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Original Research Paper

Effect of Calcium Carbonate Addition on The Growth and Feed Conversion Ratio of Gourami (*Osphronemus goramy*) Seed

Dewi Nur'aeni Setyowati[1*], Anita Prihatini Ilyas[2], Awan Dermawan[2], Sanca Rahmatullah[2]

[1]Aquaculture Study Program, Faculty of Agriculture, University of Mataram, Mataram, Indonesia
[2]Vocational of Aquaculture, University of Mataram, Bima, Indonesia

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*Corresponding Author:
Dewi Nur'aeni Setyowati,
University of Mataram, Mataram, Indonesia,;
Email: dewins@unram.ac.id

Abstract: Gourami is one of the main freshwater fish commodities which has a high economic value. One of the efforts that can be made to increase the productivity of gourami is the provision of macromineral in the form of calcium carbonate ($CaCo_3$). This study aimed to determine the effect of calcium on productivity that would be seen through the growth rate and feed conversion ratio of gourami seed. The study consisted of five doses of calcium carbonate, each of which was repeated three times. As for treating the doses of calcium carbonate, including 1 (0 mg / L $CaCO_3$), 2 (150 mg / L $CaCO_3$), 3 (200 mg / L $CaCO_3$), 4 (250 mg / L) $CaCO_3$) and 5 (300 mg / L $CaCO_3$). The maintenance medium is added with a salinity of 3 ppt in order to save metabolic energy through an osmoregulation mechanism so that the available energy is expected to be used to increase growth. The result or absolute weight growth was not significantly different based on the analysis of variance and linier regression analysis. The analysis of variance showed that no significant different for survival rate of all treatments. The value of feed conversion ratio was not significantly different based on analysis of variance and linier regression analysis. Addition of calcium carbonate did not give significant difference in the absolute weight growth, survival rate, and feed conversion ratio of gourami seed.

Keywords: calcium carbonate, gourami, growth

Introduction

Gourami (*Osphronemus gourami*) is a fish with high economic value which is one of the main commodities of aquaculture in Indonesia. The problem faced is that these fish have a relatively slow growth rate (Budi, 2014; Nugraha *et al.*, 2020). To reach a size of 200 g / head from a size of 15 g / head it takes 120 days, in the first stage of enlargement with a protein content of 20-26% while in the second stage of enlargement from a size of 200 g / head to reach a consumption size of 500 g / head takes 150 days (SNI 2006). This is an obstacle faced by cultivators in order to increase the productivity of gourami. One of the efforts to increase the productivity of gourami is the addition of minerals in the form of calcium.

Salinity is closely related to the osmotic and ionic pressure of water. The salinity medium affects the osmoregulation system in the fish body. Freshwater fish body fluids have a higher pressure (hyperosmotic) than their environment so they tend to take salts in the form of Na + and Cl- ions from the water through a diffusion mechanism. The 4 g / L salinity environment in catfish farming will make the conditions close to isoosmotic so that it reduces energy use for osmoregulation and then diverted it for growth. In order for fish organ cells to function properly, these cells must be in a fluid media (extracellular) which has the same ionic composition and concentration as the fluid in cells (intracellular) (Fujaya, 1999).

One of the efforts to increase productivity through optimization of growth of gourami is the addition of minerals in the form of calcium. According to Boyd (1982) in Heriadi et al. (2016), calcium is also needed by fish for the osmoregulation process that occurs in the fish's

body and the environment and is important for bone formation and the formation of the outer skeleton of crustaceans. Calcium is an essential mineral that is needed in sufficient quantities. Calcium needs can be met with the addition of lime. Liming materials that are often used for agriculture are CaCO3 (calcite), CaMg (CO3) 2 (dolomite), and other types of lime such as Ca (OH) 2 and CaO. The available lime content in quicklime (CaO) (71%), extinguished lime (Ca (OH) 2) (54%), and agricultural lime (CaCO3) (40%). Therefore, the optimal dose of lime to increase the growth of gourami needs to be known.

Material and Methods

Time and Place

This research was conducted from August to September 2019 for 60 days, taking place in the wet laboratory of the Aquaculture Study Program Vocational Program, Mataram University, PDD, Bima Regency.

Tools and Materials

The tools and materials used in this study were aquariums with a size of 50 x 30 x 30 cm3, pipes for recirculation system installations, blowers, pH meters, DO meter, thermometer, refractometers, calcium carbonate powder, sea water, buckets, ditches, scales, digital and a ruler.

Research Method

The method used in this study is an experimental method. Experimental research is research that carried out on variables whose data does not yet exist, so it needs to be done manipulation process through giving certain treatment to the subject research which is then observed/measured its impact (future data) (Jaedun, 2011).

