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Change of Color and Growth of Koi Fish *(Cyprinus rubrofuscus)* with Addition of Seaweed Extract *(Kappaphycus alvarezii)* on Feeds

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ABSTRACT

Seaweed is a marine plant belonging to the benthic macroalgae which lives a lot attached to the bottom of the waters. Seaweed has three main types of pigments, namely chlorophyll, carotenoids, and phycobiliproteins. The content of carotenoids is one of the most important groups of natural pigments which functions to pigment skin color (scales). Carotenoids also affect fish growth, with the availability of carotenoids in the fish's body, raw materials are available to be synthesized into important compounds needed by fish. This study aimed to analyze the effect of adding seaweed extract to feed on the brightness and growth of koi fish. This study is an experimental study using a completely randomized experimental design (CRD) consisting of 4 treatments with 3 repetitions. The treatments consisted of treatment K (100% commercial feed), A (7% seaweed extract, 93% commercial feed), B (5% seaweed extract, 95% commercial feed), C (3% seaweed extract, 97% commercial feed). Each treatment was observed on color brightness and growth (absolute weight, SGR), feed utilization (FCR and EPP), water quality, temperature, pH, and ammonia. The data was processed using SPSS version 24 program with Tukey HSD analysis. The results of this study showed that the administration of seaweed extract with different concentrations affected the color brightness and growth of koi fish (*Cyprinus rubrofuscus*). Where treatment A was the best treatment for color brightness 13.87, and treatment C was the best treatment for growth with absolute weight growth of 2.5 grams, SR 90%, FCR 1.7%, EPP 58%.

INTRODUCTION

Koi fish is a species of ornamental fish that people are interested in because of the beauty of its color and body shape. Good quality koi fish can be seen in terms of the color of the pattern and the shape that is balanced between height width and length. Feeding with pigment content can be one of the efforts in maintaining and improving the quality of color in koi fish. Adding color pigment sources to the feed can encourage an increase in color pigments in the fish body, or at least be able to maintain the color pigments of the body during the maintenance period (Wayan et al. 2010).

Growth is one of the determining factors in the success of fish farming. Good growth is influenced by good quality feed that contains good nutrients for fish. According to Ekawati (2008), caratenoids also affect fish growth, with the availability of rubberonoids in the fish body, raw materials are available to be synthesized

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into important compounds in supporting various larval life activities including for growth and development.

According to D'Alessandro & Antoniosi, (2016) seaweed contains three main types of pigments, including ficobiliproteins, caratenoids and chlorophyll. In addition, seaweed also mangadung carbohydrates fats and proteins and is rich in macro minerals and vitamins. (Endraswari et al, 2021).

MATERIALS AND METHODS

Time and Place

The research was conducted in January 2022 - February 2022 at the UPTD Fish Seed Center (BBI) Parangtambung, Tamalate District, Makassar City, South Sulawesi.

Tools and Materials

Tools: Glass aquarium, aerator, DO meter, digital scale, pH meter, thermometer, bucket, *toca color finder* (TCF), erlemeyer, *rotary evaporator*, filter paper, blender, fine sieve, dry tissue, camera. Materials: clean water, koi fish, artificial feed, ethanol, seaweed extracts

Research Procedure

Maintenance Container Preparation

The preparation is to prepare an aquarium with the size of 36 cm long, 22 cm wide, and 40 cm high, then the aquarium is cleaned, rinsed with clean water and dried for 24 hours which serves to sterilize the container. After drying the aquarium is given water and equipped with an aeration installation as much as one aeration/aquarium. Aquarium that has been clean and dried arranged according to the location of the experiment and labeled with 4 treatments with each of the 3 replicates with code A1, A2, and A3, code B1, B2, and B3, code C1, C2, and C3, code D1, D2 and D3. The type of seaweed used is *Kappaphycus alvarezii*.

Test Animal Preparation

The type of fish used is koi fish (*Cyprinus rubrofuscus*) taken from koi fish farmers in Gowa. Then given 10 fish each in each aquarium containing 10 liters of water/aquarium with fish size 8 cm and fish weight 2.2 grams.

