# Penambahan Vitamin C pada Ikan Rucah untuk Pertumbuhan dan Efisiensi Pakan Ikan Kerapu Macan (*Epinephelus fuscoguttatus*)

## [Application of Ascorbic Acid in Raw Fish Diets on Feed Efficiency and Growth Performance of Brown-Marbled Grouper (*Epinephelus fuscoguttatus*)]

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**ABSTRAK**

Pertumbuhan dan kelulushidupan adalah dua faktor utama yang harus diketahui dalam usaha budidaya ikan kerapu macan, terutama pada stadia juvenil. Penelitian ini bertujuan untuk mengamati pertumbuhan dan kelulushidupan juvenil ikan kerapu macan melalui penambahan dosis vitamin C yang berbeda ke pakan. 120 juvenil ditempatkan dalam 12 buah akuarium. Pakan yang digunakan adalah ikan rucah teri yang diperoleh dari tempat pendaratan ikan lokal. Tiga dosis vitamin C komersial yang berbeda yaitu 50 mg, 100 mg, dan 150 mg diaplikasikan dan dicampurkan ke pakan ikan rucah. Pakan komersial digunakan sebagai kontrol. Pengujian secara eksperimen dengan menggunakan desain RAL (Rancangan Acak Lengkap). Hasil penelitian menunjukkan bahwa ikan mengkonsumsi pakan yang diberikan secara lahap. Seluruh ikan hidup hingga akhir penelitian 32 hari (SR 100%). Pertumbuhan bervariasi dimana perlakuan B memiliki berat mutlak tertinggi yaitu 49,58 gram, diikuti perlakuan C (34,68 gram), A (29,79 gram) dan D (28,33 gram). FCR terbaik berturut-turut adalah perlakuan A (0,7), C (1,3), B (2,0), dan D (2,2). Kandungan nutrisi pakan dianalisis secara proksimat di laboratorium pangan dan peternakan Universitas Hasanuddin, dan parameter kualitas air diukur berkala. Secara umum, penambahan vitamin C ke dalam pakan ikan rucah yang diberikan ke juvenil ikan kerapu macan memberikan hasil yang signifikan dan menunjang pertumbuhan.

**Kata kunci***: Vitamin C, kerapu macan, pertumbuhan, pakan rucah*

**ABSTRACT**

Growth and survival rate are two main factors that should be known to develop tiger grouper aquaculture, particularly in juvenile stages. The study aims to investigate the growth and survival rate of tiger grouper juveniles (*Epinephelus fuscoguttatus*) by adding different concentrations of ascorbic acid to dietary. 120 grouper fingerlings were placed into 12 tanks. The diet used for the treatment of juveniles was discarding fish from the local fishing port, mainly anchovy species (*Stolephorus commersonii*). Three different doses of commercial ascorbic acid were applied and mixed into the raw fish feed (50 mg, 100 mg, and 150 mg, respectively). Commercial feed was used as a control. Filling Randomized Design (FRD) was applied with the experimental setup of the treatments. The results show that fish intake on the treatment diets has a quick response, which is directly caught and consumed by the groupers. The survival rate of juvenile grouper is 100% for 32 days. Growth rates (in grams of BW/week) vary among treatments which is the highest found in treatment B (49.58 g) followed by treatment C (34.68 g), A (29.79 g), and D (28.33 g) respectively. Feed Conversion Rate (FCR) also varies amongst treatments, which is 0.7 (A), 2.0 (B), 1.3 (C), respectively. Nutrition ingredients, which were measured by proximate analyses laboratory results (at UNHAS laboratory), and water quality parameters are adequate to maintain the grouper life. Overall, fish feed fortified with ascorbic acid significantly supports tiger grouper growth.

