The Effect of Feed Protein Levels on The Growth of Kissing Gourami (*Helostoma temminckii*)

Pengaruh Kadar Protein Pakan yang Berbeda terhadap Pertumbuhan Ikan Tambakan (*Helostoma temminckii*)

Retno Cahya Mukti[1], Yulisman[1*], Mohamad Amin[1], and Rahayu Permata Sari[1]

[1]Aquaculture Study Program, Agriculture Faculty, Sriwijaya University, Palembang-Prabumulih Street, KM 32, Ogan Ilir, South Sumatera

*Corresponding author: yul_cancer@yahoo.com

ABSTRAK

Budidaya ikan tambakan sudah mulai dikembangkan untuk mengurangi ketergantungan dari hasil tangkapan di alam. Keberhasilan budidaya ikan dipengaruhi oleh banyak faktor, satu diantaranya adalah ketersediaan pakan yang cukup secara kuantitas dan kualitas. Protein merupakan nutrien penting yang tidak hanya berperan untuk mendukung pertumbuhan ikan, tetapi juga mempengaruhi harga pakan. Kebutuhan protein pakan untuk setiap ikan perlu diketahui sebagai dasar dalam memformulasi pakan. Penelitian ini dilakukan untuk mengetahui kadar protein pakan yang optimum untuk ikan tambakan. Penelitian ini menggunakan Rancangan Acak Lengkap dengan lima perlakuan dan tiga ulangan. Perlakuan yang diberikan yaitu kadar protein pakan yang berbeda untuk ikan tambakan, terdiri atas 25% (P0), 30% (P1), 35% (P2), 40% (P3), dan 45% (P4). Hasil penelitian menunjukkan bahwa kadar protein pakan 35% (P2) meemberikan hasil terbaik untuk ikan tambakan yang menghasilkan pertumbuhan bobot sebesar 0,45 g, pertumbuhan panjang 0,24 cm, rasio efisiensi protein 0,49 dan efisiensi pakan 17,11%.

Kata kunci: Ikan tambakan; Pertumbuhan; Protein pakan

ABSTRACT

Kissing gourami culture has begun to be developed to reduce the dependence on natural catches. Many factors that are influence fish culture. One of those is the availability of sufficient quantity and quality feed. Protein is an important nutrient that supports fish growth and affects feed prices. The protein requirement for each fish needs to be known as a basis for formulating feed. This research aims to determine the optimum feed protein level for kissing gourami. This study used a completely randomized design with five treatments and three replications. The treatment given is different levels of feed protein, consisting of 25% (P0), 30% (P1), 35% (P2), 40% (P3), and 45% (P4). The result showed that feed protein level 35% (P2) gave the best result for kissing gourami which resulted a absolute weight growth of 0.45 g, absolute length growth of 0.24 cm, protein efficiency ratio of 0.49, and feed efficiency of 17.11%.

Keywords: Growth; Feed protein; Kissing gourami;

INTRODUCTION

Kissing gourami (*Helostoma temminckii*) is a fish that lives in freshwaters that have begun to be developed for cultivation. The success of a fish farming business cannot be separated from many factors, one of which is the availability of adequate feed - in quantity and quality, which plays a vital role in growth. Feed is composed of components of macro and micronutrients. The macronutrient component functions as an energy source consisting of protein, fat, and carbohydrates, and the micronutrient component includes vitamins and minerals (Afrianto and Liviawaty, 2005). Protein is an important nutrient that supports fish growth and affects feed prices. The protein requirement of feed for each fish needs to be known as the basis for formulating feed. Problems that arise when the feed protein is given are not to the needs of the fish. It can have a negative impact. The fish will lack protein, causing low growth and even no growth.

On the other hand, too high feed protein can reduce the proportion of other nutrients such as fat and carbohydrates as an energy source for maintenance, so protein will be overhauled to be used as an energy source for maintenance. This protein reshuffle requires more energy for the degradation process to reduce energy for growth. As a result of protein degradation, it will excrete ammonia which can affect water quality (Haetami, 2012). The protein level in the feed not only plays a role in supporting fish growth but will also affect the feed price, impacting the production costs of farmed fish.

