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EPISTEMOLOGICAL STUDY OF ORNAMENTAL FISH COLOR ENHANCEMENT THROUGH FEEDING

Kajian Epistemologi Peningkatan Warna Ikan Hias Melalui Pemberian Pakan

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ABSTRACT

Ornamental fish are fish that have an attractive appearance. The attractiveness of ornamental fish can be seen from the brilliant color, physical shape and completeness, behavior, and health of the fish. Feeding is one of the factors that can provide brightness to ornamental fish. The aim of this research is to conduct an epistemological study of increasing the color of ornamental fish through feeding. The method used in this research is literature review analysis. The addition of color-brightening factors or nutrients can come from chemicals and non-chemical or natural ingredients, it is recommended to use natural ingredients. The results concluded that providing color-brightening factors or nutrients in fish food with the right dosage and feeding can cause the brightness of the fish's color to increase.

Key words: Ornamental Fish, Brightness, Feeding, Nutrients

ABSTRAK

Ikan hias adalah ikan yang memiliki penampilan menarik. Daya Tarik ikan hias dapat dilihat dari warna yang cemerlang, bentuk dan kelengkapan fisik, perilaku serta kesehatan ikannya. Pemberian pakan menjadi salah satu fakor yang dapat memberikan kecerahan pada ikan hias. Tujuan dari penelitian ini adalah untuk melakukan kajian epistemologi terhadap peningkatan warna ikan hias melalui pemberian pakan. Metode yang digunakan dalam penelitian ini adalah analisis kajian pustaka (literatur research). Penambahan faktor atau nutrisi pencerah warna dapat berasal dari bahan kimia dan bahan non kimia/alami, dianjurkan menggunakan bahan alami. Hasil dari penelitian didapat kesimpulan bahwa pemberian faktor atau nutrisi pencerah warna pada pakan ikan dengan dosis dan pemberian pakan yang tepat dapat menyebabkan kecerahan warna ikan meningkat.

Kata kunci: Ikan Hias, Kecerahan, Nutrisi, Pakan

INTRODUCTION

Epistemology is a branch of philosophy that examines knowledge. It is a theory of knowledge that deals with the nature of knowledge, its assumptions, its foundations, and the accountability of questions regarding the knowledge possessed by each human being. In this context, the origins, form or structure, validity, and methodology are discussed, which collectively shape human knowledge.

Ornamental fish are characterized by their attractive appearance, making them a primary factor in their appeal. The appeal of ornamental fish can be seen in their brilliant colors, shape and physical features, behavior, and health. Factors influencing the attractiveness of ornamental fish are divided into two categories: internal and external. Internal factors include the type and characteristics of the fish (genetic factors), sex, and age. External factors include the breeding environment, feed, and health of the fish (Lesmana & Daelami, 2009).

Color is one of the parameters in determining the value of ornamental fish. One factor that influences color brightness is the food provided. The food provided, often referred to as fish feed, is divided into two types: natural feed and artificial feed. Natural feed is a type of fish food derived from living organisms. Meanwhile, artificial feed is food for cultivated organisms that is mixed with a formula tailored to the nutritional needs of these organisms (Effendi, 1997). Because color is one of the criteria for the high price of a fish, color quality must be improved and maintained, one way is through nutritional feed engineering. The type of feed affects the appearance of fish color (Said *et al.,* 2005). Therefore, for ornamental fish, the feed given not only for growth, health, and reproduction but also must contain nutrients to improve color quality. The purpose of this study is to conduct an epistemological study of improving ornamental fish color through feeding.

METHODS

This research presents an epistemological study of ornamental fish color enhancement through feeding. The method used in this study is literature research analysis from various sources available for in-depth reference. The references used in this research are literature studies, which serve as the primary tool for fieldwork. The data collection method used is documentation or literature study. The data used in this study are secondary data, sourced from literature and other sources.

RESULT

Feeding ornamental fish is a crucial component in producing high-quality fish. Many researchers have conducted research on supplementing artificial feed with nutrients from both plants and animals. However, before providing additional nutrients, we must first understand the dominant pigments in fish. Fish color is determined by the presence of pigments, or chromatophores, found in the dermis of the scales, both outside and beneath the scales.