**Key words***: Ascorbic acid, tiger grouper, growth performance, raw fish feed*

## INTRODUCTION

Brown-marbled grouper or tiger grouper *(Epinephelus fuscoguttatus)* is a highly economic species valued worldwide, which is widely distributed throughout the tropical and subtropical waters of the Indo-Pacific. According to the IUCN Red List of threatened species (2003), the grouper has imported from Indonesia between 1999 to 2003, which is the highest at 26.746 kg in 2002. Due to the intensively wild caught in years, aquaculture is considered a solution to preserve species availability. It was commercially domesticated in floating net cages in Indonesia since the 1990s (WWF, 2015). Grouper aquaculture can basically be classified into two primary activities, complete hatchery and household-scale hatchery (Zainuddin et al, 2016). A household or small-scale hatchery is a business where capital and technology can be affordable at a relatively low cost and focused on the maintenance of larvae and nurseries for seed production. No household scale hatchery includes the handling of brood fish, but the procurement of fish eggs that have already been prepared fertilized or hatched larvae from larger hatcheries, for instance, the complete hatchery (Sugama et al., 2013). Also, the broodstock of tiger grouper is usually cultured in recirculating aquaculture systems under suitable environments and good feeding conditions (Mustafa et al., 2015).

Larvae and juvenile rearing are the main activity in the grouper hatchery that is aimed to produce seeds, which depend heavily on the broodstock situation (Mustafa et al., 2015). The steps in the maintenance of the larvae include the preparation of culture tanks and feeding fish including either live or raw fish feed and artificial diets (Fitriadi et al., 2020). Maintaining and measuring water quality management on aquaculture media is also an essential part of a successful business. Some publications mentioned the most critical part of conducting grouper hatchery is feed nutrition whether activities related to feed formulation or feeding time (Zainuddin, 2016). Grouper is a carnivorous species and an active predator type, which usually chases prey for its eating habits. According to Sugama et al (2013) and Fitriadi et al (2020), the types of grouper food sources in the larval stage are rotifers, micro-crustaceans, copepods, zooplankton, small fish, and cephalopods.

Ascorbic acid or vitamin C supports growth, reduces stress levels, and can accelerate wound healing in fish (Lin

and Shiau, 2004). According to Tucker and Halver (1984) *in* Lenient et al (2006), deficiency of vitamin C in fish can cause damage to the gills and lower growth rates and recovery of life in salmon and rainbow trout. Vitamin C also functions as a collagen network builder and antioxidant that can elevate various antioxidases, such as glutathione-transferase (GST), superoxide dismutase (SOD), glutathione reductase (GR), catalase (CAT) and glutathione peroxidase (GPx) in fish (Cai et al., 2022). Jafari et al. (2020) stated that collagen is a bone-forming component in fish that is absorbed quickly in the skin, dorsal fins, head, gills, cartilage, jawbone, supporting cartilage, and mouth. Therefore the need for vitamin C in fish is absolutely necessary. Lovell (1989) states that the need for vitamin C is different for each animal depending on the species, age, fish size, growth rate, environmental factors, and metabolic function. The objective of this research at investigating the growth performance and feed efficiency of tiger grouper juveniles by adding different concentrations of ascorbic acid into raw fish feed.

## MATERIALS AND METHODS

120 juveniles of tiger grouper size 10 cm were used as the object of treatment. Each fiber tank (80x80x60 cm) was filled with 10 individuals, then 12 tanks used were placed randomly for an experimental setup. The anchovy raw fish was collected from Bastiong fishing port and cut into small pieces and mixed with different concentrations of ascorbic acid. A 3x4 randomized completely design was used to evaluate the effect of diet in four different doses as below:

Treatment A : 50 mg per gram of raw fish feed
Treatment B : 100 mg per gram of raw fish feed
Treatment C : 150 mg per gram of raw fish feed
Treatment D : Control (commercial feed)

Parameter of measurements such as survival rate, growth performance in body weight increase, feed efficiency, and water quality condition was investigated during a research study.

The survival rate is measured followed by (Djajasewaka, 1985): SR = Nt/No x 100 %; where SR stands for survival rate (%), Nt is the number of fish alive at the end of the study (ind), and No is the number of fish at the beginning of the study (ind). The feed Conversion Rate (FCR) was calculated using Watanabe's (1988) equation. FCR = F/(Wt-Wo); where F is the amount of given feed (gram), Wt is fish weight at the end of the study (gram

BW), and Wo is fish weight at the initial study (gram BW).

