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THE EFFECT OF MUSTARD GREENS POWDER AND PELLETS ON THE GROWTH OF COMMON CARP (*Cyprinus carpio*) Fry

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ABSTRACT

Common carp is a fish consumption that is relatively easy to cultivate since it tends to be adaptive (easy to adapt to its environment and resistant to various types of diseases). One of the protein requirements for the growth of fish seeds can be obtained from mustard greens. Furthermore, the abundant availability of mustard greens in Kajoran Village can be an alternative feed if developed as carp feed. The purpose of this study is to determine the effect of mustard greens powder on the growth of common carp (*Cyprinus carpio*); besides, to determine the best concentration of mustard greens powder on the growth of common carp. This study was conducted in January-February 2022. The research method used an experimental method with treatment P1 (control), P2 (mustard green powder 25%), P3 (50%), P4 (75%), and P5 (100%). The results of giving the concentration of mustard green powder for the growth of common carp show a significant difference and it can increase the growth of carp. Furthermore, the best treatment is achieved in the P3 treatment (50% mustard green powder) with an average weight gain of 1.120 g. From the results of this study, it is expected that the people of Kajoran Village can use mustard greens well for carp cultivation with a concentration of 50% pellets and 50% mustard green powder. In addition, further research is needed on the manufacture of pellets from mustard green powder to make it easier for farmers to feed.

Keywords: Common carp, Mustard green powder, Growth.

1. INTRODUCTION

Freshwaters have great potential in meeting the consumption needs of the community, especially in fish farming activities. The contribution of fish protein to the consumption of animal protein in Indonesia reaches 57%. Common carp is a type of freshwater consumption fish that is popular with the public, so it has good prospects when it is cultivated. KKP data shows carp production in 2020 reached 535,932.92 tonnes. The common carp production centers include West Java Province with 50,014.03 and East Java Province with 34,427.12.

Common carp is a consumption fish that is relatively easy to cultivate because it tends to be adaptive (easy to adapt to its environment and resistant to various types of diseases). Common carp are freshwater fish that live in shallow, calm waters. The ideal aquatic environment for common carp is between 150 and 600 m above sea level and temperatures between 25-30^{0}C.

Fish growth is influenced by two factors, namely external factors and internal factors. One of the internal factors is genetics which has occurred since the fish was in the womb, while one of the external factors is in terms of feed. The nutrients needed by common carp must be balanced with the levels of protein, fat, carbohydrates, vitamins, and other micro-nutrients that must be present in the feed. Feed is a major requirement for fish as a source of energy to support survival rate

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and growth. The minimum protein requirement for carp fry is 30%[1].

One of the protein requirements for the growth of fish seeds can be obtained from mustard greens. The abundant availability of mustard greens in Kajoran Village can make alternative feed when developed as carp feed because it contains a protein source of 2.3% and 0.3% fat which can support the growth of carp[2]. In addition, mustard greens contain vitamins C and K which are good for blood clotting and immunity, so if a fish is injured due to friction with other fish it can speed up the drying of the wound and the fish does not get sick easily. In addition, the very high calcium content in green mustard flour is very beneficial for the formation and maintenance of bone quality, so it can inhibit factors that cause brittle bones. Dietary fiber in green mustard flour can also facilitate the digestive process[3]. Because green mustard is a vegetable that spoils easily, an alternative is to dry it and make it into flour so that it has a longer shelf life.

Based on the description above, the authors are interested in researching the effect of giving a combination of mustard greens flour and pellets on the growth of common carp fry.

2. RESEARCH METHOD

Time and Place

This research was conducted for 21 days from January 21 to February 10 2022 at Pahlawan Street 24, Magelang Tengah, and at the Diponegoro University Integrated Laboratory. In measuring the proximate of mustard flour.

Method

This study used a Completely Randomized Design (CRD) which is the simplest design when compared to other designs. This design conducted several trials of all treatments and the number of replications, which consisted of 5 treatments. The feed dose used is 5% of the carp's weight. Common carp fry was fed with floating pellets as much as 5% of their body weight[4]. For each bucket filled with 5 carp seeds aged 30 days with a size of 2-3 cm. The frequency of feeding is done twice a day, namely in the morning and evening. Feeding is done by spreading it at one point to make it easier to feed the fish at the same time[5]. The following is the treatment carried out:

P1 : Feeding pellets (100% pellets)
P2 : Feeding green mustard flour 25% and 75% pellets
P3 : Feeding green mustard flour 50% and 50% pellets
P4 : Feeding green mustard flour 75% and 25% pellets
P5 : Feeding green mustard flour (100% flour)

Data Analysis

To determine the effect of feed treatment by giving mustard green concentrations to goldfish, it was statistically analyzed using one-way Analysis of Variance (ANOVA) analysis of variance with error levels $\alpha = 0.05$ and 0.01. If in the calculation of the analysis of variance the results are significantly different ($P<0.05$) or very significantly different ($P<0.01$), then the Duncan's Multiple Range Test (DMRT) is carried out between treatments to find out the mean value between the effects of the treatment with the software SPSS[6].

