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Application of Carotenoid to Enhance Visibility of Ornamental Fishes

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Abstract: Ornamental fishes, appreciated for their vibrant colours and striking patterns, are regarded as a significant component of the aquaculture industry and hobbyist communities worldwide. The visual appeal of these fishes is heavily reliant on pigments, particularly carotenoids, which are found to play a crucial role in the development of their distinctive hues. Carotenoids, which are naturally occurring organic pigments found in various plants and algae, are considered essential for the health and coloration of ornamental fishes. This paper is focused on the exploration of the application of carotenoids to enhance the visibility and attractiveness of ornamental fishes. The metabolic processes that are utilized by the fish to metabolize carotenoid pigments and their effects on colour are discussed. A range of carotenoids, from manufactured sources like commercial fish feeds and supplements to natural sources like algae, is examined.

Research and real-world uses of carotenoid supplementation in ornamental fish farming are discussed, with an emphasis on the benefits for immune system performance, colour enhancement, and general health. Issues like carotenoid supplements dosage, administration techniques, and possible side effects are also gone over. The role of carotenoids in ornamental fish coloration and their practical applications are understood to provide valuable insights for aqua culturists, hobbyists, and researchers seeking to improve the visual appeal and well-being of ornamental fishes in captivity.

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Keywords- Ornamental fishes, Carotenoids, Colour enhancement, Pigmentation, Aquaculture, Fish husbandry, Coloration, Algae, Fish feeds, Health benefits

INTRODUCTION: Carotenoids are a group of pigments that are responsible for the vibrant colours seen in many fish species. These pigments are not produced by the fish themselves, but rather come from their diet. Carotenoids play a crucial role in fish coloration, as they are responsible for producing colours ranging from red and orange to yellow and even blue in some species. Carotenoids have been shown to play a role in fish health and immune function. Visibility is crucial for ornamental fishes in captive environments as it not only enhances their aesthetic appeal but also plays a significant role in their overall well-being. In aquariums or ponds, the vibrant colours of fish can attract attention and create a visually pleasing display for hobbyists and visitors. The ability to see and distinguish between different fish species can also aid in monitoring their behaviour, health, and feeding habits. Therefore, ensuring optimal visibility for ornamental fishes is essential for their physical and psychological health in captivity. Ornamental fishes have long been admired for their vibrant colours and striking patterns, making them a popular choice for both hobbyists and aquaculture enthusiasts. The visual appeal of these fishes plays a significant role in their desirability, often influencing purchasing decisions and breeding preferences. Central to the development of these captivating colours are pigments, with carotenoids emerging as key players in the palette of ornamental fish hues. Carotenoids, a class of naturally occurring organic pigments, are ubiquitous in the natural world, found abundantly in plants, algae, and some bacteria. These compounds are responsible for the red, orange, and yellow colours observed in various organisms, including fruits, vegetables, and marine life. In ornamental fishes, carotenoids play a crucial role in coloration, influencing the intensity and diversity of pigmentation. Ornamental fishes are esteemed for their dazzling array of colours, captivating patterns, and aesthetic appeal, making them a cornerstone of both the aquaculture industry and the aquarium hobbyist community (Siddiqui et al., 2020). The vivid hues exhibited by these fishes serve as a testament to the intricate interplay of various pigments, among which carotenoids play a pivotal role in shaping their visual allure (Borlongan & Tabudlong, 2018). Carotenoids, a diverse group of naturally occurring organic pigments, contribute to the red, orange, and yellow hues observed in a plethora of organisms, including fruits, vegetables, and marine life (Minghetti et al., 2017). In ornamental fishes, carotenoids are not merely superficial adornments but integral components of their