Seaweed Extract

The process of making seaweed extract, the first step is first washed and drained seaweed, then cut into small pieces and weighed as much as 500 grams then added ethanol solvent, maceration for 2x24 hours. The results of maceration then filtered with Whatman filter paper no. 42 so that the resulting filtrate and residue. The filtrate was evaporated with a vacuum rotary evaporator at 40^{o} C until a thick extract was obtained. (Alindra et al. 2018).

Feed Manufacturing

The obtained seaweed extract was added to the commercial feed. First the pellets were crushed by grinding, then the seaweed extract was added according to the treatment in the feed.

Acclimatization

The fish used are acclimated first for 2 hours into a container that has been given aeration, so that the fish can adapt to its new environment (Agus 2002).

Maintenance of Test Animals

Maintenance of test animals was carried out for 28 days, feed was given 2 times a day at 08:00 and 17:00.

Synonyms

Syphoning is done to remove dirt or residual feed that settles at the bottom of the aquarium, syphoning time is done in the morning and the amount of water that is reduced during syphoning is one liter.

Parameter Observation

Observations of water quality parameters measured were ammonia, temperature and pH. Temperature, and pH parameters were measured twice a day while ammonia was measured 3 times during the study, namely on the first day of the study, midway through the study period and the end of the study period. Observations of color brightness and fish growth parameters were made every 7 days during the study.

Fish Weight Growth Measurement

The weight growth of koi fish was observed once a week, by weighing the koi fish using a digital scale. Koi fish fry were taken from each aquarium then put into containers and then weighed.

Trial Design

This research is experimental with a completely randomized design.

- Treatment K used 100% commercial feed without seaweed extract,

- Treatment A 93% commercial feed plus 7% seaweed extract,
- treatment B 95% commercial feed plus 5% seaweed extract,
- treatment C 97% commercial feed plus 3% seaweed extract.

Data Collection Methods

The observation method with verbal testing is carried out *in* two ways, namely in the field (*in situ)* and testing in the laboratory (*ex situ*).

RESULTS AND DISCUSSION

Discoloration of koi fish

The observation of color change shows an increase in each treatment with the addition of seaweed extract. The observation results of koi fish color increase can be seen in Figure 1.

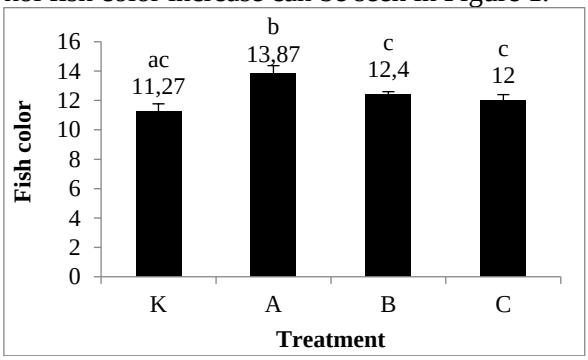

Figure 1: Graph of Fish Color Increase

From the observation of the highest color change is in treatment A (93% commercial feed and 7% seaweed extract) which is 13.87, while the lowest color change is in treatment K (control) which is 11.27%. The research can be obtained that there is an effect of changes in the color of koi fish (*Cyprinus rubrofuscus*) in each administration of seaweed extract. This occurs due to the source of pigments consumed by koi fish. According to Nasir et al. (2015) sources of seaweed pigments include ficobilin, carotenoids and chlorophyll.

During the study, the addition of seaweed extract to the feed increased the color of koi fish. The average results showed that the largest color increase was obtained in treatment A (93% commercial feed and 7% seaweed extract) with an average of 13.87%. This is because the provision of 7% seaweed extract contains high pigments compared to other treatments. According to Moalana et al (2017), by giving a high dose of feed it can produce an increase in the brightness of the color of koi fish.

Furthermore, the low increase in color in treatment K (control) because it does not use additional seaweed extract in the feed so that the color increase runs normally as the age of the fish increases. This is in accordance with Maulid (2011), the need for additional sources of pigments because ornamental fish are unable to synthesize carotenoids in their bodies. Kalidupa et al. (2018) dosing according to the needs of beta-carotene in the body in order to increase the color of koi fish.

Absolute weight growth

Observation of absolute weight growth in koi fish with the addition of seaweed extract. The results of observations of absolute weight growth in koi fish during the study can be seen in Figure 2.

