



Effects of Different Live Feeds on the Color Intensity, Growth Performance, and Survival of Koi Fish Fingerlings (*Cyprinus rubrofuscus*)

Agung Luthfi Fauzan^{1*}, Meylinda Anugrah Putri Perdana², Nina Nurmalia Dewi³,
Muhammad Ahya Rafiuddin⁴

¹Department of Aquaculture, Faculty of Food Security, Universitas Negeri Surabaya, 60286, East Java, Indonesia

²Aquaculture Study Program, Faculty of Fisheries and Marine, Universitas Airlangga, 60115 Surabaya, East Java, Indonesia

³Department of Aquaculture, Faculty of Fisheries and Marine, Universitas Airlangga, 60115 Surabaya, East Java, Indonesia

⁴Noto Centre for Fisheries Science and Technology, Kanazawa University, Kanazawa 9270552, Japan

*Corresponding Author: agungfauzan@unesa.ac.id

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ABSTRACT

This study evaluated the effects of different live feeds on color intensity, growth performance, and survival of koi fish (*Cyprinus rubrofuscus*) fingerlings. A completely randomized design was employed with four treatments: P0 (control, no live feed), P1 (*Tubifex*), P2 (*Artemia*), and P3 (*Daphnia*), each with three replicates containing 250 fingerlings. Over a 49-day rearing period, significant differences were observed among treatments. The highest color intensity was recorded in the *Tubifex*-fed group (mean score: 2.86), followed by *Artemia* (2.73), control (2.26), and *Daphnia* (2.18). Specific growth rates (SGR) were the highest in the *Artemia* group (4.75%/day) and the lowest in the control group (3.53%/day), though these differences were not statistically significant. Survival rates were at their highest in the *Tubifex* group (95.10%), followed by *Artemia* (85.30%), *Daphnia* (64.90%), and control (62.00%). Analysis of variance indicated that live feed type significantly affected color intensity and survival ($P < 0.05$), deducting growth performance ($P > 0.05$). These findings suggest that *Tubifex* and *Artemia* can enhance the coloration and survival of koi fingerlings, highlighting the importance of selecting appropriate live feeds in koi fish hatchery phase.

INTRODUCTION

The koi fish (*Cyprinus rubrofuscus*), one of the most widely raised ornamental fish species globally, is valued for both its aesthetic appeal and cultural significance. Because of its vibrant coloring and distinctive patterns, it is a popular choice for aquascaping,

ornamental fish competitions, and aesthetically pleasing ponds. Due to increased demand in the international market, Indonesia's koi fish export value increased significantly from USD 12 million in 2010 to USD 20 million in 2011 and USD 65 million by 2016, according to **Hendriana *et al.* (2021)**. This trend highlights the necessity of sustainable production practices to ensure a consistent supply of high-quality koi fingerlings to meet demand from both domestic and international markets.

For koi aquaculture to be successful, the quality of the seeds, particularly regarding development rate, survival, and coloration, is just as crucial as their availability in adequate amounts. **Raharjo *et al.* (2016)** and **Andriani *et al.* (2019)** state that body shape, behavioral traits, health, and most importantly, pigmentation are key factors in determining market value, which determine the aesthetic value of the koi fish. Therefore, to produce koi fish that are commercially viable, it is imperative to improve these traits in the early stages of growth.

Larval rearing is thought to be the most vulnerable stage in fish aquaculture, and effective nutrition management is crucial for this stage's successful completion. The appropriate nutrient requirements for koi fish larvae are very important to be met from the live feed sources provided, with the criteria that live feed fits the mouth opening and is easily digested so that it helps in nutrient absorption and increases survival (**Pangkey *et al.*, 2019**). *Daphnia* sp. and *Artemia* sp., and *Tubifex* sp. are examples of live feeds. They have long been used in larviculture due to their high protein content, palatability, digestibility, and capacity to encourage eating behavior through movement (**Buwono, 2019**).

Carotenoids have also drawn a lot of attention for their ability to improve the pigmentation of ornamental fish. These substances, among them astaxanthin, give fish scales and skin their red, orange, and yellow colors. Because fish cannot produce carotenoids on their own, dietary supplements are required (**Sitorus, 2015**). It is well known that natural live feed contains varying concentrations of carotenoids. *Tubifex* sp. can improve growth and red color pigmentation in koi fish due to its high protein content (58.13%) and carotenoid content (**Sulmartiwi *et al.*, 2003**). While *Artemia* sp. has a protein content of 42%, which increases to 60% in the adult phase, *Daphnia* sp. has a protein content of 42.65% as well as essential fats and mineral levels needed by fish (**Cahyanti *et al.*, 2015**).