Grouper juveniles were reared for 32 days and given 20% feed from biomass. The frequency of feeding fish was 3 times a day. Diet nutrition was obtained using proximate analysis in the Food and Veterinary Laboratory UNHAS, whereas the water quality parameter was measured in situ. Data obtained were calculated using SPSS 20 statistical packages.

## RESULT AND DISCUSSION

Species survival means the number of cultivated organisms that live for a certain period of time during rearing activity. The results show that the tiger grouper (*E. fuscoguttatus*) survived for 32 days and reached a 100% survival rate in each tank. The survival rate of an organism is influenced by stocking density, age, and environmental factors such as temperature, pH, salinity, dissolved oxygen, and the ability to metabolize food. Raw anchovy can be easily consumed by all juveniles because it was given when the grouper is starving, the small shape is effective to digest, and it has an attractive odor. According to Paruntu et al (2012), using anchovy as a main feed for monoculture and polyculture of tiger grouper with rabbitfish in floating net cages, the appetite behavior was increasing and affected their daily growth rate.

The absolute growth of juvenile tiger grouper fed with different doses of ascorbic acid in raw anchovy is shown in Figure 1. The highest growth is performed by treatment B (100 mg of Vitamin C in a gram of raw fish), which is about 49.58 g BW per day. It is followed by treatments C (34.68 g BW/day), A (29.79 g BW/day), and D (28.33 g BW/day), respectively. The results show that juvenile groupers are able to adapt to the food sources given and increase their body weight. On the other hand, Muhammadar et al (2013) study mentioned that raw fish is only suitable for wild grouper, and cultivated juvenile grouper in the hatchery is preferring to choose commercial pellets. When comparing wild and hatchery tiger grouper, it was revealed that wild juveniles could not adapt properly to the diet, and hatchery juveniles were difficult to adjust to trash fish. However, some studies have shown that the use of trash fish and commercial pellets or a combination of both sources gives a good result (Sugama et al., 2013). The proper additions of Vitamin C can increase the performance of fish (Nurcahyo et al., 2013). A micronutrient called vitamin C is required

for the body of the fish to operate properly. It is essential for nutritional and ion absorption, and fish with a deficiency show structural malformations such as curved spines, fractured skulls, and hemorrhages. Add vitamin C to fish meals at the required amounts for active absorption. It has a significant role in the manufacturing of collagen, which helps fish preserve the integrity of their skeletons and structural integrity. Because a significant amount of the micronutrients might be lost during feed processing and storage, the usage of the phosphorylated form should be used during feed formulation for the best stability in feeds (Omoniyi and Ovie, 2018).

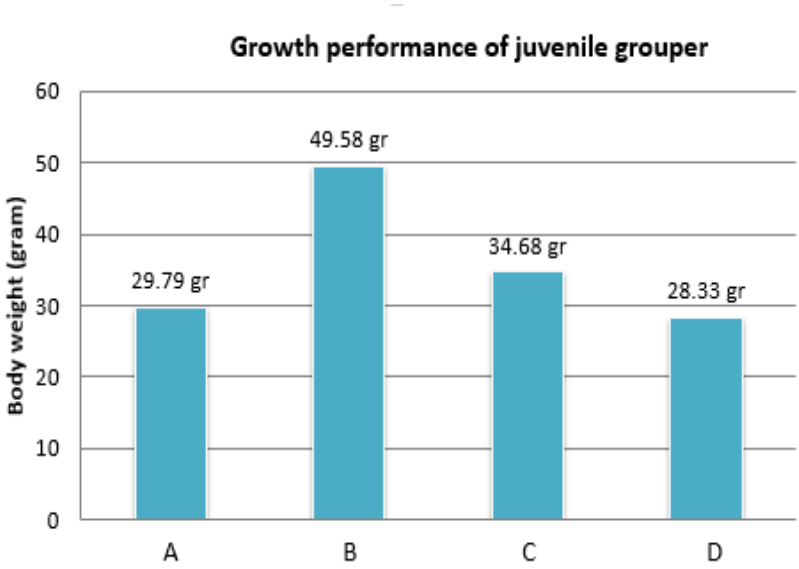


Figure 1. The number of juvenile body weights (g BW per day) in different raw fish feed given.