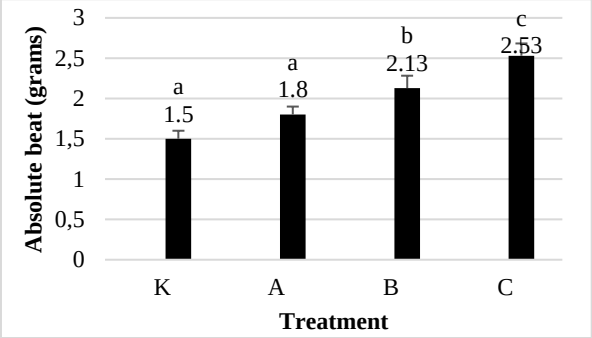

Figure 2: Fish Weight Gain Chart

Based on the results of the study on the addition of seaweed extract, the highest growth was obtained in treatment C with a value of 2.5, treatment B with 2.1, treatment A with 1.8, and the lowest value was obtained in treatment K with 1.5. That these results show the addition of seaweed extract gives a real influence on the growth of absolute weight.

Reduction in fish weight occurs as the concentration of seaweed extract given increases, this is because the feed consumed at the appropriate dose makes optimal feed so that the weight of the fish increases. Feeding with the appropriate dose helps fish in the growth process. (Islamiyah et al., 2018).

Survival Rate (%)

Observation of *survival rate (SR)* in koi fish with the addition of seaweed extract. The results of SR observations during the study can be seen in Figure 3.

In this study, the addition of seaweed extract obtained the highest SR value with a value in treatment C 90%, treatment B 77%, treatment A 67% and the lowest in treatment K

50%. This shows the extract of seaweed extract gives a real influence on the value of SR. This is in accordance with the research of Irmadiati et al. (2021) that the addition of seaweed as much as 4% resulted in an SR value of 90%.
The best SR value in treatment C is thought to occur because the addition of seaweed extract has an appropriate dose. This is in accordance with the opinion of Hanief et al. 2014, stating that one of the factors affecting survival rate is the environment in the maintenance process. Strengthened Vardian et al. (2013) *internal* and *external* factors can affect survival in fish.

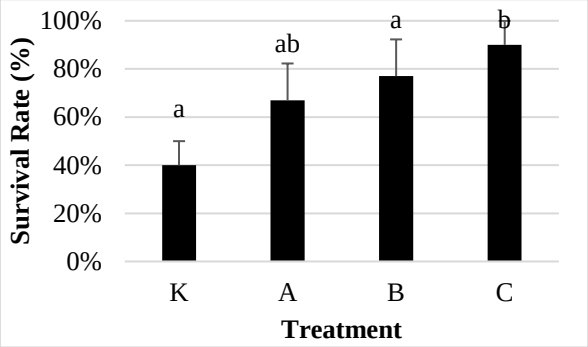

Figure 3: SR Average Value

Specific Growth Rate (SGR) Total

The results of daily growth rate observations on koi fish with the addition of seaweed extract. The results of the total growth rate (SGR) observation during the study can be seen in Figure 4.

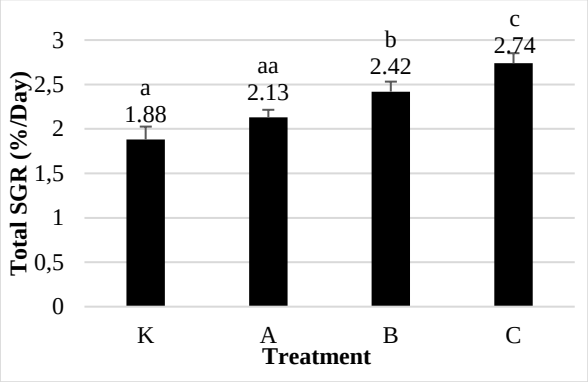

Figure 4: Total Growth Rate Graph

The best SGR value in the addition of seaweed extract was obtained in treatment C 2.74%, followed by treatment B 2.42%, treatment A 2.13% and treatment K 1.88%. This shows the addition of seaweed extract gives a real influence on the value of SGR. This is in accordance with research conducted by Irmadiati et al. (2021) with the addition of 4% seaweed produced an SGR value of 2.62%.

The less the addition of seaweed extract produces a better SGR value, this is thought to be because the specific growth rate in fish is influenced by the feed consumed.