Research Design

This study used linear regression analysis with five treat doses of calcium carbonate. Where each treatment was repeated three times. P1: 0 mg/L CaCO3, P2: 150 mg/L CaCO3, P3: 200 mg/L CaCO3, P4: 250 mg/L CaCO3, and P5:300 mg/L CaCO3**.**

Research Procedure

The containers in the form of an aquarium were washed with soap, then rinsed with clean water and left to dry. The media for keeping gourami was freshwater (0 ppt) with the addition of 3 ppt salinity obtained from the addition of salt. The media water was deposited first so that the remaining dirt goes to the bottom and then filtered. Media water was then collected in a water reservoir and aerated for three days.

The fish used in this study were gourami seeds with a length of 3-5 cm. The stocking density for each container was 20 individuals. The selected fish are healthy seeds, which are characterized by agile movements and are not deformed. Before being put in a rearing container, the fish are acclimatized for one day without feeding with the aim of adjusting to the new environment.

Fish were stocked with a density of 20 fish per aquarium on a maintenance medium with a salinity of 3 ppt. The lime used is CaCO3 in powder form. CaCO3 lime was added to the aquarium according to the respective doses in the treatment medium. During the maintenance period, the fish are fed in the form of pellets twice a day in the morning at 09.00 am and 04.00 pm in the afternoon as much as 5% of the biomass weight with a protein content of 25%. Growth sampling and water quality control carried out once a week during the maintenance period. Water entry into the maintenance container was only carried out when there was evaporation.

Research Parameters

Absolute Growth Weight

The total body length of the gourami is measured once a week using a ruler. Absolute length growth is calculated using the Effendie (1997): Pm = Lt – L0, with Pm = absolute length growth (cm), Lt = the final average length (cm), and L0 = initial average length (cm).

Survival Rate

The survival rate (SR) is the percentage of the number of live fish at the end of maintenance compared to the number of fish at the beginning of stocking which is stated in the following Effendi (1979) cit Setyowati *et al.* (2007): SR = (Nt/No) x 100%, with SR = degree of survival (%), Nt = Number of live fish at the end of

maintenance, and No = Number of fish at the beginning of maintenance.

Feed Conversion Ratio

The feed conversion ratio is calculated using the formula (Kordi, 2012): $FCR = \frac{F}{(Wt+Wd)-Wo}$ with Wt = individual average weight at time t (g), Wd = total biomass of fish that died during the experiment (g), Wo = individual average weight at the start of maintenance (g), and F = amount of feed eaten (g)

Statistic Analysis

The absolute wight growth, survival rate, and feed conversion ratio were analyzed by Analysis of Variance and Analysis of Regression. The water quality were analyzed with descriptive analysis.

Results and Discussion

Absolute Weight Growth

The data of absolute weight growth was presented in figure 1. The highest weight was obtained in treatment P5 (17 g). And the lowest weight was obtained in treatment P4 (7 g). But based on analysis of variance showed that no significant different for all treatment.

Table 1. Absolute Weight Growth of Gourami

Treatment	Absolute Weight Growth (g)
P1	11[a]
P2	10[a]
P3	12[a]
P4	7[a]
P5	17[a]

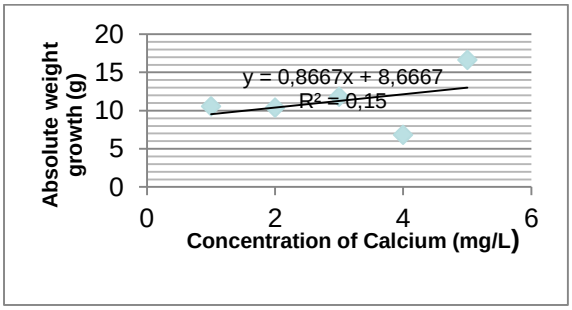

Figure 1. Regression Analysis of Absolute Weight Growth

The regression analysis showed that the result of R^2 on concentration of calcium and absolute growth 0.15.

Survival Rate

Table 2 gave information of the survival rate of gourami. The highest value of survival rate was in treatment P5. And the lowest value of survival rate was in treatment P1.

Table 2. Survival Rate of Gourami

Treatment	Survival Rate (%)
P1	57[a]
P2	63[a]
P3	67[a]
P4	60[a]
P5	83[a]

The analysis of variance showed that no significant different for all treatment. And the linier regression analysis showed that the R^2 was 0.5799

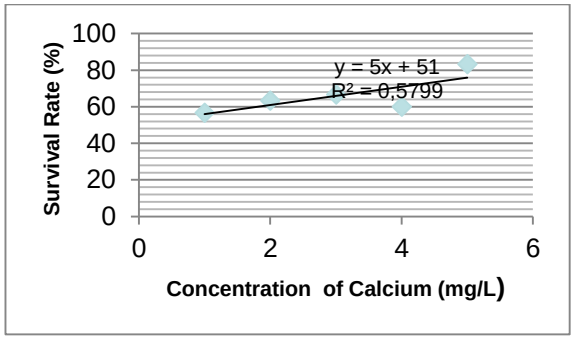

Figure 2. Regression Analysis of Survival Rate

FCR (Feed Conversion Ratio)

The value of FCR were 0,4-0,9. The lowest value of FCR was treatment P5, and the biggest value of FCR was traetment P4. But the value was not significantly different based on analysis of variance and linier regression analysis.