Figure 2. Juvenile tiger grouper rearing for 32 days fed by raw anchovy.

Feed Conversion Ratio (FCR) has differed among treatments. Treatment A has 0.7 and C has 1.3. Both numbers are considered good for the hatchery business, which means that when running a grouper fish farming business, it will not cause business losses. FCR is defined as the proportion of feed intake to weight increase. By increasing FCR within a species, feed intake can be decreased for the same amount of growth, lowering feed costs, and having a smaller negative effect on the environment (Elvy et al., 2022). Treatments B and D have FCR 2.0 and 2.2, respectively.

Nutritious and vitamin feed will accelerate the maturity of the gonads as well as improve the quality of eggs and sperm (Nasrullah, 2018). The nutrient compounds in the fish diet are important to prepare for aquaculture activities. Regarding the raw fish that has been chosen for fish feeding during treatment days, the proximate analysis of anchovy with additional ascorbic acid was performed to measure its ingredients. The laboratory analysis with some publication results can be seen in Table 1.

Table 1. Nutritional composition of given anchovy (*Stolephorus commersonii*) and other species from some references.

| Ingredients (g/100 g) | Species of anchovies | | | | |
|---|---|---|---|---|---|
| | *S.commersonii* | *S.heterolobus* | *Coilia dussumieri* | *Enrasicholina devisi* | *E.anchoita* |
| Moisture | 79.32 | 81.00 | 75.56 | 76.20 | 75.70 |
| Protein | 16.32 | 19.32 | 17.24 | 19.00 | 22.20 |
| Fat | 2.41 | 1.62 | 2.57 | 2.40 | 3.50 |
| Ash | 1.31 | 1.90 | 1.40 | ND | 1.50 |
| Carbohydrate | 0.11 | ND | ND | ND | ND |

ND: Not determined

Water quality is also one of the factors that affect growth and larval survival. The larvae will be able to grow and live well inside optimum water quality conditions. The observed water quality variables include salinity, DO (dissolved oxygen), temperature, and pH. The water quality measurement can be seen in Table.

Table 2. Water quality parameters during rearing study

| Treatment / Replication | Water quality parameters | | | |
|---|---|---|---|---|
| | Temperature ($^0$C) | pH | Salinity (ppt) | DO (ppm) |
| A | 25-26.7 | 7.8-7.92 | 31-34 | 5 |
| B | 25-26.7 | 7.0-7.92 | 32-35 | 5 |
| C | 25-26.7 | 7.0-7.95 | 32-35 | 5 |
| D | 25-26.7 | 7.8-7.95 | 31-34 | 5 |

Based on Zainuddin's (2016) study, the results of measurements of water quality parameters during the observation period are still within the limits of eligibility and survival of tiger grouper juveniles. Temperature media ranged from 27.5ºC to 29.6ºC. The pH of the media water ranged from 8.05 to 8.30. Dissolved oxygen 4.00 to 5.34 ppm, salinity 33 to 34 ppt, ammonia 0.004 to 0.007 ppm, and nitrites around 0.28 up to 0.34 ppm.

Subyakto and Cahyaningsih (2003) mentioned that the water quality good for the maintenance of tiger grouper is 25ºC to 32ºC, water pH ranges from 7.3 to 8.4, dissolved oxygen ranges from 4 to 8 ppm, whereas according to Boyd (1990) ammonia levels not more than 0.1 ppm and no nitrites more than 0.5 ppm.

## CONCLUSION

The feed given to the juvenile stage of tiger grouper/ Brown-Marbled Grouper *(Epinephelus fuscoguttatus)* is appropriate and sufficient for the needs of absolute growth and survival rate, with sufficient FCR number. The nutritional ingredients of raw fish anchovy are adequate for fish in rearing time, and water quality parameters supported the growth significantly.

## COMPETING INTERESTS

The authors have declared that no competing interests exist.

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