According to Yanti et al. (2013) The amount of feeding and the type of enzyme can affect fish digestibility. Aditya et al., (2012) When fish can make good use of feed that suits their needs, it can increase the growth rate.

Feed Conversion Ratio (FCR)

The results of observations of feed conversion *ratio* (FCR) on koi fish with the addition of seaweed extract. The average observation results of the ratio during the study can be seen in Figure 5.

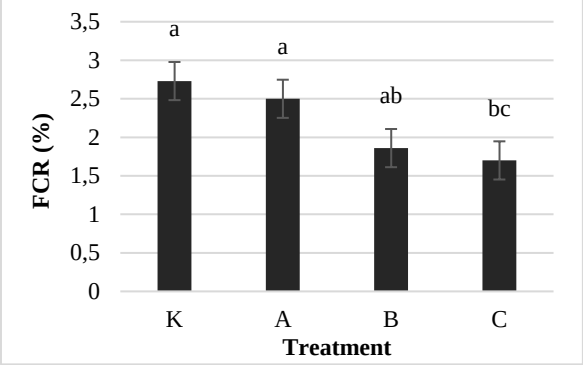

Figure 5: Average Feed Conversion Ratio Results

The highest FCR value in the addition of seaweed extract was obtained in treatment K which was 2.73 and the lowest in treatment C which was 1.7. This shows that the addition of seaweed extract gives a real influence on the FCR value. In research conducted by Irmadiati et al. (2021) with the addition of seaweed as much as 4% resulted in an FCR value of 1.47. According to Iskandar (2015) the level of feed efficiency is good if it produces a small feed conversion value, so if the feed conversion value is large, the efficiency of feed utilization is not good.

The highest FCR value in treatment K is thought to be due to fish experiencing stress during the rearing period which makes fish lose their appetite, in the research of Dani et al. (2005) If the FCR value is high it is an indicator that indicates that the lack of feed utilization in fish.

In treatment C get a better FCR value it is different in treatment K because of the low level of feed consumption in treatment K. Lestari et al. (2013) Feed quality factors and balanced

composition can affect the FCR value. Strengthened by the opinion of Sulawesty et al. (2014) and Iskandar, (2015) The small value of feed conversion ratio indicates efficiency in the utilization of feed given, on the contrary, the large value of feed conversion ratio indicates inefficiency in the utilization of feed given.

Efficiency of Feed Utilization (EPP)

The observation of feed utilization efficiency in koi fish with the addition of seaweed extract can be seen in Figure 6.

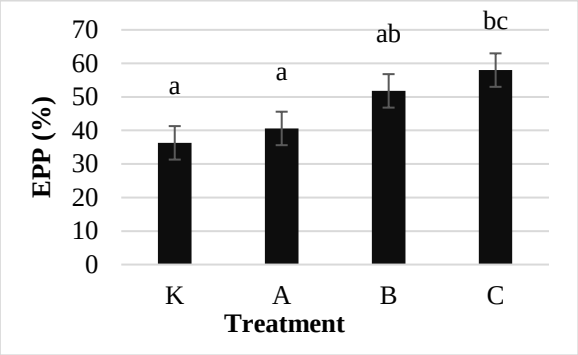

Figure 6: EPP Average Value

In the study, the addition of seaweed extract produced the best value of 58% then treatment B = 51, 8% treatment A 40.6% and treatment K = 36.3%. Haerudin et al., (2017) the EPP value of feed utilization efficiency with a value of more than 25% shows good efficiency. This shows the addition of seaweed extract gives a real influence on the efficiency value of feed utilization. In research conducted by Irmadiati et al. (2021) with the addition of seaweed as much as 4% produced a value of 66%.

In treatment C, the value of 58hal is due to the appropriate composition of the addition of seaweed extract. Endraswari et al. (2021). In the use of efficient feed produces a high efficiency value. According to Amarwati (2015), if the feed used efficiently will produce a high efficiency value.

In treatment A, the EPP value decreased with the addition of seaweed extract. This is thought to be because the composition given is not able to be digested optimally.

Water Quality Parameters

Temperature

The results of the average temperature observation in koi fish with the addition of seaweed extract can be seen in Figure 7.