Recent research has also looked at other live feed alternatives and feed supplements. According to research by **El-Malah *et al.* (2024)**, black soldier fly larvae meal (BSFLM) can effectively replace fishmeal in koi feed at a dose of 200g/ kg feed, increasing weight gain and specific growth rate (SGR) without reducing survival rates. **Zhang *et al.* (2023)** found that koi fish fed chlorogenic acid (CGA) diets showed higher color intensity, which was the result of increased carotenoids deposited on their scales.

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These findings emphasize that to improve the usability and visual appeal of ornamental species, specific dietary practices are required.

The objective of this research was to assess how different types of live feed affect the growth performance, survival rate, and color intensity of fingerling koi fish (*Cyprinus rubrofuscus*), with a focus on *Tubifex* sp., *Artemia* sp., and *Daphnia* sp. compared to the control group that was not fed on live feed. Fish fed with live feed such as *Tubifex* sp. and *Artemia* sp. showed significantly higher growth rate, survival rate, and body color intensity when compared to the control group or the group fed with *Daphnia*. The results of this study are expected to be used as basic information for planning natural feeding to improve color quality in koi fish hatcheries.

MATERIALS AND METHODS

Tools and materials

This research was conducted in the experimental pond of Omah Koi Farm Indonesia, Banyuwangi, East Java. The research materials used include koi fish larvae (*Cyprinus rubrofuscus*), which are F1 results of natural spawning of Kohaku koi parents with a ratio of female parents: male parents is 1:3, egg yolk, HI-PRO-VITE flour feed, and natural feed (*Tubifex* sp., *Artemia* sp., and *Daphnia* sp.). The tools used in this study include 16 aquariums with a size of 50 × 50 × 50 cm, LP-100 air pump aerator, aerator hose, aerator stone, pH paper, thermometer, DO kit, digital scales, ruler, millimeter block paper, basin, sieve, knife, and stationery.

1. Experimental setup and design

The experiment was conducted in a controlled laboratory setting using sixteen aquariums, each with a capacity of 50 × 50 × 50 cm. The aquariums were filled with dechlorinated water to a depth of 35 cm, and water quality parameters such as pH, temperature, and dissolved oxygen (DO) were monitored daily using standard water testing kits. The experiment followed a completely randomized design (CRD) with four treatments and four replications per treatment. The treatments were as follows:

- **P0 (Control):** No live feed supplementation.
- **P1:** Supplementation with *Tubifex* sp.
- **P2:** Supplementation with *Artemia* sp.
- **P3:** Supplementation with *Daphnia* sp.

Each treatment was applied to 250 koi fish larvae, and the experiment lasted for 49 days.

2. Work procedures

Fish were fed three times daily, and the quantity of feed was adjusted based on the fish's consumption rate. The feeding schedule was designed to ensure that the fish received adequate nutrition without overfeeding, which could lead to water quality issues. For the live feed treatments, *Tubifex* sp. and *Daphnia* sp. were provided live, while *Artemia* sp. was administered in its polar red form, which is readily available and convenient for use in aquaculture.

3. Test parameters

a. Color intensity

Color intensity was measured using digital image analysis with ImageJ software (Hafidah *et al.*, 2024)

b. Specific growth rate (SGR)

The formula for specific growth rate (SGR) is as follows (Najdegerami, 2016).

$$SGR = \left(\frac{\ln W_t - \ln W_o}{t} \right) \times 100$$

SGR = specific growth rate (%)

Wt = average wet weight at the end of culture (g)

Wo = average wet weight at the beginning of culture (g)

t = days of culture (day)

c. Survival rate

According to Zaman *et al.* (2020), survival can be calculated by the formula.

$$SR = \left(\frac{N_t}{N_o} \right) \times 100$$

SR = survival rate (%)

Nt = number of fish at the end of rearing (fish)

No = number of fish at the beginning of maintenance (fish)

4. Data analysis

Color intensity, specific growth rate, and survival rate were analyzed using analysis of variance (ANOVA) by the SPSS v.22, and the means were compared using the

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Duncan test ($P < 0.05$). Water quality parameters measured were pH, temperature, DO, nitrite, nitrate, and TAN and analyzed descriptively (Fauzan *et al.*, 2017).