3. RESULT AND DISCUSSION

Absolute Weight Growth

Based on the results of research on the measurement of carp on the effect of the growth of mustard green flour, the weight growth of carp was obtained, with the percentage of carp weight growth as follows (Figure 1).

Based on the results of the above study it was found that the feeding of mustard greens affected the weight growth of carp seeds. The absolute growth of carp can be seen in the picture above. The greatest absolute weight growth was

achieved in treatment P3 (50% mustard green flour) with an average weight gain of 1.120 g, followed by treatment P4 (75% mustard green flour) of 0.857 g, then P2 treatment (25% mustard green flour)) of 0.847 g, treatment P1 (control) of 0.657 g, whereas in treatment P5 (100% mustard flour), the absolute weight growth was 0.630 g.

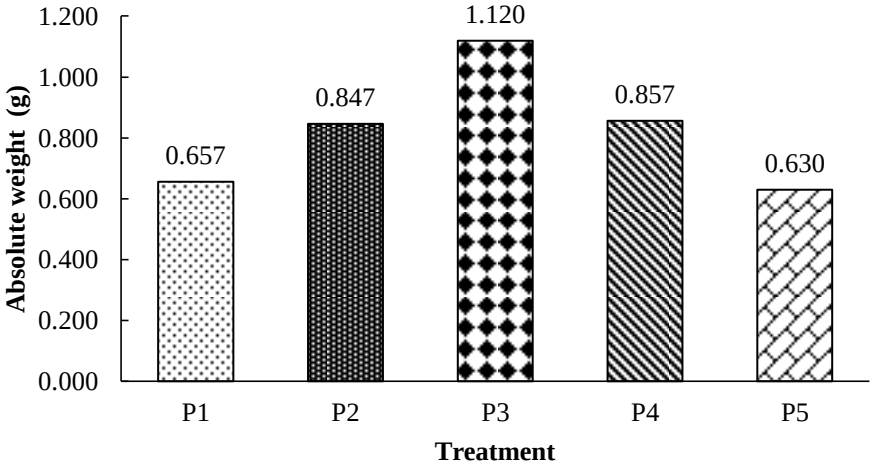

Figure 1. Absolute weight measurement results for common

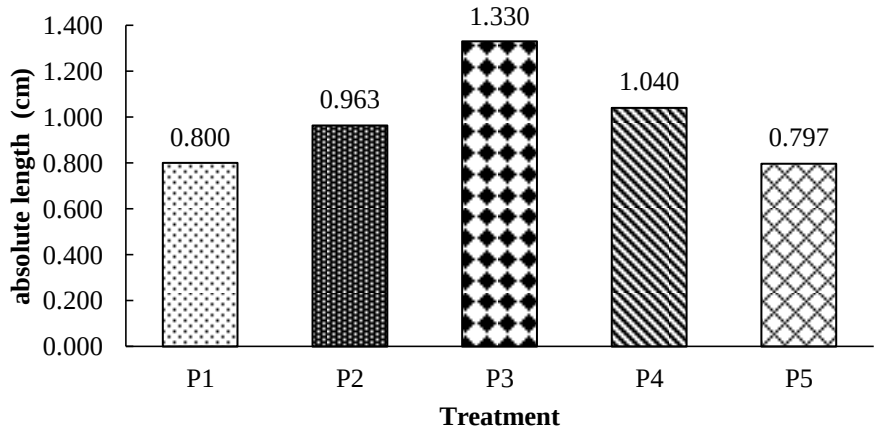

Figure 2. Absolute length measuring results of common carp

Based on the results of the study, it was found that feeding mustard greens could increase the growth in length of goldfish. The greatest absolute length growth was achieved in P3 (50% mustard green flour) with an average absolute length increase of 1.330 cm followed by treatment P2 (25% mustard green flour)1.040 cm, treatment P4 (75% mustard green flour) by 0.963 cm, at P5 (100% mustard greens flour), namely 0.800 cm and treatment P1 (control) by 0.790 cm (Figure 2).