In this study it is known that the average temperature in the morning ranged from 25.38-25.44^{O} C while in the afternoon the temperature ranged from 27.42-27.49^{O} C. This shows that the measured temperature is still within normal limits Bachtiar (2002) temperature ranges from 24-28^{O} C is still within the optimal limits for koi fish. Antono, (2010) The appetite of stinging fish is influenced by metabolism in the fish body if the water temperature is not optimal then the fish appetite will decrease.

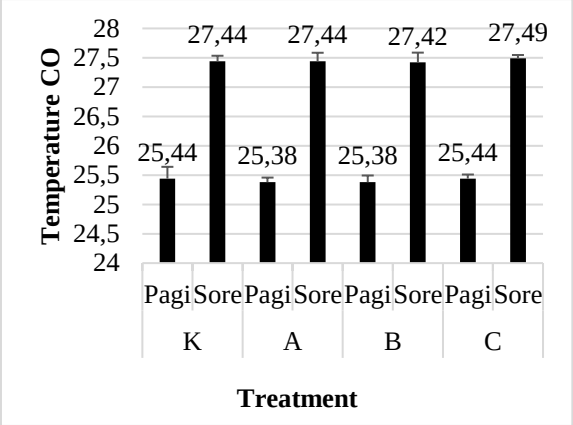

Figure 7: Average Temperature Value

pH

The observation of the average pH of koi fish with the addition of seaweed extract can be seen in Figure 8.

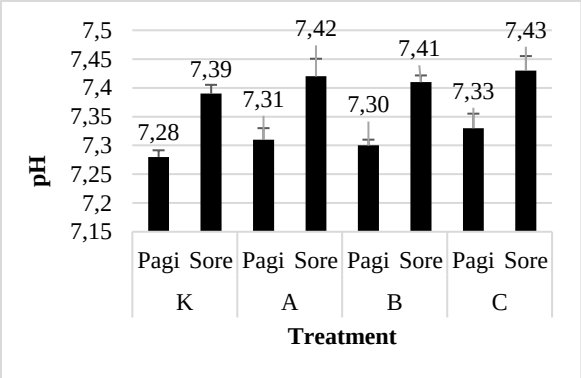

Figure 8: Average PH Value

In this study, the average pH ranged from 7.28-7.33 in the morning and 7.39-7.43 in the afternoon. pH. According to Lesmana (2001), pH ranges between 6.5-8.0. classified as optimal in the maintenance of koi fish. High pH in koi fish can have an impact on the color of the fish becoming blurred and can cause fish stress. (Bachtiar 2002). Strengthened by Mulyani et al. (2014) pH values that are too high and too low can have a negative impact on fish growth.

Ammonia

In the observation of water quality in the form of ammonia, the results were observed in koi fish with the addition of seaweed extract. Based on the results of the measured ammonia levels are 0.0058 mg/L in the study, 0.006-0.195 mg/L mid-study and 0.0027-0.0140 mg/L in the study.

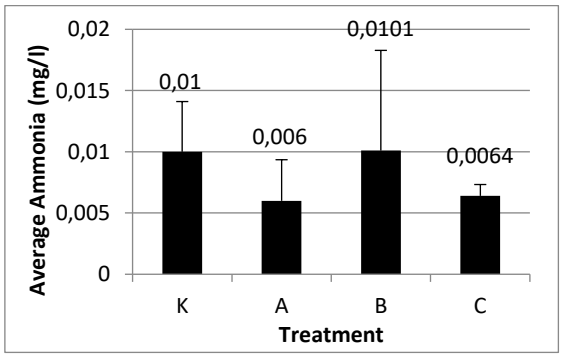

Figure 9: Average Ammonia Value

The increase in ammonia from the laboratory test results is thought to be due to the increase that occurs in the fish body. Effendie (2003) metabolic activity contains a lot of ammonia which produces fish farming waste. At high concentrations, ammonia is toxic to fish, which results in altered ecosystems and decreased oxygen concentrations. However, the ammonia measured in this experiment can still be tolerated by aquatic animals.

CONCLUSION

Based on the results of this study it can be concluded: the best percentage was produced in treatment A (93% commercial feed, 7% seaweed extract) with the addition of seaweed extract to commercial feed with different percentages giving a significant effect on color change. While seaweed extract in commercial feed with different percentages gives a real influence on the growth of koi fish with the best percentage in treatment C (97% commercial feed, 3% seaweed extract).

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