RESULTS

1. Color intensity

The color intensity of koi fish was evaluated using the ImageJ 1.53 (University of Wisconsin, US) application, where higher scores indicated greater vibrancy and appeal. The results showed that the *Tubifex* sp. treatment (P1) achieved the highest color intensity score of 2.86 ± 0.28 . This was followed by the *Artemia* sp. treatment (P2) with a score of 2.73 ± 0.08 , the control group (P0) with a score of 2.26 ± 0.40 , and the *Daphnia* sp. treatment (P3) with the lowest score of 2.18 ± 0.29 .

The superior color intensity in the *Tubifex* sp. treatment can be attributed to the live feed's nutritional profile, particularly its high content of pigments such as astaxanthin, a carotenoid known to enhance red coloration in fish. This aligns with previous studies that have demonstrated the positive effects of dietary carotenoids on color intensity in koi fish. The vibrant colors of koi fish are a key factor in their market value, making *Tubifex* sp. a beneficial choice for farmers aiming to enhance the aesthetic appeal of their fish.

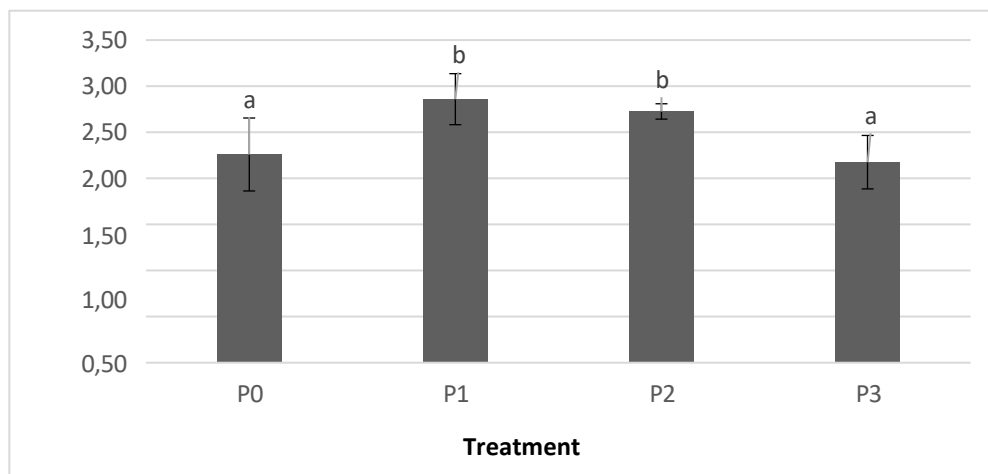


Fig. 1. Color intensity of koi fish in P0: control, P1: *Tubifex* sp., P2: *Artemia* sp., P3: *Daphnia* sp.

2. Specific growth rate

The specific growth rate (SGR) is a critical measure of how quickly the fish are growing, which is essential for optimizing production cycles in aquaculture. The results indicated that the *Artemia* sp. treatment (P2) yielded the highest SGR of $4.75\% \pm 0.95$. This was followed by the *Daphnia* sp. treatment (P3) with an SGR of $4.10\% \pm 1.56$, the *Tubifex* sp. treatment (P1) with an SGR of $3.66\% \pm 0.71$, and the control group (P0) with the lowest SGR of $3.53\% \pm 0.53$.

The highest SGR in the *Artemia* sp. treatment suggests that this live feed provided a balanced mix of nutrients, including high protein and essential fatty acids, which are crucial for growth and development in koi fish larvae. While *Tubifex* sp. and *Daphnia* sp. also supported growth, they may not offer the same level of nutrients needed for growth as *Artemia* sp. for this parameter. This finding highlighted the importance of selecting feeds that cater to the specific nutritional needs of koi fish to maximize growth rates.

