily growth rate, feed conversion, and survival. Data gained were analyzed using F-test, followed by Duncan Test if differences were found between treatments. Results showed that growth rate and feed conversion of all treatments were not different compared to control. The highest result was found in treatment A (31% protein, ratio 10) with a daily growth rate of 3.99% and feed conversion of 1.95%.

Keywords: Nilem carp fish, Protein-Energy Ratio, Feed Conversion, Daily Growth Rate

INTRODUCTION

Nilem (*Osteochilus hasselti*) plays an important role to provide animal protein, with a very good potentials to be cultivated because it is easy to maintain, affordable, and has a good nutrition value. Nilem carp fish cultivation is done in many areas in East Priangan and this fish is considered as one of unique fish of West Java. Nilem carp fish production tends to decline, making improvement in its cultivation is necessary, including through, among others, feed provision approach for nilem carp fish.

Energy ratio is one of the aspects of fish feed quality assessment. Optimum energy-protein ratio in feed is needed to get maximum fish growth. This is due to the fact that the energy needed for maintenance should be met first and that surplus of energy is needed for growth (Guillaume *et al* 2001). If the feed energy content is low, the feed protein will be used as the energy source; however, if the energy is too high, fish' appetite will be reduced and growth will decline. Therefore, feed needs to have a certain energy-protein ratio to be able to provide adequate non-protein energy to ensure that most of the protein will be used for growth (Syamsunarno et al. 2011).

The determination of energy-protein ratio also aims to make protein utilization in the feed more efficient. Protein saving in feed will significantly reduce the cost of feed because protein is the most expensive ingredient in fish feed composition. In addition to meeting amino acid need, protein is also used as the main energy source in feed, rather than carbohydrate and fat. When the protein content in feed is inadequate, it will only meet the need for body defense mechanism and will not be able to support growth. Hence, it is important to pay attention to the optimum protein content in fish feed to be able to support growth with more efficient utilization to achieve more affordable feed manufacture cost.

MATERIALS AND METHOD

Instruments used in this study were: 40 x 30 x 20 cm^3aquariums, Turbo-B 8200 pumps, aeration tubes, air stones, AND EK-120G digital scale, Luthron pH meter, Hanna HI-3810 DO meter, mercury thermometer, 75 watt AMARA heater, and pelletizer. The materials used were: 3-5 cm nilem carp fish from Tarogong Nilem carp fish Cultivation in Garut District, test feed that had been formulated with 28% and 31% protein contents and 8 and 10 protein energy ratio each, and HI-Pro-Vite commercial feed from PT. Central Pangan Pertiwi with 31 - 33% protein content.

Method

The method applied in this study was the experimental method using Complete Randomized Design (CRD) consisting of 5 treatments and 3 repetitions. Treatments consisted of five feed formulations with different energy-protein ratios:

Treatment A: 31% protein level and energy-protein ratio of 10
Treatment B: 31% protein level and energy-protein ratio of 8
Treatment C: 28% protein level and energy-protein ratio of 10
Treatment D: 28% protein level and energy-protein ratio of 8
Treatment E: commercial feed with 31 % protein level (Control).

Feed for treatement was formulated by first testing the ingredients to be used using proximate analysis. After the contents of the ingredientes were identified, the ingredients were used to formulate the feed based on the treatments in this study (Table a).

Table a. Study Feed Ingredient Formulation

Feed Ingredients	Treatment			
	A (31%) ratio 10	B(31%) ratio 8	C (28%) ratio 10	D (28%) ratio 8
Soybean Meal	26	30	23	24
Fish meal	18	13	17	12
Bran	12	9	8	8
Pollard	6	19	18	15
Coconut Meal	12	14	19	20
Corn	17	9	14	15
Fish Oil	2	1	2	2
CMC	2	2	2	2
Bone meal	1	1	1	2
Premix	2	2	2	2
Total	100	100	100	100

Notes: Based on feed formulation using Microsoft Excel software using trial and error method.