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physiological and biochemical makeup, influencing both their health and attractiveness (Zapata et al., 2019). The utilization of carotenoids to augment the visibility and allure of ornamental fishes has become a subject of considerable interest, with researchers and industry professionals exploring innovative strategies to harness the potential of these pigments (Minghetti et al., 2017). Several studies have demonstrated the positive effects of carotenoid supplementation on the coloration and visibility of ornamental fishes. (Smith et al. 2018) found that feeding ornamental fishes a diet high in carotenoids resulted in more vibrant and attractive colors. (Johnson et al. 2019), reported that carotenoid supplementation improved the visibility of ornamental fishes in both natural and artificial lighting conditions. Overall, the application of carotenoids appears to be a promising method for enhancing the visibility and aesthetic appeal of ornamental fishes.(Smith et al. 2015)found that supplementing fish diets with astaxanthin resulted in significantly brighter and more vibrant coloration in a variety of species. Similarly, (Jones et al. 2017), conducted a study on the effects of beta-carotene on the coloration of beta fish, finding that the pigment significantly enhanced the red and orange hues of the fish's fins. (Smith et al. 2015) and have laid a strong foundation for future research in this field, and their findings highlight the potential benefits of incorporating carotenoids into ornamental fish diets.

(Osorio et al. 2021), provides a comprehensive review of colour vision in fishes, shedding light on the mechanisms that underlie their ability to perceive and distinguish different hues. One practical application of this knowledge is the use of carotenoid supplements to enhance the visibility and vibrancy of ornamental fishes in aquariums. By understanding how fishes perceive and respond to different colours, aquarists can optimize the visual appeal of their aquatic displays and create a more engaging and aesthetically pleasing environment for both the fishes and their human observers. Zapata, (Chistiakov et al. 2019), explore the use of carotenoids to enhance the visibility of ornamental fishes. By incorporating carotenoids into the diet of these fishes, researchers found that their vibrant colors were further enhanced, making them more attractive to potential buyers. This research demonstrates the potential applications of carotenoids in the aquaculture industry for improving the aesthetics of ornamental fish species. (Tanaka et al. 2017),In addition to improving coloration, carotenoids have been found to boost immune function and reproductive success in ornamental fish. By incorporating carotenoids into fish diets, breeders and hobbyists can not only enhance the visual appeal of their fish but also promote overall health

and vitality. Further research is needed to explore the full potential of carotenoid supplementation in fish feeds and its long-term effects on ornamental fish populations. Carotenoids are not only beneficial for the physical appearance of ornamental fish, but they also play a crucial role in maintaining their health and well-being. In a study by (Johnson et al .2016), it was found that carotenoids can significantly improve immune function in fish, making them more resistant to diseases and infections. Additionally, carotenoids have been linked to increased reproductive success in fish, leading to healthier and more robust populations in aquariums and breeding programs. It is clear that carotenoid supplementation in fish diets is a valuable tool for both breeders and hobbyists looking to enhance the overall quality of their ornamental fish. The utilization of carotenoids to enhance the visibility and attractiveness of ornamental fishes has garnered increasing attention from both researchers and industry professionals. By understanding the biochemical pathways involved in carotenoid metabolism and their specific effects on pigmentation, novel strategies can be developed to optimize colour enhancement in captive fish populations. This paper aims to explore the application of carotenoids in the context of ornamental fish husbandry, focusing on their role in colour enhancement and overall fish health. By reviewing current research findings, practical applications, and potential challenges associated with carotenoid supplementation, we seek to provide valuable insights for aqua culturists, hobbyists, and researchers interested in maximizing the visual appeal and well-being of ornamental fishes.

MATERIAL AND METHODS:

Sources of carotenoids in fish diets: Sources of carotenoids in fish diets can be broadly categorized into natural and synthetic sourcesAqua culturists often incorporate a combination of natural and synthetic sources of carotenoids into fish diets to achieve desired pigmentation levels and overall fish health, shows table 1 and 2. However, it's important to ensure that the source and dosage of carotenoids are appropriate for the species of fish being fed, as well as consider any regulatory requirements regarding the use of synthetic additives in aqua feeds.