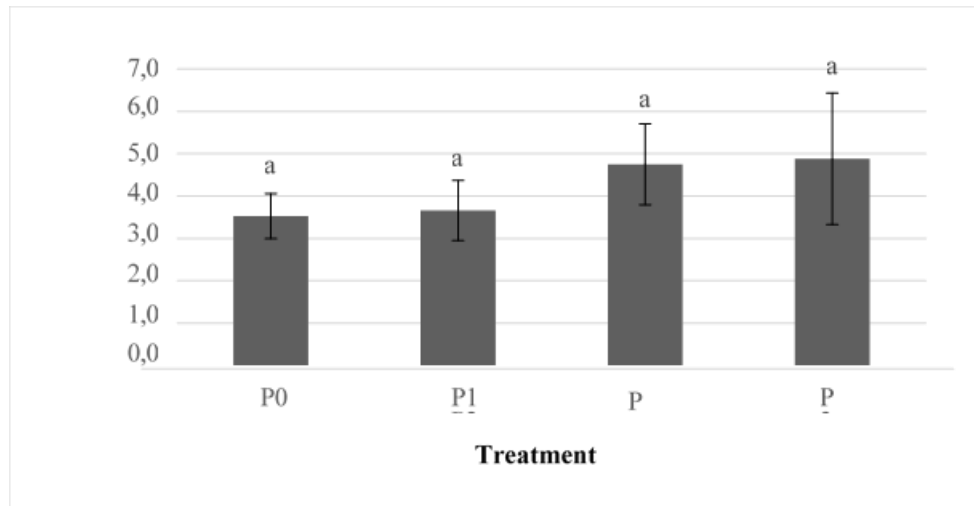


Fig. 2. Specific growth rate of koi fish in P0: control, P1: *Tubifex* sp., P2: *Artemia* sp., P3: *Daphnia* sp.

3. Survival rate

Survival rate is a vital indicator of the overall health and resilience of fish under given conditions. The results showed that the *Tubifex* sp. treatment (P1) achieved the highest survival rate of $95.10\% \pm 2.85\%$. This was followed by the *Artemia* sp. treatment (P2) with a survival rate of $85.30\% \pm 4.67\%$, the *Daphnia* sp. treatment (P3) with a survival rate of $64.90\% \pm 12.74\%$, and the control group (P0) with the lowest survival rate of $62.00\% \pm 8.90\%$.

The significantly higher survival rate in the *Tubifex* sp. treatment underscores its role in enhancing the health and resilience of koi fish. A higher survival rate translates to fewer losses during the growth period, which is economically beneficial for farmers. The lower survival rates in the *Daphnia* sp. and control treatments may be attributed to inadequate nutrition or a lack of essential nutrients that *Tubifex* sp. and *Artemia* sp. provided. This emphasizes the importance of providing high-quality, nutrient-rich feeds to koi fish to maximize their survival and overall health.

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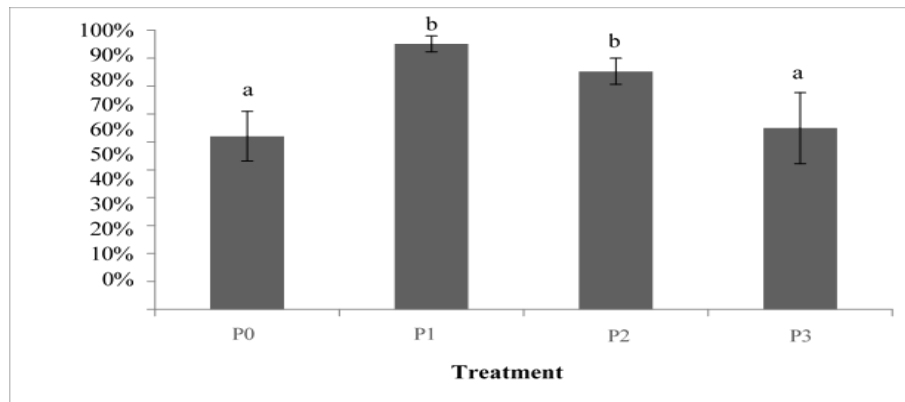


Fig. 3. Survival rate of koi fish in P0: control, P1: *Tubifex* sp., P2: *Artemia* sp., P3: *Daphnia* sp.