Procedure

Nilem carp fry were acclimated for three days before the study. Test fish was weighed to determine its initial weight and to define the amount of feed to be given. The test fish was put in an aquarium with 10 fish per aquarium. Feed was given according to the treatment, three times a day, at 08.00, 12.00, 16.00 Indonesian Western Time WIB, 5% of the fish biomass weight (Watanabe 1988). Siphoning was performed each morning, 30% each, to maintain the quality of water. Fish biomass weight weighing and water quality measurement were conducted every 10 days for 40 days of the study. Water quality was assessed based on temperature, pH, and dissolved oxygen (DO). Water quality assessment was done in the beginning, middle, and end of the study.

Observation Parameters

Data observed in this study includes specific growth rate (SGR), feed conversion ratio, and survival using the following formula:

Specific Growth Rate

$$SGR = \frac{(\ln W2 - \ln W1)}{T}$$

Note:

SGR = Specific growth rate (%/day)
W_1 = Initial weight of fish (g)
W_2 = Final weight of fish (g)
T = The number of days during cultivation (days)

Feed Conversion Ratio (FCR)

$$FCR = \frac{F}{(Bt - D) - Bo}$$

Notes:
FCR = Feed Conversion Ratio
F = Amount of feed (g)
B_t = Fish biomass at the end of the cultivation period (g)
D = Fish biomass that died during the cultivation period (g)
B_0 = Fish biomass at the beginning of the cultivation period (g)

Survival Rate

$$SR = \frac{Nt}{No} \text{ x } 100\%$$

Note :
SR = survival rate (%)
Nt = Fish number at the end of the research (individu)
No = Fish number at the beginning of the research (individu)

Data Analysis

Data collected were analyzed using F Test, followed by Duncan Test if there were differences among treatments.

RESULTS AND DISCUSSION

Daily Growth Rate

Results of this study showed that nilem carp fish weight in each treatment increased along with the time of cultivation (Figure 3). Control feed produced the highest weight of 64.50 grams followed by treatment with Energy-Protein Ratio (EPR) of 11, i.e. with 31% and 28% protein levels (60.63 grams). In EPR 8 with 31% protein level, the fish weight was 60.89 grams while feed with 28% protein level produced the lowest weight of 58.4 grams.

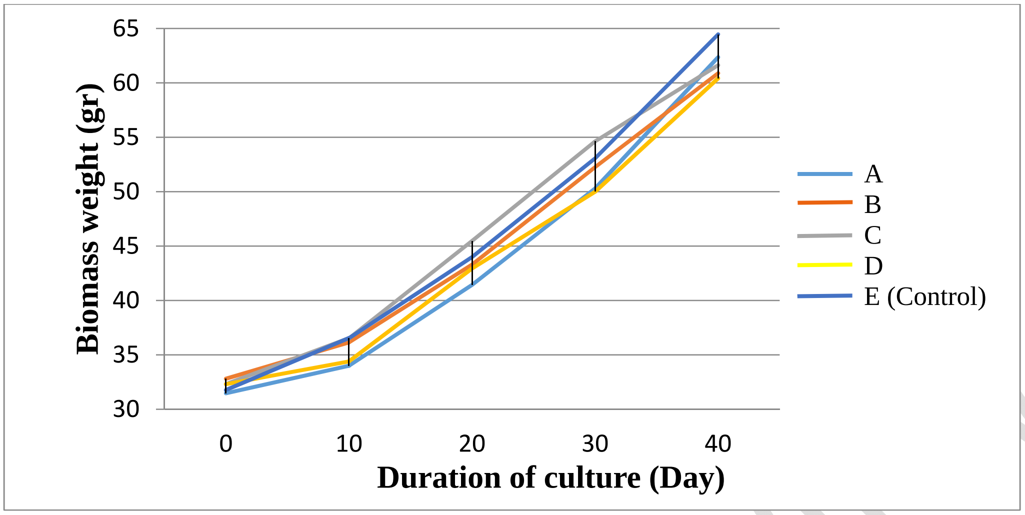

Figure 1. Nilem carp fish growth

Based on variance analysis, it was shown that the nilem carp fish that was provided with feed that had different protein levels and EPR gave results that were not significantly different in terms of growth rate when compared to control (commercial feed) (Table 1). ERP 8 and 10 treatments, both with 31% and 28, can be responded well with no significant differences in growth rate.

