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EFFECT OF ASTAXANTHIN IN HIGH FAT FOOD ON THE GROWTH OF GURAMI FISH (OSPHRONEMUS GOURAMY LAC.)

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ABSTRACT
Gurami fish is a freshwater fish commodity that is very popular with the public because of the deliciousness of gurami fish meat, therefore many efforts have been made to cultivate gurami fish, namely in terms of growing and increasing consumption of fish production in a more modern way, one of which is in the artificial feed section which uses astaxanthin additives. The aims of the research: to analyze the effect of astaxanthin in high-fat feed on the growth of gurami fish; determine the optimal dose of astaxanthin in high-fat feed on the growth of gurami fish.

KEY WORDS
Astaxanthin, growth, survival rate, gurami fish.

Cultivation of gurami fish (*Osphronemus gouramy* Lac.) is one of the promising freshwater fish cultivation businesses due to high market demand. This fish meat has become a target for culinary businesses such as restaurants, hotels and *catering* as a main dish at quite high prices. This is what causes the price of gurami fish meat on the market to be relatively high, namely around IDR 35,000-50,000 per kg at retail level (KKP, 2020).

The development of gurami fish cultivation has experienced obstacles, mainly due to the slow growth of gurami fish and their easy exposure to stress. In the market, this type of fish also has a higher selling price the larger the size, because the meat of this fish will be processed by filleting (taking the flesh). The long maintenance process causes high feed costs, so that gurami fish farmers often do not make a profit in their cultivation business, even approaching losses. This is in accordance with the opinion of (Pratama, 2019).

In cultivating gurami fish (*Osphronemus gouramy* Lac.) one of the keys to increasing the growth of gurami fish is by providing high protein, as a way out of the problem of slow growth. Protein sourced from animal ingredients is known as the best source of protein and fat. These macronutrients provide the necessary energy, essential amino acids and essential fatty acids for growth. Protein in animal ingredients contains more complete and balanced essential amino acids compared to protein in plant foods. The protein content in animal ingredients can be more easily digested and absorbed by the body.

Astaxanthin is an ingredient known to contain red and orange pigments and contains many antioxidants. Astaxanthin as an antioxidant is able to inhibit lipid peroxidation and protect cell membranes from oxidative damage in aquatic organisms and helps reduce the side effects of high *Low Density Lipis* (LDL) (Higuera-Ciapara *et al*., 2006).

Research uses maggots because they are easy to obtain or cultivate and are a fairly high source of protein, therefore they use maggots as the main ingredient or basic ingredient in feed. The problem found is that the high fat content in maggots can inhibit growth. It is hoped that astaxanthin in high-fat fish feed can be a breakthrough to increase the growth of gurami fish with feed that is high in fat content.

METHODS OF RESEARCH

The research for this study was carried out in the nutrition laboratory in the context of feed production, while biological feed testing was carried out at the UPT Freshwater

Cultivated Fishery Production (Mentaos Village). This research study was conducted for more than 4 months.

Table 1 – Tools Required in Research

No	Tool	Amount	Utility
1	Sieve	1 piece	Filtering the material that has been in the grinder
2	Oven	1 piece	Drying Maggots
3	Grinders	1 piece	Smoothing Feed Ingredients
4	Meat grinder	1 piece	Printing Feed
5	Iron Tray	4 pieces	Laying Artificial Feed
6	Plastic Tray	4 pieces	Laying Materials
7	Digital scales	1 piece	Weighing Feed Raw Materials
8	Spoon	3 pieces	As a tool for taking feed raw materials
9	Mortar and Pestle	1 piece	As an aid in refining artificial feed (physical test)
10	Plastic plate	1 piece	Assisting in the Weighing Process
11	Porcelain Cup	3 pieces	Helps in the process of weighing oily or watery materials
12	Used Bottles	4 pieces	Assist in the process of carrying out physical tests
13	Stopwatch	1 piece	Assist in the process of carrying out physical tests