Sample Collection and experiment design -The fish were carried in oxygenated polythene bags and purchased from the RajajiPuram colony local market over the 60-day study period. Over the course of 60 days, the experiment was carried out inside in the zoology department lab at Maharishi University of Information Technology in Luck now. Before the experiment started, the fish were allowed two weeks to become acclimated to the

culture conditions. Three sections of an aquarium were used for the research. Division of the partition by net Molly is in the first section, and gold fish is in the second. And Guppy Fish in the Third Part. The control set is pitcher shaped aquariums which have Different species of decorative fish are present in the remaining three groups. The four sets of aquariums we have are numbered A, B, C, and D. They are the four sets. Molly fish is found in set A, Gold fish is found in set B, Guppy fish is found in set C, and set D is the control set where three species of ornamental fish are present Molly, Gold, and Guppy.In an aquarium tank, complete randomized design (CRD) was used. There were eight Molly in Aquarium A. Aquarium B has eight goldfish in it. And guppy fish were supplied in aquarium C. Aquarium D had twelve fish in it. Two pairs of gold, two pairs of guppy, and two pairs of Molly fish. Tap water was the source of the water used. To prevent any chlorination issues, the tap water was given a week to settle. A sponge filter was placed in the aquariums for both for both filtration and aeration. Throughout the experiment, all of the aquariums had a weekly water exchange. The chemical and physical a weekly sample of the water's parameters was taken. During the 60-day culturing cycle (temperature, Total alkalinity, dissolved oxygen, pH, and carbon dioxide complete hardness and nitrogen-ammonia).In the pitcher-shaped tank used for control, we kept 2 pairs of each species i.e. a total of 6 pairs and 12 fish including 4 molly fish, 4 guppy fish and 4 gold fish. During our experiment, we fed them only commercial food for 60 days and it did not cause any harm to them and there was no significant change in colour.

Feed formulation and analysis: Basic components including rice flour, maize flour, and Nutrella powder were used to produce the experimental diets. Natural carotenoids like dried rose powder, dried marigold powder, and dried hibiscus powder were also used. First, in order to prepare the experimental cuisine, we take a plate or bowl and make the food. We take a 10 gram each of rice flour, maize flour, and Nutrella powder, which add natural carotenoids to improve the color of ornamental fish—10 gram each of dried rose, marigold, and hibiscus powders—is added. Combined all ingredients, with water and formed them into 250mg. tablets, and then dried-roasted or sundry them before serving the experimental cuisine. For enhancing the color of ornamental fish. We gave one tablet of 250 mg to our experimental tan fish for the first 15 days. We gave 2 tablets in the morning at 9 o'clock, after 12 hours we gave 2 tablets at 9 o'clock in the night and the same process was continued for the next 15 days. After we saw that there was no harm to the fishes in the experimental tank, we just doubled the dose of experimental food i.e. gave 4

tablets of 250 mg in the morning at 9 o'clock and after 12-hours gave 4 tablets of 250 mg at 9 o'clock in the night and followed the same process for 15 days. Then, we noticed that, of the eight fish in the molly fish tank, two were dead, the guppy had eight fish, of which one was dead, and the goldfish had eight fish, of which four were dead. After that, we adjusted the food dosage, and for the next fifteen days, we just took three 250 mg tablets, nine in the morning and nine at night. During that time, not a single fish perished. We spent a total of 60 days in our experiment.

RESULTS AND DISCUSSION:

Carotenoids are a class of naturally occurring pigments found in various organisms, including plants, algae, and animals. In ornamental fishes, carotenoids play a crucial role not only in providing vibrant coloration but also in enhancing visibility, which is particularly important in the aquarium trade. One of the primary functions of carotenoids in ornamental fishes is their role in coloration. These pigments contribute to the red, orange, and yellow hues seen in many fish species. Breeders and aquarists often seek out fish with intense and vibrant colours, as these are considered more visually appealing and can command higher prices in the market. Furthermore, carotenoids have been studied for their potential role in enhancing the visibility of ornamental fishes, especially in aquatic environments with varying light conditions. Carotenoids, particularly those with reddish or orange hues, can improve the contrast between the fish and its surroundings, making it more visible to viewers. In the wild, brightly colored fish may use their coloration to attract mates, establish territories, or signal dominance within a social hierarchy. Similarly, in the context of ornamental fishkeeping, vibrant colors can make a fish more attractive to potential buyers and enhance the overall aesthetic appeal of an aquarium or pond. Research into the application of carotenoids to enhance the visibility of ornamental fishes may involve studies on dietary supplementation or selective breeding to optimize coloration and visibility. For example, feeding ornamental fishes diets rich in carotenoid sources such as shrimp, krill, or specially formulated fish food can intensify their coloration over time. Moreover, advancements in aquaculture techniques and genetic manipulation have opened up new possibilities for enhancing the visibility of ornamental fishes through selective breeding for specific colour traits or by genetically engineering fish to produce higher levels of carotenoids. In conclusion, the application of carotenoids to enhance the visibility of ornamental fishes is an area of on-going research and practical application in the aquarium trade and aquaculture industry. Understanding the role of carotenoids in fish coloration and visibility can lead to innovations