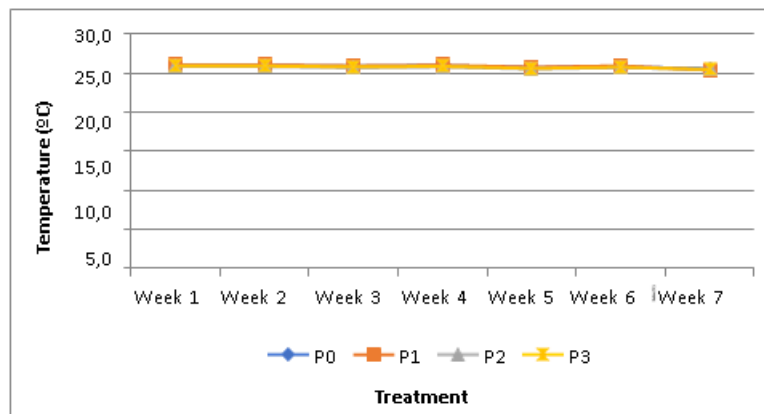


Fig. 4. Temperature of koi ponds in P0: control, P1: *Tubifex* sp., P2: *Artemia* sp., P3: *Daphnia* sp.

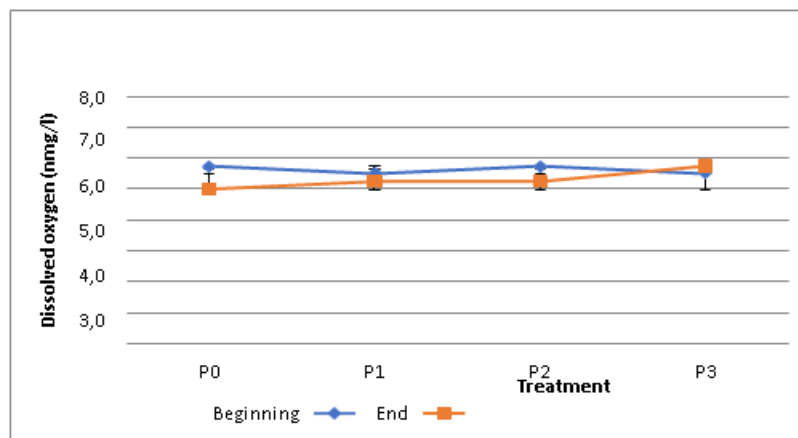


Fig. 4. Dissolved oxygen of koi ponds considering P0: control, P1: *Tubifex* sp., P2: *Artemia* sp., P3: *Daphnia* sp.

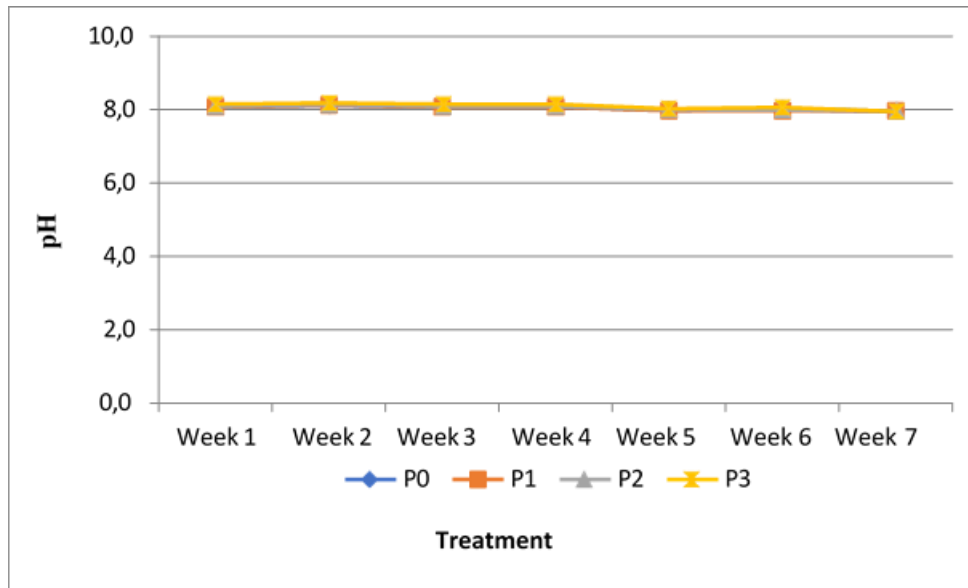


Fig. 4. pH of koi ponds regarding: P0: control, P1: *Tubifex* sp., P2: *Artemia* sp., P3: *Daphnia* sp.