From the absolute weight and length measurements that have been carried out, there is a difference in each concentration of mustard green flour and the pellets given to have a significant effect. Where P3 (50% concentration of mustard greens) with an average weight of 1.12 g is suitable for the growth of carp compared to other feeding treatments because the protein content in the pellet is 50% with a protein content of 30% and 50% mustard greens flour with a protein content of 38 % if an average of 34% can meet the growth of carp, this is in line with the statement of Takeuchi[7], explaining that the protein requirement in carp feed is 30-35%. Meanwhile, goldfish fry requires feed with a protein content of around 30-36%. Optimal protein requirements are influenced by the use of protein for energy, amino acid composition,

feed digestibility, and energy-protein balance. High-quality protein is a protein that has a high digestibility value and can provide all the essential amino acids[8].

The results of measuring the nutritional content of mustard green flour are shown in Table 1.

Table 1. The nutritional content of green mustard flour

Nutrient content	Unit	Amount
Proteins	%	38.05
Fat	%	1,978
ca	(mg)	4338,67

Treatment P4 (75% mustard green flour) has a protein content of 36%. In P2 (25% mustard green flour and 75% pellets) it has a protein content of 32% and P1 (Pellet) has a protein content of 30% which is the lowest protein content among other treatments. The low absolute growth in P1 is because the fish only depend on the nutrients in the pellets. Meanwhile, in their natural habitat, carp eat food from nature which is more adequate in protein, and P5 (100% mustard greens flour) has a protein content of 38% (Table 1) higher than the optimum amount carp needs.

Meanwhile, the protein requirement for carp is between 30-35%. If the protein in the feed is too high, only some will be absorbed and some will be used to form or repair cells the damaged one. Protein that is too high will produce excess energy to oxidize amino acids so that ammonia increases. This is also following the statement of Adelina[9], who explained that the more protein is catabolized, the more energy to oxidize amino acids will increase which will ultimately increase the ammonia produced. Excess ammonia can be toxic to fish because it can irritate the gills, inhibit growth rates, and can even result in death.

In addition to protein, fat also plays an important role in weight growth, this is because fat is a source of energy that must be available in feed hampered. According to Takeuchi[7], the most optimum fat for the growth of carp is 5-15%. At P3 (2.5% fat), although it did not meet the needs of fat in carp, it showed the best growth in the study. Allegedly because the utilization of fat for energy is sufficient protein is used for maximum growth. Then P4 (2.25% fat) and P2 (2.75% fat) showed growth which was still in the good category, presumably because protein greater than 3% could still be used for carp seed activity, and P1 (3% fat) balanced with 30% protein showed good carp growth results compared to P5. At P5 (2% fat), it is hoped that most of the energy for all fish fry activities will come from non-protein nutrient materials, in this case, carbohydrates and fats. Due to the low energy contribution of fat, then protein will be used as an energy source for these various activities so that P5 growth is lower. This is in line with Simamora et al.[10] complete and balanced protein and amino acid composition has a better quality for growth in koi goldfish (*C.carpio* koi).

Fat is one of the macro-nutrients with the largest energy content compared to protein and carbohydrates. Fat has a main function that is different from other energy sources, namely fat is a preferred energy reserve compared to carbohydrates. Fat in feed acts as a source of energy and is also important as a source of essential fat for the process of growth and defense of the body. Feed fat has various important roles in fish nutrition including as a source of energy, phosphor fat, and steroid components as vital organs, as well as when fish maintain balance in water (buoyancy). In addition, the fat in the feed also provides essential fatty acids (EPA) needed for growth and normal development and helps the absorption of various types of fat-soluble vitamins. Freshwater fish require linoleic or linolenic fatty acids. In carp, the required requirement is 1.0% linoleic acid and 1% linolenic acid.

The main role of carbohydrates in animal nutrition is as a source of energy[7]. According to Furuichi *in* Adelina[9] carbohydrates are the cheapest and most easily available energy source for fish feed compositions and also act as a protein-

sparing effect. A good quality source of carbohydrates is very important because it will function as non-protein energy so that less protein is used as an energy source but more is used for growth.

Daily Growth Rate

The daily growth rate of carp weight and length is also presented in Figure 3 and Figure 4.