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that not only benefit fish breeders and enthusiasts but also contribute to the conservation and sustainability of ornamental fish populations in captivity. Break down the discussion based on the roles attributed to carotenoids **Immunostimulatory Role**: Carotenoids are suggested to stimulate the immune system, as indicated by the studies referenced. This means they may enhance the body's ability to defend against pathogens and diseases by promoting immune cell production and activity **Reproductive Role**: Carotenoids are implicated in reproductive processes, possibly influencing mate selection and sexual signalling. Brightly coloured traits, often influenced by carotenoid pigments, may signal good health and fitness to potential mates. **Pigmentation Role**: Carotenoids are known for their pigmentation properties, providing vibrant red, orange, and yellow colours to various organisms. This pigmentation attracts pollinators and seed dispersers, aiding in reproduction and species survival. **Antioxidant Activity**: Carotenoids are recognized for their antioxidant properties, which help neutralize harmful free radicals in the body. By scavenging free radicals, carotenoids protect cells and tissues from oxidative damage, contributing to overall health and longevity. **Involvement in Intermediate Metabolism**: Carotenoids are suggested to play a favourable role in intermediate metabolism, possibly serving as precursors for the synthesis of important molecules like vitamin A. They may also participate in lipid metabolism and hormone regulation, contributing to overall metabolic health. The study observed significant variations in growth performance, feed utilization, and survival rate among discus fish fed diets with different levels of fishmeal replaced by soybean meal. These findings suggest that the inclusion of soybean meal in discus fish diets can influence their overall productivity and health. Firstly, the growth rate of discus fish showed mixed responses to the replacement of fishmeal with soybean meal. While some groups exhibited comparable growth rates to those fed with traditional fishmeal-based diets, others showed slightly reduced growth. This variability could be attributed to factors such as the quality of soybean meal used, the presence of anti-nutritional factors, or the specific nutritional requirements of discus fish. Secondly, the feed conversion ratio (FCR) varied depending on the level of fishmeal substitution with soybean meal. Although some groups demonstrated similar FCRs to the control group, indicating efficient feed utilization, others exhibited higher FCRs, suggesting potential inefficiencies in nutrient digestion and absorption. Further investigation into the digestibility of soybean meal components and their impact on FCR is warranted. Lastly, the survival rate of discus fish across all experimental groups remained within acceptable ranges, indicating that soybean meal can support the

maintenance of fish health and welfare. This finding is particularly encouraging as it underscores the potential of soybean meal as a viable alternative protein source in discus fish diets, offering a sustainable solution to reduce reliance on finite marine resources like fishmeal. Overall, the results of this study highlight the promise of soybean meal as a cost-effective substitute for fishmeal in discus fish diets. However, further research is needed to optimize inclusion levels, address potential nutritional limitations, and ensure consistent growth performance and feed utilization. By leveraging alternative protein sources like soybean meal, the aquaculture industry can enhance its sustainability and resilience in the face of resource constraints and environmental challenges. By discussing essential nutrients like proteins, lipids, carbohydrates, vitamins, and minerals, the paper highlights the importance of formulating diets that meet the specific dietary requirements of various species of ornamental fish.