4. Water quality

Despite the temperature of 27°C in the P1 treatment, the results show that the water temperature is still within the ideal range (Table 1). The ideal range of temperatures for koi living media is between 20 and 26 degrees Celsius, per the Indonesian National Standard (SNI, 2011). SNI (2011) states that the ideal pH range is between 6.5 and 8, the dissolved oxygen level should be at least 5mg/ l, the maximum nitrate should be 50mg/ l, and the maximum nitrite should be 0.2mg/ l. Conversely, Boyd (1982) states that an ammonia concentration of less than 0.2mg/ l is ideal.

The pH value for each treatment was 6. The range of dissolved oxygen was 4.39 to 5.28mg/ l (Table 1). From the start of the experiment to the end, the nitrite and TAN parameters dropped, with the exception of the control, but the values remained within the ideal range (Tables 2, 4). After the initial maintenance recorded a high value above the ideal limit for koi fish, nitrate also dropped in all treatments (Table 3).

Table 1. Data of temperature, pH, and dissolved oxygen in treatment

Parameter	Unit	Time	K	P1	P2	P3
Temperature	(°C)	07.00	25	25-26	25-27	25-27
		17.00	25-27	25-27	25-27	25-26

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pH		07.00	6	7	6	6
		17.00	6	6	7	6
Dissolved oxygen	(mg/l)	07.00	5,22	5,11	5,08	5,22
		17.00	5,11	5,11	5,06	5,11

Table 2. Data of nitrite (NO₂) in treatment (mg/l)

Treatment	Week 1	Week 4	Week 7
K	0.024	0.038	0.079
P1	0.110	0.042	0.009
P2	0.066	0.041	0.042
P3	0.169	0.037	0.049

Table 3. Data of nitrate (NO₃) in the treatment (mg/l)

Treatment	Week 1	Week 4	Week 7
K	87.667	45.000	30.000
P1	64.667	34.000	35.333
P2	75.667	35.667	32.333
P3	96.667	34.333	34.667

Table 4. Data of total ammonia nitrogen TAN in the treatment (mg/l)

Treatment	Week 1	Week 4	Week 7
K	0.060	0.048	0.153
P1	0.091	0.043	0.008
P2	0.062	0.003	0.013
P3	0.052	0.024	0.003

DISCUSSION

1. Color intensity

The study revealed that the provision of different natural feeds significantly influenced the color intensity of koi fish seeds. The treatment using *Tubifex* sp. resulted in the highest color intensity value (2.86 ± 0.28), followed by *Artemia* sp. (2.73 ± 0.08), the control group (2.26 ± 0.40), and *Daphnia* sp. (2.18 ± 0.29). This finding aligns with previous research that found that *Tubifex* sp. enhanced the color intensity in ornamental fish (Septiyan *et al.*, 2017). Color intensity in koi fish is influenced by the content of carotenoid pigments in their diet, particularly astaxanthin, which plays a crucial role in enhancing red pigmentation (Indarti *et al.*, 2012). *Tubifex* sp. contains a relatively high amount of astaxanthin (8,000 ppm) compared to *Artemia* sp. (0.8mg/ g) and *Daphnia* sp. (800µg/ g) (Gaillard *et al.*, 2004; Kumar & Marian, 2006). The higher carotenoid content in *Tubifex* sp. explains why this treatment yielded the highest color intensity. However, this result differs from a study by Prasetyo *et al.* (2020), which found that *Daphnia* sp. enriched with astaxanthin could improve the red coloration of koi fish. This discrepancy may be attributed to differences in nutritional content and enrichment methods used in the studies.

2. Specific growth rate (SGR)

The study indicated that the provision of different natural feeds did not significantly affect the specific growth rate (SGR) of koi fish fingerlings. The treatment with *Artemia* sp. showed the highest SGR ($4.75\% \pm 0.95$), followed by *Daphnia* sp. ($4.10\% \pm 1.56$), *Tubifex* sp. ($3.66\% \pm 0.71$), and the control group ($3.53\% \pm 0.53$). The high protein content in *Artemia* sp. (58%) likely supported the higher growth rate compared to other live feeds (Cahyanti *et al.*, 2015). However, this finding contrasts with a study by

Taufiqurrahman et al. (2017), which reported that *Tubifex* sp. improved the growth rate of snakehead fish fingerlings. This difference could be due to variations in fish species and their nutritional requirements.