Pigments are substances responsible for producing certain colors. Melanin (black), erythrean (red), and xanthine (yellow). Other colors formed, such as green or blue, are a combination of one, two, or all three types of pigments. The dominant color in ornamental fish is usually red or yellow. Orange is a combination of red and yellow chromatophores. Brown is a mixture of black and yellow chromatophores. Blue is produced from the dense black pigment in the skin with iridophores in the middle layer of the skin. The blue color appears when the iridophores come into contact with light. White is the background color in the skin and muscles of the iridophores (non-chromatophores). Silvery, iridophores on the surface of the scales. Dull white iridophores in the lower layers. Iridophores can combine with chromatophores to produce reflective colors such as sparkling gold, namely iridophores combined with chromatophores containing erythrosine (red pigment). The main component that forms the red color is

carotenoid pigments. Astaxanthin is a carotenoid molecule that is predominantly found in fish (Satyani & Sugito, 1997).

a. Giving Shrimp Head Flour

The addition of shrimp head meal is intended to produce a red color in ornamental rainbow trout. This shrimp head meal is chosen because it contains natural astaxanthin, reduces production costs in cultivation, increases the added value of waste (30-75% of shrimp processing waste is discarded), and facilitates its management.

Artificial feed supplementation with fish meal was carried out at a rate of 5% of the fish's body weight, with feeding frequency three times daily (morning, noon, and night). The fish head meal supplementation was carried out in five treatments: 2%, 4%, 6%, 8%, and 10%. A control comparison was made with 0%. The method used was an experimental method, with shrimp head meal in the artificial feed as the independent variable, while fish color improvement was the dependent variable. The research design used a completely randomized design (CRD).

Of the five treatments, the best results were obtained with 10% fish meal. This resulted in an improvement in the color of the rainbow trout. The addition of fish head meal, as a carotene source in the fish's body, can increase the absorption of pigment cells, thus improving the color quality of the fish compared to feeding without additional carotene sources (Subamia *et al.,* 2010).

b. Addition of Moringa Leaf Extract

Moringa leaves contain chlorophyll, a pigment found in green vegetables. Dried moringa leaves contain 162 mg of chlorophyll per 8 grams. Therefore, 30 grams of moringa leaf extract contains 4,860 mg, or 4.9 grams of chlorophyll (Krisnadi, 2015). Moringa leaves contain 520 mg/kg of carotenoids, making them a valuable alternative pigmentation factor for fish.

Moringa leaf extract was administered to comet carp fry, resulting in an improvement in color. The feeding method involved mixing the moringa leaf extract with prepared feed, fed three times daily. A clear improvement in color was observed with the treatment of 45 ml of moringa leaf extract/kg of feed, compared to 30 ml of moringa leaf/kg of feed, 15 ml of moringa leaf/kg of feed, and 0 ml/kg of feed (Angelica *et al.,* 2020). Fish are animals that cannot synthesize carotenoids on their own, so when carotenoid sources are added to their feed, their skin color will increase. The level of color brilliance, or color change, is caused by changes in the number of pigment cells. The more pigment cells there are, the more vivid the color. Adding moringa leaf extract to feed has been shown to improve the color of fish.

c. Providing Astaxanthin in Feed

The intensity of color brightness in fish can be increased by adding carotenoid sources to the fish. Carotenoids are components that form dyes that provide red and yellow colors (Satyani & Sugito, 1997). Changes in color pigment cells can be caused by stress, environmental changes, lack of sunlight, disease, or lack of food. The most effective and widely found type of carotenoid pigment for coloring is astaxanthin (Meiyana & Minjoyo, 2011). Astaxanthin can be given to feed by spraying it on the feed. Treatments are carried out with several doses, namely 40 mg, 30 mg, 20 mg, and 0 mg. Feeding to fish is done ad libitum. And to measure the color determination score using M-TFC paper on each fish every 10 days during the 60-day maintenance process. From the results of observations, it was found that the administration of 30 mg of astaxanthin has the right dose. Because if it is not right it will cause a decrease in the fish's immune system (Yulianti, *et.al.,* 2014).