Some studies showed that feeding with different protein levels causes different feed efficiency and growth of fish. This indicates that the protein requirements of each fish can be different. Based on the NRC (2011), fish generally require feed protein ranging from 20-60%. Snakehead requires a minimum of 40% feed protein (Yulisman *et al*., 2012), carp need 30% feed protein (Putranti *et al* ., 2015), and giant gourami 40% feed protein (Ahmad *et al*., 2017). The study by Muslim *et al*. (2012) showed that kissing gourami with an initial weight of 3.5 - 5 g were fed a diet containing 34% protein added with hypothalamic cow flour as much as 0.10% in the feed can produce an average final weight of 10.22 g after being reared for 40 days (mean growth of 0.15 g of fish/day). The results of Agusta's research (2016), kissing gourami fed a feed containing 40% protein results a weight gain of 3-4 g/fish every two weeks (average growth of 0.25 g/day). Based on the two studies, it was shown that there was a tendency for higher kissing gourami growth with a higher feed protein given. However, research on optimal protein requirements for kissing gourami has not been carried out. This research suspected that feeding with different protein levels would affect cultured fish's growth rate and feed efficiency. If the feed protein is optimum, the utilization of protein for growth will be maximum. Therefore, research related to this was carried out to increase the growth and feed efficiency of kissing gourami.

METHODS

Materials

Materials used in this study were kissing gourami with an initial length of 4.81 ± 0.12 cm and an initial weight of 1.69 ± 0.10 g, fish meal, soybean meal, rice bran, tapioca flour, fish oil, vitamins mix, and potassium permanganate.

Laboratory Equipment

The laboratory equipment used were an aquarium measuring 25x25x25 cm^3, pH meter, Dissolved Oxygen (DO) meter, thermometer, digital scale, spectrophotometer, measuring cup, basin, sieve, pellet press, aerator, and ruler.

Research Design

This study used a completely randomized design with five treatments

and three replications. The treatments given were different feed protein levels for kissing gourami, consisting of:
P0 = feed with 25% protein level
P1 = feed with 30% protein level
P2 = feed with 35% protein level
P3 = feed with 40% protein level
P4 = feed with 45% protein level

Feed Formulation

The feed formulations used are presented in Table 1.

Table 1. The feed formulations

Raw Material	Composition (%)				
	P0	**P1**	**P2**	**P3**	**P4**
Fish meal	14	33	44	52	70
Soybean meal	35	21	21	26	14
Rice bran	36	31	20	7	1
Tapioca flour	10	10	10	10	10
Fish oil	3	3	3	3	3
Vitamin mix	2	2	2	2	2
Total	100	100	100	100	100
Proteins* (%)	25.10	30.06	35.08	40.06	45.09
Fat* (%)	16.44	14.66	13.80	13.28	11.62
Nitrogen-free extracts* (%)	40.92	37.66	33.91	30.02	26.64
Fiber* (%)	8.90	7.22	5.84	4.58	2.93
GE** (kcal/100 g)	462.82	460.56	465.19	472.21	470.99
GE/P (kcal/g protein)	18.44	15.32	13.26	11.79	10.44
DE*** (kcal/100 g)	197.77	201.39	211.26	223.30	227.90
DE/P (kcal/g protein)	10.37	8.82	7.92	7.33	6.65

Notes: *Feed proximate test was carried out at the Fish Nutrition Laboratory, Faculty of Fisheries and Marine Sciences, Bogor Agricultural University.
**Gross Energy (GE) value is calculated based on the energy content of protein 5.6 kcal /g, fat 9.4 kcal /g, and carbohydrates 4.1 kcal /g (NRC, 2011).
***The calculation of Digestible Energy (DE) with assumptions refers to the results of research by Djajasewaka and Tahapari (1999) regarding the digestibility of feed nutrients by kissing gourami.

Preparation of Rearing Containers

The container used for rearing kissing gourami is an aquarium measuring 25x25x25 cm^3, as many as 15 units. Before use, the aquarium was washed and disinfected with potassium permanganate at a concentration of 3 mg/L for 24 hours, then rinsed with clean water and dried. After drying, the aquarium was filled with 12 L of water, and an aeration installation was installed. Each aquarium was assigned a treatment code at random.

Fish Rearing

Adapted fish were weighed, and their body length was measured as initial data. Then the fish were put into the rearing container with a stocking density of 2 fish/L (Raharjo *et al.*, 2016). Fish were reared for 30 days. Fish were fed 5% of their body weight per day with a feeding frequency of three times a day (at 08.00 a.m, 12.00 a.m, and 4.00 p.m) (Ahmad, 2016). During rearing period, weighing, and measuring the fish length were carried out once every ten days. Siphoning is carried out once a week, and water is added according to the volume of wasted water. Fish that died during rearing were weighed.