Live feed is fundamental factors in larval rearing for sustainable culture of fin fishes and shellfishes. Fin fishes larvae have undeveloped digestive system with low level enzymes. The zooplankton serves as living capsules of nutrition to the cultivable species. About the protein, carbohydrate, and lipid contents of the larvae of goldfish and koi carp after 40 days of feeding experiments, there is no statistical difference between the experimental diets. However, the highest survival of both fishes was recorded in mixed feeding regimes but the highest growth was recorded in *T. decipiens* feeding regimes (**Kandhasamy et al., 2023**).

The results indicated that both phytoplankton and zooplankton played a crucial role in the early phases of carp fry growth. The fry mostly fed on rotifers, cladocerans, and various algae species. The nutritional composition and availability of plankton in the ponds were significantly affected by water temperature and fertilization techniques, which played a role in the overall productivity of the ponds. The study asserts that ensuring a well-balanced and diverse plankton population through suitable fertilization is crucial for maximizing the growth and survival of carp fry in nursery ponds (**Al-Hilali et al., 2025**).

3. Survival rate (SR)

The study demonstrated that the provision of different live feeds significantly influenced the survival rate of koi fish seeds. The treatment with *Tubifex* sp. resulted in the highest survival rate ($95.10\% \pm 2.85\%$), followed by *Artemia* sp. ($85.30\% \pm 4.67\%$), *Daphnia* sp. ($64.90\% \pm 12.74\%$), and the control group ($62.00\% \pm 8.90\%$). The high protein content in *Tubifex* sp. (58.13%) likely contributed to the superior survival rate (**Rahmi et al., 2017**). This finding is consistent with a study by **Septiyan et al. (2017)**, who found that *Tubifex* sp. improved the survival rate of guppy fish.

4. Water quality

Water quality parameters during the study, including temperature (25–27°C), pH (7.9–8.5), and dissolved oxygen (5.0–6.0 mg/l), were within the optimal range for koi fish growth. These results align with a study by **Deriyanti (2016)**, which determined that optimal water quality for koi fish includes a temperature range of 25–30°C, pH of 6.5–8.5, and dissolved oxygen levels above 5mg/l.

5. Similarities and differences with related studies

This study shares similarities with previous research in the use of natural feeds to enhance color brightness and survival rates in koi fish (Septiyan *et al.*, 2017; Prasetyo *et al.*, 2020). However, differences were observed in the specific growth rate results, possibly due to variations in fish species and nutritional requirements.

CONCLUSION

In conclusion, the study demonstrates that the choice of live feed significantly impacts the color intensity, growth rate, and survival rate of koi fish. *Tubifex* sp. emerged as the most effective feed for enhancing color intensity and survival rate, while *Artemia* sp. supported the highest growth rate. These findings provide valuable insights for koi fish farmers seeking to optimize their feeding strategies to produce healthier, more vibrant fish. By understanding the effects of different natural feeds, farmers can make informed decisions to enhance the quality and market value of their koi fish.

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REFERENCES

- Al-Hilali, H.; Lozovski, A. R. and Al-Khshali, M. (2025). The natural food base of nursery ponds and the diet of the common carp fry in Iraq. *Egyptian Journal of Aquatic Biology & Fisheries*, *29*(1), 1023–1046.
- Boyd, C. E. (1982). *Water Quality Management for Pond Fish Culture*. Elsevier.
- Cahyanti, E. N.; Subandiyono and Herawati, V. E. (2015). Tingkat Pemanfaatan *Artemia* sp. Awetan dan Pakan Buatan untuk Udang Windu (*Penaeus monodon*). *Journal of Aquaculture Management and Technology*, *4*(2), 44–50. <https://doi.org/10.35799/jamt.v4i2.44>
- Deriyanti, A. (2016). Korelasi Kualitas Air Dengan Prevalensi *Myxobolus* Pada Ikan Koi (*Cyprinus carpio*) Di Setra Budidaya Ikan Koi Kabupaten Blitar, Jawa Timur. Skripsi. Fakultas Perikanan dan Kelautan, Universitas Airlangga.
- Fauzan, A. L.; Soelistyowati, D. T.; Junior, M. Z.; Hardiantho, D. and Setiawati, M. (2017). Aromatase gene expression and masculinization of Nile tilapia immersed in water at 36 °C containing 17 α -methyltestosterone. *Jurnal Akuakultur Indonesia*, *16*(1), 116-123.
- Gaillard, M.; Juillet, C. and Cézilly, F. (2004). Carotenoids of Two Freshwater Amphipod Species (*Gammarus pulex* and *G. roeseli*) and Their Common