Table 3. FCR of Gourami

Treatment	Feed Conversion Ratio (FCR)
P1	0.6[a]
P2	0.8[a]
P3	0.5[a]
P4	0.9[a]
P5	0.4[a]

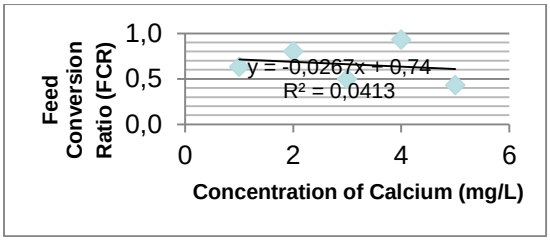

Figure 3. Regression Analysis of FCR

Water Quality

The water quality measured in this research were temperature, pH and Dissolved Oxygen (DO). The temperature range between 27.6-30.4ºC, the pH range were 8.4-9.0 and the DO range were 3.9-5.0 mg/L.

Table 4. Water Quality

Treatment	Temperature (ºC)	pH	DO (mg/L)
P1	27.6-30.2	8.4-9.0	4.0-4.6
P2	27.6-30.4	8.5-9.0	4.0-4.7
P3	27.7-30.0	8.7-9.0	4.0-5.0
P4	27.7-29.9	8.7-8.9	4.2-4.6
P5	27.7-30.2	8.5-8.9	3.9-4.8

Discussion

Absolute Weight Growth

The result or absolute weight growth was not significantly different based on the analysis of variance and linier regression analysis (Table 1 and Figure 1). The results of linear regression analysis on absolute weight growth showed that the value did not differ between treatments because the R2 value was 0.15. According to Gomez and Gomez (2007), a good / positive value is if R^2 approaches to 1. Calcium is needed for the body's skeletal formation. Calcium also acts as an enzyme activator. The addition of mineral supplements to feed can increase fish growth (Halver and Hardy, 2002). Deficiency of calsium can give effect to the growth and bone mineralization (Hossain and Yoshimatsu, 2014). However, the results showed that the addition of calcium had no effect on increasing fish weight. This is due to the fact that gourami is a slow-growing fish, so that the difference in growth is not significant between treatments. Sitanggang and Sarwono (2007) in Wibawa *et al*. (2018) stated that gourami growth was relatively slow both in the seed maintenance and enlargement phases. The experiment of Kelentarian *et al*. (2013) and Liang *et al.* (2017) showed that the dietary calsium had no significant effect on the growth of fish. But, Hossain and Furuichi (2000) in Zainudin (2010) stated that addition of calsium in the feed is necessary for the growth of Japanese flounder, black sea bream, and redlip mullet. Hastutui *et al*. (2016) also stated that addition of calsium is necessary for the grotwh of freshwater tambaqui.

Survival Rate

The result of analysis of variance and regression analysis showed that the addition of calsium didn't give effect for survival rate of gourami with the range of survival rate are 57% to 83%. The value of R^2 in linier regression analysis was 0.5799. Based on Sembiring (1995), the effect will be significant if the value of R^2 approching to 1. e. The survival data obtained during the study were 57-83%. According to SNI (2000), survival for gourami nurseries is 60-80%. The data on the survival results showed that the addition of calcium could make better for survival rate of gourami. It was different with the result of Liang *et a*l (2018), that calcium did not give effect for fish survival rate. Hastuti *et a*l (2014) also stated that the addition of calsium in the water with salinity didn0t give effect for survival rete of *Pangasius* sp.

FCR (Feed Conversion Ratio)

The value of FCR in the gourami cultivation are less than 1, it mean that the fish can effective use feed for the growth. Fry *et a*l. (2018) gave a fact that FCR for aquaculture species is lower than cattle and pig with the value between 1.0-2.4. The smaller the FCR value, the more optimal the feed will be used by the fish body for growth. The FCR value of 0.4-0.9 means that every 0.4-0.9 g of feed produces a weight gain of 1 g. This value is still higher than the study by Anti *et al.* (2018) who obtained FCR

values of 2.35-2.60 for gourami which were fed with moringa leaf enrichment.

Water Quality

The temperature in maintenance is still in the normal range because the value is 27.6-30.2. According to SNI (2000), the optimal temperature for gourami is 25-30ºC. The pH value in this study shows an alkaline pH of 8.5-9.0. Calcium in the water will react with H^+ so that the pH will increase. (Boyd, 1982 in Heriadi et al., 2016). According to SNI (2006), the optimal pH range for gourami maintenance is 6.5-8.5. The pH value during the study showed a rather high upper listmit value of 9.0. The Dissolved oxygen result is still normal for the fish to survive.

Conclusion

Addition of calcium carbonate did not give significant difference in the absolute weight growth, survival rate, and feed conversion ratio of gourami seed.

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