Table 1. Average nilem fry Growth Rate

Treatment	Protein	Daily weight gain (%)
A	31% Ratio 10	$3{,}99^{a} \pm 0{,}01$
B	31% Ratio 8	$3.96\ ^{a} \pm 0{,}008$
C	28% Ratio 10	$3{,}97^{a} \pm 0{,}004$
D	28% Ratio 8	$3{,}91^{a} \pm 0{,}016$
E	31% Control	$4^{a} \pm 0{,}004$

Note: Value that is followed by a similar letter is not significantly different based on Duncan Multiple range test at 95% significance level.

Referring to the results of the study in Table 1, the highest average growth rate was produced by treatment A of 3.99 grams. The high fish daily growth rate in Treatment A is due to the fct that the feed composition in this treatment has a higher fish flour content when compared to other treatments. Another treatment, i.e. 18% (180 grams in 1 kg of feed, also used it as one of the protein sources. The high protein content in feed produces a high growth rate because protein is the primary energy source of fish. This is in line with a statement made by Andriani et al. (2016) stating that protein in feed plays a role as an energy and amino acid source as well as meeting the demand for functional protein (enzymes and hormones) and structural protein (flesh and organs).

The different level of protein content in the test feed does not give significant effect on nilem carp fish growth rate. This shows that nilem carp fish is less sensitive to the increase in protein content of feed, where the increase in protein is not followed by protein assimilation into body protein.The need for protein in fish is influenced by feed provision level and the energy content. Meanwhile, the amount of feed provided is influenced not only by the energy content but also by the capacity of the fish digestive capacity.

Feed with approriate energy-protein ratio with appropriate method of provision will result in the best growth and feed conversion ratio. The utilization of protein and fish growth can be optimized by providing appropriate energy-protein ratio (Kaushik & Seiliez, 2010). The fish need for protein is mostly met by non-protein nutrients such as fat and carbohydrate so protein (amino acid) is expected to be concentrated for body tissue synthesis materials. In this experiment, the nilem carp fish used was in seed stadium, In early stage of life, fish needs more protein than non-protein materials such as carbohydrate and fat. However, the adequacy of energy from non-protein materials in synthetic feed composition can also support the fish growth. Furthermore, in this study, both for 31% protein level and 28% protein level, with different EPR (10 and 8 kcal/gram protein), produce similar growth responses in test fishes. This is because, among others, of the right amount of fish oil and fish meal that improves the palatibility of the feed. In addition, the amount of feed provided in each treatment is the same, which is 4% of body weight per day, that there is no difference in daily growth rate in each treatment.

Feed Conversion

Feed conversion presents the amount of feed needed to produce one kilogram of fish weight. The increase in fish weight relates to the ability of the fish to utilize the feed provided. The difference between the total amount of feed given and weight gained is referred to as feed conversion ratio.