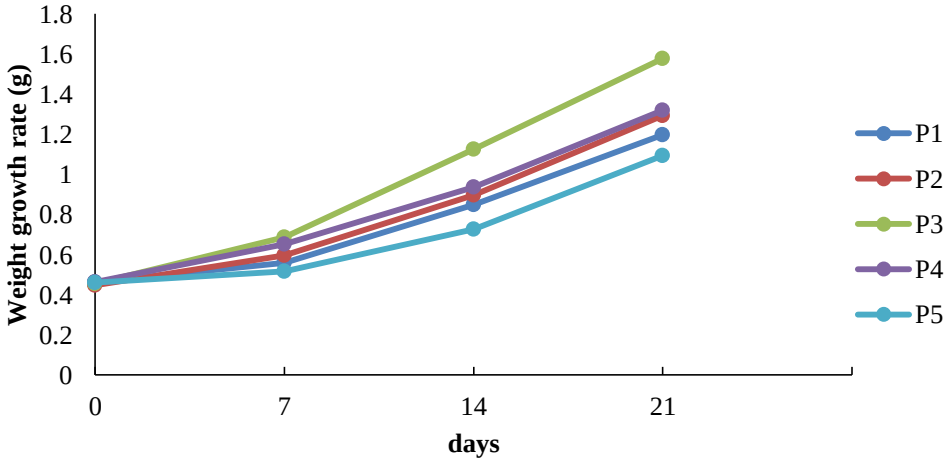

Figure 3. Weight growth rate

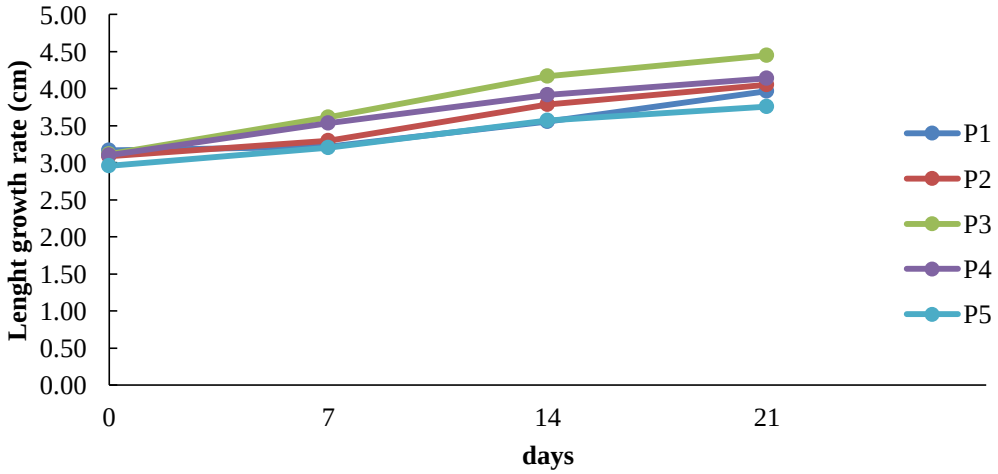

Figure 4. Length growth rate

In Figures 3 and 4, it can be seen that the weekly growth rate of carp in all treatments showed a different increase every 7 days. The weight gain of each treatment increased along with the increasing maintenance time for each carp treatment. Weight growth for 3 weeks between 1.09-1.58g. This is in line with Sabrina et al.[4] which stated that the absolute weight growth data for carp obtained for 30 days ranged from 1.28 to 1.78 g. Food plays an important role in the growth of carp fry. Good food is food that contains the elements needed by golden seeds. Good food contains 30-35% protein according to the needs of the carp. Mustard flour also has a protein content of 38% (Table 1). Growth in carp in the optimal study was due to the fulfillment of nutrients from green mustard flour combined with pellets and timely feeding so that it could increase growth properly. An equal amount of nutrients in the feed is not only able to provide energy for the metabolic activities of the tilapia body but also able to meet the needs of tilapia to grow.

In addition, a supportive cultivation environment such as good water quality can

also affect the growth of carp seeds. At the time of the study, the change of culture water every week and the presence of filters and aerators could control the clarity and dissolved oxygen in the water so that the fish were not easily stressed. Healthy fish can digest the food given according to their needs. Whereas if the fish is stressed because of the environment, the fish will lose their appetite so that growth can be stunted. This is in line with the statement of Hidayat[11] that when fish are stressed or shocked, it will inhibit the rate of the growth process because the fish's appetite decreases.

Fish growth is influenced by several factors including feed, cultivation containers, temperature, salinity, season, and physical activity. Feeding according to the needs of the fish will give a slightly higher growth. The added feed must be rich in protein, carbohydrates, and fat, and must also contain vitamins and minerals to ensure the growth of the fish being cultivated. Malnutrition in fish will reduce growth performance and can cause illness or even death. So it is very important to develop suitable feed in fish farming as a counterweight to the stocking density of cultivated fish. The high survival rate is due to the environment in which fish-rearing media supports the survival of fish.

Survival Rate

The average survival of carp for 3 weeks is presented in Figure 5.