Parameters

Absolute Weight Growth

The absolute weight growth of fish during rearing was calculated using the formula according to Effendie (2002) as follows:

$$W = W_t - W_0$$

Information:
W: Absolute weight growth (g)
W_t: Weight of fish at the end of rearing (g)
W_0: Weight of fish at the beginning of rearing (g)

Absolute Length Growth

The absolute length growth of fish during rearing was calculated using the formula according to Effendie (2002) as follows:

$$L = L_t - L_0$$

Information:
L : Absolute length growth (cm)
L_t : Length of fish at the end of rearing (cm)
L_0 : Length of fish at the beginning of rearing (cm)

Feed Efficiency

Feed efficiency is calculated using the formula according to NRC (2011) as follows:

$$\text{Feed efficiency (\%)} = \frac{(W_t+D)-W_0}{F} \times 100\%$$

Information:
W_t: Fish biomass at the end of rearing (g)
W_0: Fish biomass at the beginning of rearing (g)
D: Fish biomass of dead fish (g)
F: Total of feed consumed (g)

Protein Efficiency Ratio

The protein efficiency ratio is calculated using the formula according to Hardy and Barrows (2002) as follows:

$$\text{Protein efficiency ratio} = \frac{W_t-W_0}{P_i}$$

Information:
W_t: Fish biomass at the end of rearing (g)
W_0: Fish biomass at the beginning of rearing (g)
P_i: Weight of feed protein consumed (g)

Survival Rate

Survival rate (SR) is calculated using the formula according to Effendie (2002) as follows:

$$SR\ (\%) = \frac{Nt}{N0} x100$$

Information:
N_t : Number of fish that live at the end of rearing (fish)
N_0 : Number of fish at the beginning of rearing (fish)

Data Analysis

Data on growth, feed efficiency, survival, and protein efficiency ratio were analyzed using variance analysis. It is continued with the Least Significant Difference test at a 95% confidence level if it is significantly different.

RESULT AND DISCUSSION

Data on the absolute weight and length growth of kissing gourami reared for 30 days are listed in Figures 1 and Figure 2. Feeding with different protein levels significantly affected absolute weight growth but had no significant impact on the absolute length growth of kissing gourami.

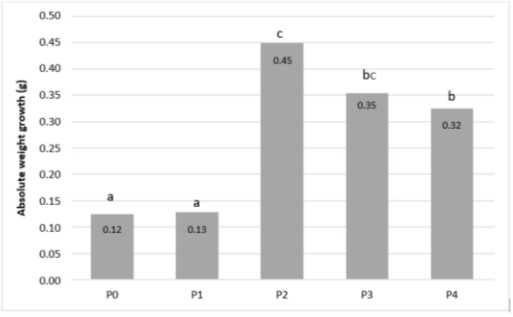

Figure 1. Absolute weight growth of kissing gourami. Notes: Different superscript letters showed a significant

difference (P> 0.05) at the 5% significance level.

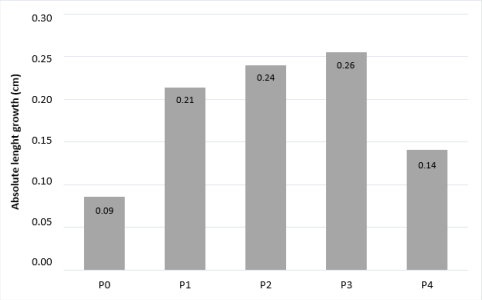

Figure 2. Length and growth of kissing gourami

The treatment with the highest protein level (45%) did not provide the best growth for kissing gourami. According to Kardana *et al*. (2012), increasing feed protein does not always lead to increas growth. If protein intake from the feed is too excessive, then only some will be absorbed and used for growth. And it was forming or repairing cells that have been damaged, and the excess is excreted. Stageari and Darmawan (2018) stated that if protein intake from the feed is too excessive, protein will be converted into energy to excess protein. This is because of an increase in energy requirements for protein catabolism which results in increasing SDA (Specific Dynamic Action), namely, using energy to remodel proteins that are not used for growth.

The data of kissing gourami protein efficiency ratio during rearing in Figure 3.

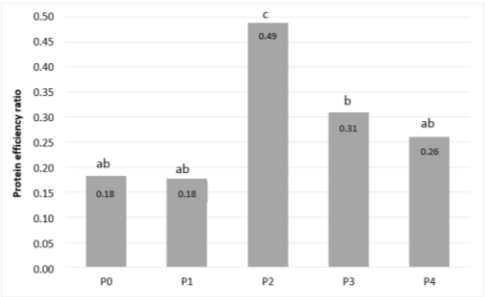

Figure 3. Protein efficiency ratio of kissing gourami. Note: Different superscript letters showed a significant difference (P> 0.05) at the 5% significance level.