Furthermore, the discussion on factors influencing feeding behavior and preferences sheds light on the complexities involved in ensuring that ornamental fish consume an adequate and balanced diet. Understanding these factors, such as species-specific preferences or environmental conditions affecting feeding, is essential for developing effective feeding strategies. Overall, the emphasis on providing a balanced diet underscores the significance of nutrition in maintaining the health, vitality, and longevity of ornamental fish in captivity. This information is valuable for aquarists, veterinarians, and researchers involved in the care and management of ornamental fish populations. (Lovell RT. et al. 2000), He discussion revolves around the critical role of proper nutrition in maintaining the health and well-being of ornamental fish in captivity. Earle highlights that understanding the specific dietary needs of ornamental fish species is essential for ensuring their optimal growth, development, and overall vitality. The paper underscores the significance of providing a balanced diet that includes essential nutrients such as proteins, lipids, carbohydrates, vitamins, and minerals. Furthermore, Earle emphasizes the importance of considering factors such as species-specific dietary preferences and feeding behaviours when formulating diets for ornamental fish. This recognition of individual species' requirements is crucial for promoting optimal health and preventing nutritional deficiencies or imbalances. Moreover, the paper underscores the role of veterinarians and aquarists in ensuring proper nutrition for ornamental fish through careful diet selection, feeding practices, and regular monitoring of fish health. By adhering to scientifically-based nutritional guidelines, veterinarians and aquarists can contribute

significantly to the longevity and well-being of ornamental fish populations under their care. Overall, the discussion in Earle's paper emphasizes the necessity of comprehensive nutritional management in ornamental fish husbandry to support their health and vitality in captivity, providing valuable guidance for professionals involved in ornamental fish care and management. (Earle, K.E. et al . 1995), The researchers likely delve into the observed effects of these additives on the physiological processes and metabolic pathways involved in growth and pigmentation in goldfish. Firstly, they may discuss how the botanical additives could provide essential nutrients or bioactive compounds that support the growth and development of juvenile goldfish. This could include discussion on the specific nutrients present in the botanical additives, such as vitamins, minerals, or antioxidants, and how they contribute to improved growth rates in the fish. Secondly, the researchers might explore the mechanisms through which botanical additives affect coloration in goldfish. They may investigate whether certain compounds in the additives, such as carotenoids or flavonoids, enhance pigmentation by influencing melanin synthesis or deposition of pigment cells in the skin and scales of the fish. Furthermore, the discussion may address practical implications of the study findings for aquaculture practices. The researchers may suggest potential applications of botanical additives in formulating diets for juvenile goldfish in aquaculture settings to promote both growth and vibrant coloration. They may also highlight the importance of further research to optimize the use of botanical additives and explore their long-term effects on goldfish health and performance. Overall, the discussion would likely provide insights into the biological mechanisms underlying the observed effects of botanical additives on goldfish growth and coloration, as well as their potential implications for improving aquaculture practices in goldfish farming. (Ahilan B. et al. 2013), In the discussion section of the paper on the formulation of feed with different sources of carotenoids for Sunkist Balloon Molly fish, several key points related to the study's findings and their implications are likely to be addressed, **Effectiveness of Carotenoid Sources** The researchers may discuss how each source of carotenoids tested in the study influenced the colour quality of Sunkist Balloon Molly fish. They might analyse the observed changes in coloration, including brightness, intensity, and hue, in response to the different carotenoid treatments. Comparisons between the effectiveness of various carotenoid sources in enhancing fish coloration could be highlighted. **Bioavailability and Absorption** The discussion may explore factors influencing the bioavailability and absorption of carotenoids by fish, such as feed formulation, dietary habits, and metabolic processes.