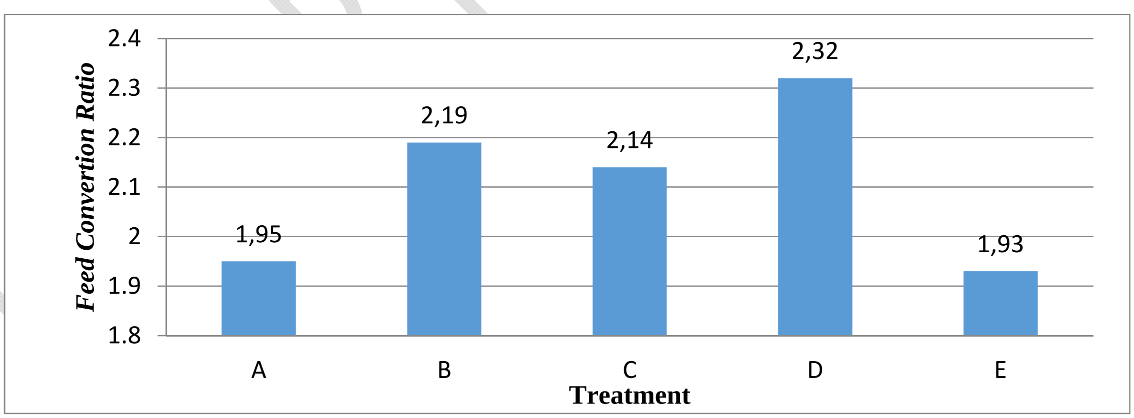

Figure 2. Feed Conversion Ratio

Figure 2 presents the feed conversion ratios in treatments with different energy-protein ratio formulation, which are quite good. In this study, good feed conversion ratios are achieved, i.e. Treatment E/control with 1.93 followed by Treatment A (1.95), C (2.14), B (2.19), and D (2.32).

The feed conversion ratio ranges between 1.93-2.32, which means that when 1.93-2.32 grams of feed is provided, 1 gram of weight is gained by the fish.

Table 2. Average Feed Conversion Ratios

Treatment	Protein	Feed Convertion Ratio
A	31% Ratio 10	$1{,}95^{a}\pm0{,}12$
B	31% Ratio 8	$2{,}19^{b}\pm0{,}16$
C	28% Ratio 10	$2{,}14^{b}\pm0{,}09$
D	28% Ratio 8	$2{,}32^{c}\pm0{,}14$
E	31% Control	$1{,}93^{a}\pm0{,}08$

Note: Value that is followed by a similar letter is not significantly different based on Duncan Multiple range test at 95% significance level.

The results of Duncan's Multiple Range Test (Table 2) shows that feed with 31% protein level produces a feed conversion ratio of 1.93 (commercial feed) and 1.95 (at EPR 10) is beter than feed with the same protein level (31%) with EPR 8, that is 2.19. Although the feed consumption rate in nilem carp fish was not observed, it is assumed that the protein that enters the body of the fish with energy-protein ratio of 10 is utilized for body tissues. Handajani and Widodo (2010) suggested that factors that influence growth include, among others, physiology activities, metabolism process, and digestibility that are different between individual fish. In this study it is shown that the provision of 31% feed formulation with EPR 10 is not different from the provision of the control feed, meaning that both feed has the same quality. Meanwhile, the provision of feed formulation with the same protein level (31%) with EPR 8, the feed quality is lower, especially when referring to the higher feed conversion ratio (2.19). This is different from the result of a study on *jambal siam* fish (*Pangasius hypophthalmus*) with the DE/P (energy-protein ratio) value for fish optimum growth ranges between 8-9 kcal/g (Haetami, 2012). If the DE/P is higher than the optimum limit, fish will feel full earlier that consumption reduces. However, in nilem carp fish, an energy-protein ratio of 10 still leads to a good reponse in terms of growth. Nematipour, et al. (1992) stated that the high energy in fish feed will lead to high fat accumulation in fish body. However, this study shows that feed conversion ratio of feed with EPR 10 is better than the ratio for feed with EPR 8. This means that nilem carp fish needs higher energy portion than the non-protein ingredients when compared to the *jambal siam* fish (*Pangasius hypophthalmus*). Nilem carp fish is an omnivor fish that tends to be herbivor. Nevertheless, in fry stadia, this fish needs more protein compared to the adult stadia.