Table 2 – Materials Required in Research

No	Material	Utility
1	Maggot Flour	Feed Compound Ingredients
2	Fish flour	Feed Compound Ingredients
3	Tapioca flour	Feed Compound Ingredients
4	Soybean Flour	Feed Compound Ingredients
5	Bran Flour	Feed Compound Ingredients
6	Fish oil	Feed Compound Ingredients
7	Vita Chicks	Feed Compound Ingredients
8	Astaxanthin	Feed Compound Ingredients
9	Vegetable oil	Feed Compound Ingredients

Table 3 – Artificial Feed Formulation

Type of Raw Material	Composition of Feed Ingredients			
	A	B	C	D
Fish flour (%)	52	52	52	52
Maggot Flour (%)	28	28	28	28
Soybean Flour (%)	15	15	15	15
Bran Flour (%)	2	2	2	2
Tapioca flour (%)	1	1	1	1
Corn oil (%)	0.5	0.5	0.5	0.5
Fish oil (%)	0.5	0.5	0.5	0.5
Vitamin Mineral Mix	1	1	1	1
Astaxanthin (mg/kg)	0	50	100	150
Amount	100	100	100	100
Treatment	(0mg/kg)	(50 mg/kg)	(100 mg/kg)	(150 mg/kg)

The drying technique for vegetable and animal ingredients is carried out by ovening at a temperature of 50ºC with a time interval of 5-10 hours or placing it under the hot sun at a temperature of 36ºC accompanied by a drying time of 8-16 hours so that the feed ingredients are completely dry. The technique for refining vegetable and animal ingredients is carried out using a grinder at 2 minute intervals, followed by filtering using a sieve, don't forget to also swing it so that the fine flour falls into the place/container (small basin) while anything that doesn't pass through the filter or is still coarse is fine. Preparation of feed raw materials begins with ingredients that have been recorded and then collected, such as maggot flour, golden snail flour, fish meal, tapioca flour, soybean flour, taro leaf flour, bran flour, fish oil, vitamin + mineral mix, astaxanthin. These ingredients contain protein, carbohydrates, fats which come from vegetable and animal feed raw materials.

Mixing feed raw materials is done by mixing the ingredients according to calculated measurements using applications, Microsoft, or manually. Followed by combining the ingredients and mixing them evenly, if it is evenly distributed, the sign is that the feed can be

milled, which means that if you take the feed ingredients, then clench them using your hands, then squeeze them until they break and don't scatter (separately), then it is said to be smooth, that is, you can processed using a meat grinder with feed size records made according to the mouth size of the fish seeds. When the feed is made, it is continued in the drying step using sunlight or an oven at a temperature of 36-38 ^{o} C for a period of 16-21 hours.

The design applied in this research was a Completely Randomized Design (CRD) in 4 treatments and 3 replications. The treatment used was the addition of different astaxanthin to the high fat in the feed made in the research, namely, placing the aquarium with 4 treatments and 3 replications was not done on one's own accord but based on the results of a complete random design that had been created in *Microsoft Excel* to determine the placement of the aquarium in research conducted.

The physical form of fish food is greatly influenced by the type of material used, printer size, amount of water, pressure, post-processing method, and the use of adhesives to produce fish food with a strong, compact and sturdy structure so that it does not break easily (Mulia *et al.,* 2017). Therefore, a rupture speed test was carried out on the feed made.

The sinking speed test is carried out by measuring the length of time it takes for the feed to move from the surface of the water to the bottom of the rearing medium and the stability of the feed in water is the level of resistance of the feed in the water or how long it takes for the feed to become soft and disintegrate (Aslamyah *et al*., 2012).

To test the homogeneity quality of the feed that is made in a complex structure, approximately 5 grams of feed is taken, then ground finely, then filtered to a diameter of 0.5 mm, after which the percentage of 0.5 mm or finer is calculated. According to (Afrianto *et al*., 2005) good pellets have a compact texture and the raw material particle size is fine and uniform.

The attractiveness test of something is tested by finding out how much the fish like the food made by calculating how fast the fish eat the food made using a stopwatch. The stopwatch is activated when the feed touches the water in the rearing medium under study. Based on (Murdina, 2007) *in* (Harianto *et al*., 2016) good feed is feed that has a distinctive odor, brown color, soft feed texture and no mold in the feed.