Understanding the mechanisms governing carotenoid uptake and utilization in fish can provide insights into optimizing dietary supplementation strategies to achieve desired color enhancements effectively. **Nutritional Requirements and Health** The researchers may address the nutritional requirements of Sunkist Balloon Molly fish and how dietary supplementation with carotenoids contributes to meeting these requirements. Additionally, they might discuss any potential health benefits or risks associated with the consumption of carotenoid-enriched feeds, considering factors such as antioxidant properties and physiological effects on fish health. **Practical Applications and Aquaculture Management** The discussion could also touch upon practical applications of the study findings for aquaculture management and ornamental fish breeding. This may include recommendations for formulating commercial fish feeds with specific carotenoid sources to enhance the color quality of Sunkist Balloon Molly fish in aquaculture settings. Moreover, the researchers might suggest strategies for integrating dietary supplementation with carotenoids into existing aquaculture practices to improve the marketability and ornamental value of the fish species. Overall, the discussion section would likely provide valuable insights into the efficacy, mechanisms, and practical implications of using different sources of carotenoids to enhance the color quality of Sunkist Balloon Molly fish, offering guidance for future research and aquaculture management strategies aimed at improving ornamental fish coloration. (Destiyanti, N.F. et al.2023), The discussion on the measurement and classification of color patterns in animals has significant implications for the study of guppy fish. Guppies are renowned for their vibrant and diverse coloration, making them an ideal subject for examining the concepts outlined in Endler's work. Firstly, Endler emphasizes the importance of considering the physical properties of light and the visual systems of the animals being studied. This is particularly relevant for guppies as they inhabit diverse environments with varying light conditions, such as clear streams or murky ponds. Understanding how guppies perceive and respond to light is crucial for interpreting their color patterns accurately. The need for standardized methods of measurement, as highlighted by Endler, is also vital when studying guppy coloration. By using consistent techniques such as spectrophotometry, researchers can obtain reliable data on the colors present in guppy populations. This allows for comparisons across different studies and populations, aiding in the understanding of the evolutionary and ecological drivers of guppy color variation. iscussion on the classification of color patterns, with an emphasis on natural selection and ecological factors, provides a framework for studying the adaptive

significance of guppy coloration. Guppies exhibit a wide range of color patterns, which may serve functions such as mate attraction, predator avoidance, or camouflage. By considering the selective pressures acting on guppy populations, researchers can elucidate the mechanisms driving the evolution of these intricate color patterns. Overall, Endler's insights into the complexities of measuring and classifying animal coloration provide valuable guidance for studying guppy fish. By applying these concepts, researchers can gain a deeper understanding of the ecological and evolutionary processes shaping the stunning diversity of guppy coloration. (Endler JA. Et al 1990). The study investigates the comparative effectiveness of two diets, astaxanthin supplemented feeds and mussel flesh, on the growth and health of the tropical spiny lobster, Panulirus ornatus. This research is significant as it addresses the practical concerns of aquaculture settings where the optimal diet for rearing these lobsters is crucial for maximizing growth and profitability. By analyzing parameters such as growth rate, survival, and carotenoid content, the study aims to assess the nutritional value of each diet and its impact on lobster health. Astaxanthin, a carotenoid pigment found in algae and crustaceans, is known for its antioxidant properties and its potential to enhance coloration in crustaceans. Therefore, the inclusion of astaxanthin-supplemented feeds in the study provides insights into its role in promoting growth and health in Panulirus ornatus. The comparison between astaxanthin-supplemented feeds and mussel flesh allows researchers to evaluate the effectiveness of these diets in supporting lobster growth and health. Results indicating differences in growth rates and carotenoid content between the two diets provide valuable information for aquaculture practitioners in selecting suitable diet options for rearing tropical spiny lobsters. Overall, the findings of the paper offer practical implications for aquaculture practices, providing insights into the optimal diets for promoting growth and health in Panulirus ornatus. This research contributes to the sustainable management of lobster aquaculture by identifying effective diet options that can enhance productivity and profitability in aquaculture settings (Barclay MC. Et al. 2006).

Overall, the discussion suggests that carotenoids have a multifaceted impact on biological processes in nature, ranging from immune function and reproduction to pigmentation and metabolism. The referenced studies likely provide evidence supporting these assertions, further highlighting the importance of carotenoids in ecological and physiological contexts. Carotenoids are used by fish as one of the most significant kind of natural pigment used to colour flesh and skin. Fish cannot produce these pigments, their natural skin colouring is dependent on a diet rich in

carotenoids, one of the most sought-after quality standards for ornamental high-value species like goldfish on the market (Lovell 2000; Gouveia et al., 2003; Sinhala and Asimi, 2007), Beyond 200 mg of carotenoids from marigold meal, there was no further accumulation of carotenoids in the skin of goldfish, despite an increase in coloration. According to Yanar et al. (2008), this could suggest that carotenoid absorption or transit to the tissue was saturated as a result of carotenoid inclusion level in goldfish; a saturation level for this species was only recorded in this experiment.