d. Adding Papaya Fruit Extract to Fish Feed

One of the main components of the formation of red and yellow pigments in fish is carotenoid compounds. Sources of carotenoids can come from plants and fruits, one of which is papaya. The beta-carotene content in papaya is 276 µ/100 g, making papaya one of the fruits that can produce and store carotene (Aulia, 2012). Experiments were conducted on administering papaya extract at doses of 0 ml/kg, 10 ml/kg, 30 ml/kg, and 50 ml/kg. This was done by spraying the prepared feed, allowing it to air dry before being fed to the fish. The study obtained the best results when treated with 30 ml/kg. This indicates that administering the correct dosage will produce optimal color. Meanwhile, administering an inappropriate dosage will cause a decrease in fish growth (Simbolon *et al*., 2021). Carotenoid levels that meet the needs of the fish's body will be immediately absorbed entirely by the pigments contained in the fish's body (Bachtiar, 2002).

e. Providing Water Hyacinth Flour

Water hyacinth (Eichhornia crassipes) is a weed in aquatic areas that lives and floats in deep water or develops roots in mud in shallow water. Water hyacinth reproduces very quickly, both vegetatively and generatively. Administration of water hyacinth flour to fish is carried out in several doses ranging from 0 g, 100 g, 200 g, and 300 g. This water hyacinth flour is administered by adding it to artificial feed after previously formulating the desired composition by creating its proximate value. Of the four treatments, the one that showed the best results was at a dose of 300 g. Therefore, it can be obtained that the greater the administration of water hyacinth flour, the better the appearance of the fish color (Syahrizal, *et al.,* 2017). This is because water hyacinth has an average carotenoid content of 19.28% of fresh water hyacinth and 33.28% of dried water hyacinth. According to Lesmana (2002), the level of color brilliance or color change is caused by changes in the amount of pigment. The more or denser the pigment cells, the more vivid the fish's color.

f. Adding nutmeg extract to feed

Nutmeg (Myristica argentea) is a plant rich in carotenoids. In addition to minerals, nutmeg also contains various important vitamins, including B-complex vitamins, including vitamin C, folic acid, riboflavin, niacin, vitamin A, flavonoids, and beta-carotene. The treatments in the study included doses of 0%, 5%, 10%, and 15%. Nutmeg extract was administered by mixing commercial feed with crude nutmeg extract. Feeding was carried out at a rate of 5% of the fish's total weight and fed three times daily.

The results of this study showed that the administration of nutmeg extract improved color quality compared to the treatment without nutmeg extract. However, the results of the 5%, 10%, and 15% doses did show improvements in color quality, but the differences were not significant. Therefore, it was concluded that administering only 5% nutmeg extract is sufficient to improve fish color (Budi *et al.,* 2021).

g. Penambahan *Spirulina platensis* pada pakan

Spirulina platensis is a natural pigment dye source that contains carotenoids, which are beneficial for enhancing the color brightness of ornamental fish. According to Rosid *et al*., (2019), Spirulina platensis contains astaxanthin, a type of carotenoid that can be used as a natural ingredient to improve the brightness of ornamental fish, especially in terms of color phenotype. The treatments used by the researchers were 0% for 100 kg of feed; 0.5% for 100 g of feed; 1% for 100 kg of feed; and 1.5% for 100 g of feed. The commercial feed was mixed with spirulina flour by mixing 0.3 g of progol in 100 g of feed and 15 ml of water as a binder. The mixture was stirred until homogeneous and then dried in the sun for approximately 1 hour. Afterward, the fish were fed twice daily.

The results showed that 1% spirulina was the best supplement, as it resulted in significant color changes. However, for growth, 0.5% spirulina can improve growth and feed conversion ratios. Therefore, if you want to improve color, you can add 1% spirulina, and if you want to support growth, you can add 0.5% spirulina (Satria *et al.,* 2020).

h. Adding Red Dragon Fruit Flour to Feed

Red dragon fruit has an attractive red color and contains carotene. The content of dragon fruit per 100 grams is 0.005–0.012 mg. The researchers used a mixture of dragon fruit flour at doses of 5%, 10%, and 15%. Dragon fruit flour is made by removing the dragon fruit skin and drying it at 60°C until it is dry and then ground. Once a fine flour is formed, it is mixed with commercial flour according to the dosage, water is added, and mixed until a paste forms. It is then molded according to the desired size.