- Acanthocephalan Parasite *Polymorphus minutus*. *Comparative Biochemistry and Physiology, Part B*, *139*(2), 129–136. <https://doi.org/10.1016/j.cbpc.2004.07.005>
- Hafidah, R.; Soelistyowati, D. T. and Sudrajat, A. O.** (2024). Genetic Relationship Analysis of Genus *Nomorhamphus* from Lindu Lake, Central Sulawesi and Adaptive Responses to Exposure Different Light Wavelengths. *Scientific Journal of Fisheries & Marine/Jurnal Ilmiah Perikanan dan Kelautan*, *16*(2).
- Indarti, S.; Muhaemin, M. and Hudaiah, S.** (2012). Modified True Match Colour Finder (MTCF) Dan Kromatofor Sebagai Penduga Tingkat Kecerahan Warna Ikan Komet (*Carassius auratus*) Yang Diberi Pakan Dengan Proporsi Tepung Kepala Udang (TKU) Yang Berbeda. *Jurnal Rekayasa dan Teknologi Budidaya Perairan*, *1*(1), 9–16.
- Kandhasamy, S.; Palanichamy, M. and Kareem, A.** (2023). Effects of different feed types on growth and production of the early life stages of farmed fish. *Egyptian Journal of Aquatic Biology & Fisheries*, *27*(1), 495–508.
- Kumar, P. A. and Marian, M. P.** (2006). Studies on Carotenoids in *Artemia parthenogenetica*. *Roumanian Society of Biological Sciences*, *11*(3), 2733–2737.
- Najdegerami, E. H.; Bakhshi, F. and Lakani, F. B.** (2016). Effects of biofloc on growth performance, digestive enzyme activities, and liver histology of common carp (*Cyprinus carpio* L.) fingerlings in a zero-water exchange system. *Fish Physiology and Biochemistry*, *42*(2), 457–465. <https://doi.org/10.1007/s10695-015-0151-9>
- Prasetyo, D.; Handajani, H.; Hermawan, D. and Fuhaira, I.** (2020). Pengaruh Pengkayaan *Daphnia* sp. Menggunakan Astaxanthin Terhadap Kualitas Warna Merah Ikan Cupang Halfmoon (*Betta splendens*, Regan 1910). *Jurnal Sains dan Inovasi Perikanan*, *4*(1), 32–37.
- Rahmi; Ramses and Pramuanggit, P. N.** (2017). Pemberian Pakan Pelet dan Cacing Sutera Pada Pemeliharaan Benih Ikan Hias Nemo. *Jurnal Simbiosis*, *6*(1), 40–47.
- Septiyan, R.; Rusliadi and Iskandar, P.** (2017). The Effect of Different Conditions on Growth and Colour of Guppy Fish (*Poecilia reticulata*). Fakultas Perikanan dan Kelautan, Universitas Riau.
- SNI.** (2011). *Ikan hias koi (Cyprinus carpio L.) - syarat mutu dan penanganan* [Ornamental koi fish (*Cyprinus carpio* L.) - Quality and handling requirements]. Badan Standardisasi Nasional. <http://sispk.bsn.go.id/SNI/DetailSNI/11643>
- Taufiqurrahman, W.; Gumay Yudha, I. and Damai, A. A.** (2017). Efektivitas Pemberian Pakan Alami yang Berbeda Terhadap Pertumbuhan Benih Ikan Tambakan (*Helostoma temminckii*). *Jurnal Rekayasa dan Teknologi Budidaya Perairan*, *8*(1), 1–10.

Zaman, Y. R.; Wiguno, T. A. A.; Dewi, N. N.; Agustono; Wulansari, P. D.; Prayogo and Fauzan, A. L. (2020). Combination of biofloc and sex reversal technology in red tilapia intensive culture (*Oreochromis niloticus*): performance of culture and water quality profile. *Ecology, Environment, and Conservation*, *27*(2), 752–758.