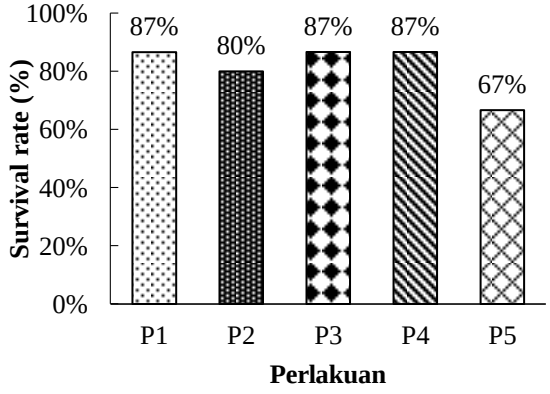

Figure 5. The survival rate of common carp

Based on the results of this study it was found that the survival of carp can be seen in Figure 5. The results of observations of the highest carp survival were at P1, P3, and P4 with an 87% survival rate, then P2 with an 80% survival rate. Survival was lowest at P5 with a 67% survival rate. Thus, it shows that the fish survival rate is classified as good because it is not less than 50%. States that a survival rate of > 50% is considered good, a survival rate of 30-50% is moderate, and less than 30% is not good.

The survival rate of carp is not directly affected by the feed. Dead fish can be due to stress during maintenance. During the study, fish that were given different treatments did not show any stress so they were able to survive. This is also supported by the water quality conditions of the rearing medium where the water quality conditions during maintenance tend to be good with temperatures between 28.3-29.0ºC and pH 7.30-8.33. According to Fitria[12], the survival rate is strongly influenced by water quality, especially temperature. Temperature is one of the factors that affect growth. Fish activities, such as respiration and reproduction can be affected by temperature. Survival can be influenced by biotic and abiotic factors. Biotic factors consist of age and the ability of fish to meet feed needs. Abiotic factors include the availability of food and the quality of living media.

Water quality that is still within optimal limits will provide good survival for carp. The survival of carp is directly affected by water quality. Good water quality will affect the survival rate of fish and fish growth.

Water Quality

Water is a living medium for aquatic organisms, so it is an important factor that must be considered in aquaculture. This aims to provide a carrying capacity for organisms to survive in the cultivation environment. Good quality (according to cultivation standards) will support optimal

growth. Conversely, poor water quality can reduce fish appetite which results in stunted growth. Degradation of water quality will cause stress to fish and can even cause death and reduce the survival rate which in turn can reduce the biomass of fish reared. Conversely, if the water quality is good, the growth of fish will be fast and the survival rate is high so that the biomass will increase. Water quality parameters carried out in this study included temperature and pH.

Temperature is one of the environmental factors that influence cultivation activities. Fish are cold-blooded (poikilothermal) animals so their metabolism in the body depends on the temperature of their environment, including their body's immunity. The optimal temperature will make the fish an optimal metabolism which has a good impact on the growth and weight gain of the fish. Low temperatures will cause the fish's metabolic rate to slow down and cause the fish's appetite to decrease and eventually, the fish will experience slow growth[13].

Based on the research results, it is known that the water temperature during the study ranged from 28.3-29.0ºC. This temperature is to the condition of carp. This is in line with the research of Effendi et al.[14] stated that a temperature of 25 ± 32ºC is suitable for fish growth.

During the study, there were no significant temperature differences that could cause stress to the fish. According to research by Ridwantara et al[15] goldfish at 28°C show the best weight gain because their metabolism and digestion are optimal. Very drastic temperature changes will cause stress to the fish. Hermanto *in* Handayani et al.[16] states that temperature changes that are too high will affect the physiological and chemical processes in the fish's body. These changes will affect the intake of feed, maintenance requirements, metabolic rate, enzymatic processes, and the speed of protein synthesis. The relationship between temperature and growth is the interaction of feed consumption and metabolism. Meanwhile, carp at 20 °C was the fish with the lowest weight gain, Low temperature causes a slow metabolic rate, not the optimal activity of enzymes and growth hormone. Low temperatures cause the enzymes to not be optimal or even not work at all and the growth hormone is not secreted optimally. The temperature will affect enzyme activity where an increase in temperature will cause a decrease in enzyme pH and at low pH digestive enzymes will more easily destroy coarse matter derived from the feed consumed.

The range of pH values during the study for all treatments ranged from 7.30 to 8.33. The pH value in this study was good for carp farming. A pH level that is classified as neutral indicates that the water has not been polluted by substances that are acidic or alkaline.

4. CONCLUSION

From the results of the study, it can be concluded that: a) the results of giving the concentration of mustard green flour for the growth of carp showed that there was a significant difference in the growth of carp. The best treatment was achieved in treatment P3 (50% mustard green flour) with an average weight gain of 1.120 g.

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