Research results indicate that 10% dragon fruit flour is the best for enhancing fish color brightness (Udjan *et al*., 2023).

i. Adding Turi Leaves to Feed

The pigeon pea plant (*Sesbania grandiflora*) is a plant readily found in the environment. Treatments for pigeon pea leaf powder were administered at doses of 0 ppm, 100 ppm, 150 ppm, and 200 ppm. The pigeon pea leaf powder was mixed with commercial feed according to the recommended dosage, mixed with water until thoroughly mixed, and then dried.

This treatment resulted in increased color brightness by adding pigeon pea leaves to the feed at a concentration of 100 ppm. Consuming more than 100 ppm did not significantly improve the fish's pigmentation (Meilisza *et al.,* 2021). Therefore, the pigmentation ability of a material is determined not only by its carotenoid content but also by the type of carotenoid it contains. Beta-carotene, the carotenoid that is mostly absorbed by the body and converted to vitamin A, is thought to have no effect on pigmentation in either fish or livestock (Sukarman & Chumaidi, 2010).

j. Addition of Shrimp Head and Carrot Flour

Natural dyes added to fish feed typically contain carotenoids, such as those found in eggs, zooplankton, shrimp shells, crab shells, paprika, yeast, seaweed, and other sources. Shrimp is abundant in astaxanthin, making it a popular food source for ornamental fish, enhancing their vibrant colors.

The selection of fish dyes should consider their availability and affordability. Therefore, shrimp head and carrot meal can be used as an alternative to expensive synthetic dyes in the production of artificial ornamental fish feed.

The shrimp head and carrot meal feeding treatment consisted of 40% shrimp head meal (A), 40% carrot meal (B), 20% shrimp head meal plus 20% carrot meal (C), and commercial feed (D). Feed preparation was carried out by weighing all ingredients, adding shrimp head meal and carrot meal, and molding according to the required measurements. Fish mouth opening was usually assessed. Fish color was assessed using an organoleptic test based on fish color and assigned a score based on a color book. Observations showed that the fish given the treatment exhibited changes and increased color brightness compared to those fed only commercial feed. Therefore, the astaxanthin and beta-carotene contained in shrimp head meal and carrot meal can enhance the color brightness of fish (Kurnia *et al.,* 2013).

k. Providing Squid Ink Extract in feed

Nutrition is a primary requirement in feed production, so determining the best nutrient sources for growth and enhancing the color of ornamental fish is crucial. Squid ink extract is

one ingredient used to brighten the color of ornamental fish. Squid ink contains black pigment (Astawan, 2008). Natural melanin is a selenoprotein containing 90% melanin, 5% protein, and 0.8% carbohydrate (Nasution *et al.,* 2017).

The treatments in this study included feed supplemented with squid ink extract at 0%, 5%, 10%, and 15% doses. Mixing the squid ink extract with the feed was done by spraying the extract with commercial feed at the appropriate dosage and allowing it to dry. Changes in color brightness were observed using a Toca Color Finder (TFC) color meter by three color-blind panelists and a chromameter.

The results of administering squid ink extract to produce black color were in the treatment of feeding with 15% squid ink extract added (Usman, *et al,* 2022).

CONCLUSION

Based on several studies, it can be concluded that supplementing ornamental fish with additional nutrients that enhance color will result in brighter colors. However, proper dosage is crucial, as knowing the correct dosage will ensure optimal color results. Not all fish can absorb nutrients to enhance color; some are converted during metabolism. Furthermore, overfeeding can also lead to poor health in fish.

One suggestion to enhance the brightness of fish color is to add color-producing nutrients to their feed. These color-producing nutrients can be synthetic or chemical, or they can be derived from natural dyes. However, natural dyes are recommended, as they are readily available in nature and tend to be more affordable.

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