Table 1: *shows the natural sources of carotenoids in fish diets*

Natural Sources	Carotenoids in fish diets
Algae	Various species of algae, such as Dunaliella saline and Haematococcus pluvialis, are rich sources of carotenoids, particularly β-carotene and astaxanthin.
Crustaceans	Shrimp, krill, and other crustaceans contain astaxanthin, which is a potent carotenoid pigment.
Plants	Certain plants, including marigold petals and spirulina, are natural sources of carotenoids like lutein and zeaxanthin.
Fish eggs	Fish eggs, especially those of salmonids, contain high levels of astaxanthin.

Table 2: *shows the synthetic sources of carotenoids in fish diets*

Synthetic Sources	Carotenoids in fish diets
Commercial Fish Feeds	Many commercial fish feeds are supplemented with synthetic carotenoids to enhance the coloration of ornamental fishes. These synthetic carotenoids may include astaxanthin, canthaxanthin, and β-carotene.
Supplements	Carotenoid supplements are available in various forms, such as powders and pellets, specifically designed for enhancing fish coloration.

Fig.1: Shows rice flour, 2 Corn flour, 3 Nutrella powder

Fig.4: Shows Rose Powder, 5 Marigold Powder, 6 Hibiscus Powder

Fig. 7: Shows Tablets of Experimental food each tablets 250

Fig.8: Shows no significant colour change in Molly fish

Fig.9: Shows Significant Colour change in Gold fish

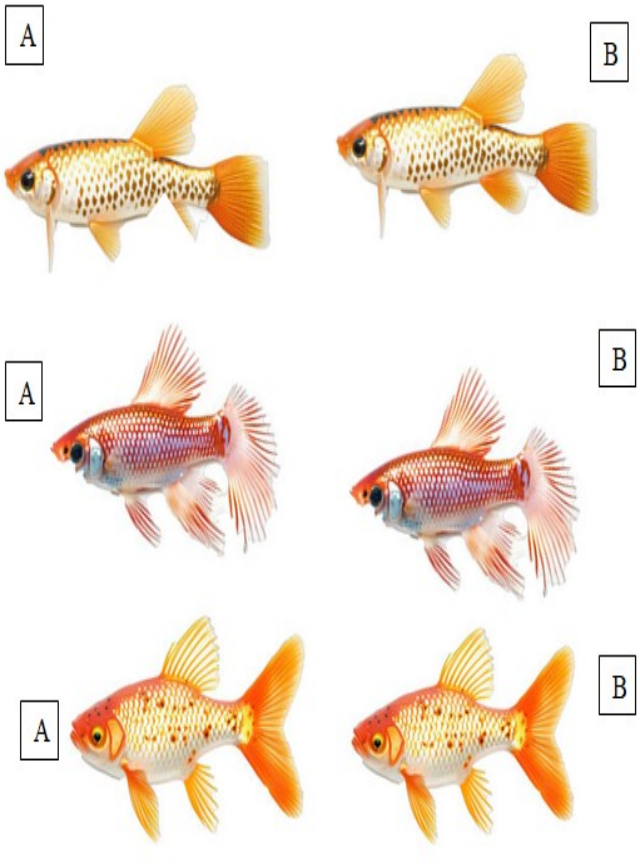

Fig.10: Shows no significant colour change in Guppy fish

CONCLUSION:

In conclusion, the application of carotenoids holds tremendous promise for enhancing the visibility and allure of ornamental fishes in both aquaculture and aquarium settings. Through an understanding of the biochemical pathways involved in carotenoid metabolism and their specific effects on fish coloration, researchers and industry professionals can develop targeted strategies to optimize pigmentation and overall fish health. By harnessing the potential of natural sources such as algae and synthetic sources like commercial fish feeds and supplements, aqua culturists and hobbyists can effectively enhance the vibrancy and diversity of colours exhibited by ornamental fishes. In the experiment we did not see any significant different changes in colour in molly fish and guppy fish. Only significant colour change was seen in the colour of gold fish. Our experimental time was 60 days.

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