The highest feed conversion ratio (2.32) is found in feed with 28% protein and EPR 8 formula which reflects lower quality of feed when compared to other feed formulation (Table 2). When compared to the feed with the same protein level (28%) but with EPR 10, the feed conversion ratio of the later is better (2.14). This supports the suggestion from Haetami (2012), stating that if the energy-protein level in the feed is lower than the optimum DE/P value, the energy source in the feed-especially fat and carbohydrate- cannot meet the demand of the body. Hence, fish will get energy from amino acid through the gluconeogenesis process, making the allocation for body protein syntesis reduced.

In feed with 28% protein and EPR 8, the feed conversion ratio is higher than that of feed with 28% with EPR 10. The lower the FCR is, the more efficient the feed and feed consumed used by the fish for its growth (Ardita et al., 2015). This is in line with what is stated by Haryati et al. (2012) that the protein content in the feed will partially be absorbed and used to form or repair damaged cells while the remaining protein will be converted into energy.

Survival Rate

The 40-day study shows that nilem carp fish fry that is given feed with different energy-protein ratio produces a quite high survival rate (Figure 3).

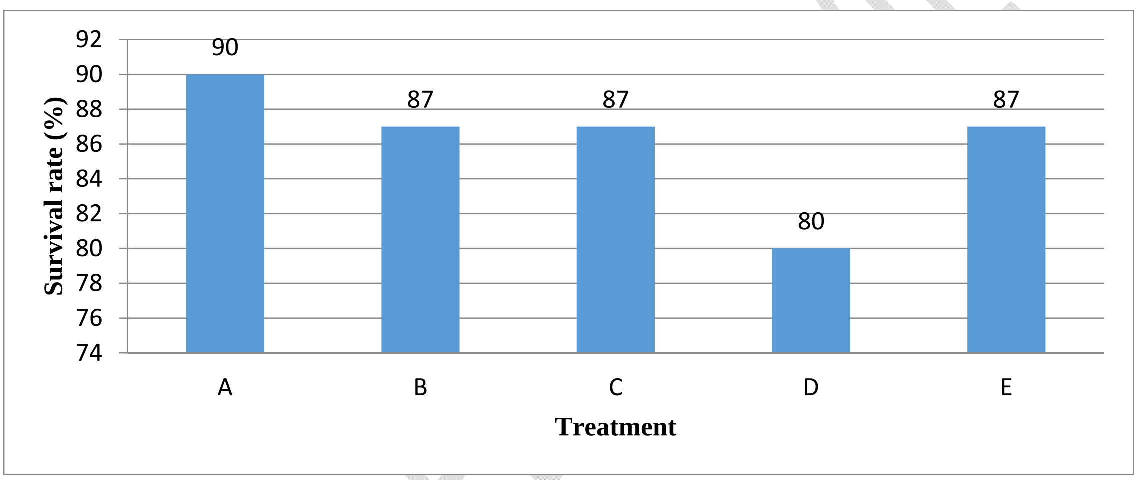

Figure 3. Survival Rate

The highest survival rate of nilem carp fish is found in Treatment A (31% protein, EPR 10) with 90% rate while the average survival rate in Treatment B (31% protein, EPR 8), Treatment C(28% protein, EPR 10), and commercial feed is 87% while the lowest is found in Treatment D (28% protein, EPR 8) with a survival rate of 80%. Fish survival rate in Treatment A is better than the rate in other treatments (90%). It is suggested that this is due to the fact that nilem carp fish can adapt easily to the culture environment and feed, as well as having good appetite. Suvival rate can be used as the indicator to identify the toleration and ability of fish to survive. The survival rate is a comparison between the number of organisms that survive at the end of the period with the number of organisms in at the start of the period (Effendie, 1997).

Conclusion

Based on the stud, it can be concluded that the effect of energy-protein ratio 31% protein level and energy-protein ratio of 10 produces the best growth for nilem carp fish seed with a growth rate of 3.99 ± 0.01 and a feed conversion ratio of 1.95.

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