The effects of exogenous dietary enzyme on the growth of giant gourami (Osphronemus goramy)

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Abstract. The commercial complex enzymes containing protease, lipase, and amylase are potentially used for exogenous dietary enzymes on giant gourami (Osphronemus goramy) as growth booster indirectly. The aims of this study are to know the effect of the exogenous dietary enzymes on giant gourami growth and to obtain the optimal dose of this enzyme. The research was conducted on January-April 2019 in the aquaculture facility and laboratory of Universitas Airlangga, Banyuwangi Campus. A total of 200 giant gourami juveniles (5.5 ± 0.5 cm in total length) were obtained from the fish hatchery centre of Kabat, Banyuwangi, Indonesia. All fish was divided into 20 glass aquaria (40 x 30 x 30 cm3) and reared for 40 days with exogenous dietary enzyme treatments in the diets following: control (no enzyme), 2.5 ml/100 g feed, 5.0 ml/100 g feed, 7.5 ml/100 g feed, 10.0 ml/100 g feed (4 replication in each treatment). The parameters were observed in this study are daily growth rate (DGR), specific growth rate (SGR), and feed conversion ratio (FCR). The exogenous dietary enzyme significantly (P < 0.05) effect to all parameters, the best result was showed in 10.0 ml/100 g feed treatment as optimum applicate dose.

1. Introduction
The giant gourami (Osphronemus goramy) is one of Indonesia’s most economically important local species [1]. This fish has become one of the most widely farmed species and is in high demand in the aquaculture food sector [2], and often served as grilled fish in Indonesian restaurants. Giant gourami farming production has slowed for several reasons. There are still gaps in information on numerous aspects of this species’ biology, notably for the juvenile life stages, due to its traditional production techniques based on empirical know-how [3]. On the other hand, Giant gourami grows slowly, so its production is difficult to boost to meet increasing market demand [4,5]. One way to increase fish growth is to use exogenous enzymes in the diets [6–8] trough improve the feed digestibility and utilization [9].

In recent years, feed manufacturers and animal producers have paid close attention to the use of enzyme products as animal feed additives as a method of enhancing animal performance [7]. Exogenous enzymes have applicable commonly in the meals of terrestrial animals like pigs and chickens [10]. Meanwhile, the use of exogenous enzymes in fish has also been carried out in many species including common carp (Cyprinus carpio) [6], great sturgeon (Huso huso) [11], gibel carp...
(Carassius auratus gibelio) [12], tra catfish (Pangasianodon hypophthalmus) [13], etc. Meanwhile, in the previous exogenous dietary enzymes study in giant gourami, supplementation of papain and bromelain had no statistically significant effect on growth rate [14]. Multi-enzyme complex (Newzime™, Balai Besar Perikanan Budidaya Air Payau Jepara, Indonesia) was used in recent study to improve and clarify the previous study.

Feed consists of a complicated mixture of crude protein, crude lipid, carbohydrates, inorganic salt, and other ingredients. As a result, using an exogenous enzyme combination rather than a single enzyme may be more beneficial [9]. Exogenous enzyme mixtures with suitable adjustments have also been demonstrated in several experiments to greatly improve fish growth and minimize feed coefficient [8,11,15]. This study aims to know the effect of exogenous dietary enzyme on giant gourami growth and to obtain the optimal dose of this enzyme.

2. Materials and methods
2.1. Time and place
This research was conducted in January-April 2019 at Aquaculture Facility and laboratory Universitas Airlangga, Banyuwangi Campus.

2.2. Fish origin and acclimation
In this study, 200 giant gourami fry with total length 5-6 cm were obtained from Balai Benih Ikan Kabat, Banyuwangi, East Java, Indonesia. Fry were stocked in rearing glass aquaria (40 x 30 x 30 cm$^3$) 10 fish/aquarium in the morning (07.00 AM). The treatment was started after 1 week acclimation the fish to laboratory condition. The dissolved oxygen (DO) in rearing media was maintained by aeration. The temperature, pH, and DO were measured during acclimation and experiment is 25-30 ºC, 7.5-7.9, and 6.8-7.0 ppm.

2.3. Experiment design, feed preparation, and fish rearing
The completely randomized design was used in this experiment consist of 5 exogenous dietary enzyme dosage treatment and 4 replication in each treatment. The treatments were given are no enzyme addition (P0), 2.5 ml enzyme/100 g feed (P1), 5.0 ml enzyme/100 g feed (P2), 7.5 ml enzyme/100 g feed (P3), and 10.0 ml enzyme/100 g feed (P4).