Analysis of data from research results starting from survival, absolute length growth, relative length growth, absolute weight growth, relative weight growth, feed conversion ratio, feed efficiency. Followed by normality test, diversity test, ANOVA and continued with *Duncan's Multiple Range Test.* Research supporting data obtained from each treatment includes temperature, DO, pH, ammonia and fish hematology.

RESULTS AND DISCUSSION

The feed that is made is subjected to physical tests to determine the level of components of the raw feed ingredients in the manufacture and determine the stability of the artificial feed, as well as the interest of fish in eating the feed made. The physical test of the feed will be carried out in stages, starting from sinking speed, feed homogeneity and attractiveness.

a b c

Image 1 – Feed Physical Test: a) Sinking Speed, b) Homogeneity, c) Allure

The results of the physical feed test for 45 days can be seen in Table 4.

Table 4 – Physical test results of artificial feed

No	Test Parameters	Treatment Code			
		A	B	C	D
1	Sinking Speed (cm/sec)	8,322	7,124	8,11	4,806
2	Homogeneity (g)	4.74	4.49	4.24	4.66
3	Allure Power (minutes)	2.09	1.50	1.73	1.88

In Table 4 it can be seen from the data that the sinking speed test parameter is around 4.806 cm/sec in treatment D and the longest is 8.322 cm/sec in treatment A. Meanwhile, in the homogeneity test it is in a too wide range, namely between 4.24 g - 4.74 g. g, while the attractiveness parameter ranges from 1.88 minutes – 2.09 minutes.

The sinking speed test is carried out to determine the sinking speed of the feed being made. The food sinking speed test was carried out by dropping the food into a medium plastic bottle filled with water to a height of 20 cm, after that calculating the time taken for the dropped food, observing from the surface of the water to the bottom of the water using *a stopwatch* with 5 repetitions then taking the average The average is in treatment A 8.322 cm/sec, treatment B 7.124 cm/sec, treatment C 8.11 cm/sec, treatment D 4.806 cm/sec. The results of observing the attractiveness showed that the gurami fish in the aquarium were very interested in eating the food provided. Because the food that is dropped looks actively moving, there is movement of the fish that approaches the food and then eats it by sucking it, and then the fishability of the food has a time, namely treatment A 2.09 minutes, treatment B 1.50 minutes, treatment C 1.73 minutes, treatment D 1.88 minutes. The way fish eat food by sucking is a typical way for gurami fish because the size of the food made is smaller than the opening of the gurami fish's mouth. The attractiveness test is obtained by calculating how long it takes the test fish to approach or consume (initial) food (Aslamyah, 2012).

Homogeneity test to determine whether the feed being made, to determine the level of raw materials for the artificial feed has been mixed evenly or uniformly. The homogeneity test is carried out by preparing tools such as a mortar, sieve pestle, plastic basin and scales. Meanwhile, the materials provided are artificial feed that is ready-made and ready to be given to fish. After that, it is crushed using a mortar and pestle, then when it looks fine, sieving continues to separate the coarse part from the fine part, where the fine part passes through the sieve hole with a diameter of 0.05 mm, while the coarse part does not pass through the sieve hole with a diameter of 0.05 mm. Weighing was carried out on the fine portion of the feed using analytical scales to determine how much weight passed through the sieve holes with a diameter of 0.05 mm, so the results obtained for treatment A were 4.74 g, treatment B 4.49 g, treatment C 4.24 g, and treatment D 4.66 g. The level of feed homogeneity aims to determine the similar level of particle size of the ingredients that make up the feed (Mulia, 2017). Physical properties that need to be considered in feed ingredients include specific gravity, pile density, pile compaction density and pile angle, because these properties are closely related to the handling and processing of feed ingredients (Yatno, 2011).

CONCLUSION

Based on physical tests in the sinking speed test, it is said to be quite good, showing that there is a time when it does not fall to the bottom too quickly, there is a pause for the fish to eat the food, the level of homogeneity of each treatment in the category is quite homogeneous, the sinking speed is considered good because the response speed of the fish in eating the food made is very fast.

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