The protein efficiency ratio is a measures of the weight gain in grams per unit protein feed (Hardy and Barrows, 2002). Protein level and protein-energy ratio in feed influence the value of the protein efficiency ratio (Setiawati *et al*., 2008).

Based on the research conducted, it was shown that the feed with a protein level of 35% with a protein-energy ratio (GE/P) of 13.26 kcal/g protein (or *Digestible Energy* (DE)/P of 7.92 kcal/g protein. The results of research by Djajasewaka and Stageari (1999) regarding the digestibility of feed nutrients by kissing gourami, according to the highest feed protein efficiency ratio. According to Putranti *et al*. (2015), DE /P ratio for fish should range from 8-10. Furthermore, Syamsunarno *et al.* (2011) stated that excess energy in the feed will cause the fish's appetite so that fish growth will decline. According to Haetami (2012), if the protein-energy level in the feed is lower than the optimal value, the energy source in the feed, especially fat and carbohydrates, is insufficient for the body's needs, so the fish will not grow.

The data of kissing gourami feed efficiency during rearing period in Figure 4 shows that feeding with different protein levels significantly affected feed efficiency. The highest growth of kissing gourami at P2 (35% protein), also in the highest feed efficiency, is 17.11%. However, the feed efficiency value is still relatively low because, according to Craig and Helfrich (2017), the value of good feed efficiency is more than 50%. The higher the feed efficiency value, the more efficient the use of feed by fish body and the better the feed quality (Setiawati *et al.*, 2008). The lowest feed efficiency value was obtained at P0 (25% protein), followed by low growth.

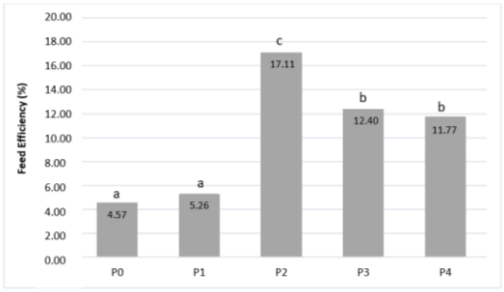

Figure 4. Feed efficiency of kissing gourami. Note: Different superscript letters showed a significant difference (P> 0.05) at the 5% significance level.

The low growth and efficiency of feed with a protein level of 25% is suspected because the feed protein is too low, and the fish lacks protein, causing low growth. The feed with a 25% protein level contained a higher percentage of vegetable matter than the other treatments (Table 1), thus affecting the digestibility feed by fish. According to Suwondo *et al.* (2021), feeds derived from plant materials are usually less digestible than animal materials. This is because vegetable materials have crude fiber, which is difficult to digest, and strong cell walls that are difficult to break. Melita *et al.* (2018) stated that crude fiber could reduce the digestibility of nutrients, including protein. According to Mukti (2012), high crude fiber causes a more significant portion of excreta, so the absorption of digestible protein decreases. In general, fish require a maximum of 8-12% crude fiber (Fatmawati *et al*., 2020). The crude fiber level in this study was still within the range of fish needs in general. The treatment feed containing 45% protein and the lowest crude fiber did not produce the best growth on kissing gourami. This is thought to be related to feed protein that is too high, causing the ratio of energy to protein to be below so that energy from non-protein is limited.

The survival rate of kissing gourami during rearing period shows that feeding with different protein levels had no significant effect on survival rate. Based on Figure 5. the highest survival of kissing gourami was found in P1 (30% feed protein), and the lowest was in P2 (35% feed protein). Based on the analysis of variance, the survival of kissing gourami fed with different protein level had no significant effect between treatments. High fish survival indicates the condition of the waters, and the feed (quantity and quality) provided can meet the needs of the fish.

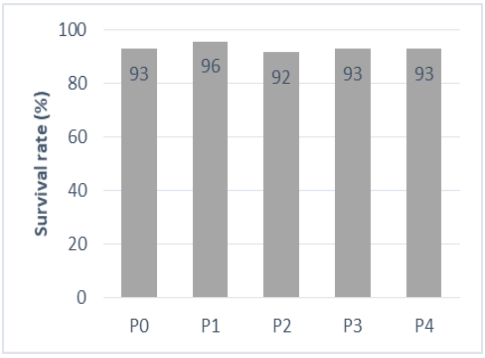

Figure 5. Survival of kissing gourami

CONCLUSION

Feeding with different protein levels significantly affected absolute weight growth, protein efficiency ratio, and feed efficiency of kissing gourami. However, it did not significantly affect the fish's absolute length growth and survival rate. The best treatment in this study was found in feed with a feed protein level of 35% (P2).

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