The feed was used is commercial feed PF LP1 (PT. Matahari Sakti, Indonesia) with size 1.9-2.3 mm, crude protein 33%, lipid 4%, crude fibre 5%, mineral matter 13%, and water content 10%. The exogenous complex enzyme was used is Newzime™ (Balai Besar Perikanan Budidaya Air Payau Jepara, Indonesia) containing protease, lipase, and amylase. The feed was sprayed with enzyme solution according to treatment dosage with preparation method following Prabarini et al. [16].

The fish was feed on ad satiation twice daily at 08.00 AM and 04.00 PM. Media siphoning (30-50%) was done every day in the afternoon to maintain water quality. The fish was reared for 40 days.

2.4. Observed parameters and data analysis
In this study, the parameters were observed are daily growth rate (DGR), specific growth rate (SGR), and feed conversion ratio (FCR). All of them were determined following formula:

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\begin{align*}
\text{DGR} \ (g/day) &= (BW_f - BW_i)/t \\
\text{SGR} \ (%/day) &= (ln BW_f - ln BW_i) / t \\
\text{FCR} &= FC/(N_f BW_f - N_i BW_i)
\end{align*}
\]

Where BW$_i$ and BW$_f$ are the initial mean body weight (g) and the final mean body weight (g); N$_i$ and N$_f$ are the initial number and the final number of fish; t is the treatment duration in days; FC is total of feed consumption during treatment.

The data's distribution and homogeneity were investigated; all of the data had a normal distribution and homogeneity of variances. The data was then statistically evaluated using the analysis of variances (ANOVA) test with a 95% confidence level and the Duncan Multiple Range Test (DMRT) with SPSS 17.0 software.
3. Results and discussion

The exogenous dietary enzyme significantly affects (P < 0.05) to the daily growth rate (DGR), specific growth rate (SGR), and feed conversion ratio (FCR) shows in Fig. 1. The value of DGR and SGR directly proportional, where the highest DGR and SGR showed on P4 (0.0457 ± 0.0025 g/day and 1.9237 ± 0.1174 %/day) and the lowest showed on P1 (0.0267 ± 0.0010 g/day and 1.2093 ± 0.0498 %/day). The best FCR also found in P4 (0.9549 ± 0.0695) and the worst show in P0 (1.5040 ± 0.2476).

![Graphs showing daily growth rate (g/day), specific growth rate (%/day), and feed conversion ratio (%/day) for giant gourami (Osphronemus gourami) given different enzyme treatments.](image)

**Figure 1.** The daily growth rate (g/day) (A), specific growth rate (%/day) (B), and feed conversion ratio (%/day) (C) of giant gourami (Osphronemus gourami) that given exogenous dietary enzyme for 40 days. Values (mean ± SD, n = 4) with different superscript show significantly different (P < 0.05). P0, P1, P2, P3, and P4 are no enzyme addition, 2.5 ml enzyme/100 g feed, 5.0 ml enzyme/100 g feed, 7.5 ml enzyme/100 g feed, and 10.0 ml enzyme/100 g feed treatment.

In comparison to fish fed a control diet, giant gourami supplemented with Newzime™ gained more weight. Exogenous enzyme supplementation resulted in significantly better growth, lower FCR values, higher protein efficiency, and higher protein digestibility in all treatments compared to fish given the control diet. Fish given diets supplemented with 10.0 ml Newzime™/100 g feed had the best DGR, SGR, and FCR. According to several authors, exogenous enzymes increase the use of dietary energy and amino acids, resulting in improved fish growth performance [7,17,18].

Exogenous enzymes such as protease, amylase, and lipase that contained in Newzime™ are supplemented to complement endogenous enzymes generated by the fish and improve digestion. Exogenous enzyme supplementation also increased endogenous enzyme release and improved digestion in catfish diets [18,19]. Supplementing a meal with a mixture of proteolytic enzymes and carbohydrase also had a favourable effect on growth performance and feed efficiency in Atlantic salmon smolt (Salmo salar) [20]. When the level of Newzime™ in the diet was raised, the growth rate
climbed to an optimum level while food intake continued to rise. This implies that nutrient digestion and transport may be limiting the ability for growth [20].

4. Conclusion
The exogenous dietary enzyme had a significantly (P < 0.05) influence on giant gourami growth, with 10.0 ml/100 g feed treatment as optimal dose showing the greatest results for DGR, SGR, and FCR.

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