

THE EFFECT OF COMMERCIAL FEEDING FREQUENCY ON THE ABSOLUTE LENGTH GROWTH OF 2-3 cm COMET FISH (*Carassius auratus*)

Pengaruh Frekuensi Pemberian Pakan Komersial terhadap Pertumbuhan Panjang Mutlak Ikan Komet (*Carassius auratus*) Ukuran 2-3 cm

Usu Rismayanti*, Muhajir, Indra Wirawan

Aquaculture Study Program, Dr. Soetomo University

Semolowaru Street No. 84, Surabaya, East Java 60118

*Corresponding author: usurismayanti@gmail.com

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ABSTRACT

The comet fish (*Carassius auratus*) is one type of freshwater ornamental fish that has many enthusiasts and maintains a relatively stable price in both domestic and international markets. The high demand for comet fish needs to be supported by excellent feed given to the fish, whether in the form of natural feed or commercial feed. Commercial feed has many advantages, including having a very complete and balanced nutritional composition as well as consistent availability throughout the year. In addition, one of the important elements in feed management is the feeding frequency. Feeding too infrequently can cause the fish to lack nutrients when needed, whereas feeding too often can reduce water quality. This study aims to determine the effect of commercial feed feeding frequency on the absolute length growth of comet fish. This study uses the Complete Randomized Design (CRD) experimental method with 3 treatments and 9 repetitions, where treatment A (frequency 2 times a day), B (frequency 3 times a day), and treatment C (frequency 4 times a day). The test animals were comet fish measuring 2-3 cm, totaling 81 individuals with a stocking density of 1 fish/L. The experimental medium used freshwater with a volume of 3 L per container. The results of the study showed that treatment B provided the best results for the absolute length growth of 2-3 cm comet fish at 2.2 cm per fish. Water quality data showed a water temperature ranging from 28.1 to 28.3 °C, a pH ranging from 7.16 to 7.19, and dissolved oxygen ranging from 5.39 to 5.57 ppm.

Keywords: Absolute Length Growth, Commercial Feed, Frequency, Goldfish

ABSTRAK

Ikan komet (*Carassius auratus*) merupakan salah satu jenis ikan hias air tawar yang memiliki banyak peminat dan harganya relatif stabil baik pasar domestik maupun internasional. Tingginya permintaan terhadap ikan komet ini perlu didukung oleh pakan unggul yang diberikan pada ikan baik berupa pakan alami maupun pakan komersial. Pakan komersial memiliki banyak keunggulan, diantaranya memiliki komposisi nutrisi sangat lengkap dan seimbang serta konsistensi ketersediaannya sepanjang waktu. Selain itu, salah satu unsur

penting dalam manajemen pemberian pakan adalah frekuensi pemberian pakan. Pemberian pakan dengan frekuensi terlalu jarang menyebabkan ikan kekurangan asupan gizi pada saat dibutuhkan, sebaliknya bila terlalu sering dapat menurunkan kualitas air budidaya. Penelitian ini bertujuan untuk mengetahui pengaruh frekuensi pemberian pakan komersial terhadap pertumbuhan panjang mutlak ikan komet. Penelitian ini menggunakan metode eksperimen Rancangan Acak Lengkap (RAL) dengan 3 perlakuan dan 9 ulangan, dimana perlakuan A (frekuensi 2x sehari), B (frekuensi 3x sehari), dan perlakuan C (frekuensi 4x sehari). Hewan uji berupa ikan komet ukuran 2-3 cm sebanyak 81 ekor dengan padat tebar 1 ekor/L. Media percobaan menggunakan air tawar dengan volume 3 L/wadah. Hasil penelitian menunjukkan perlakuan B memberikan hasil terbaik terhadap pertumbuhan panjang mutlak ikan komet ukuran 2-3 cm sebesar 2,2 cm/ekor. Data kualitas air diperoleh suhu air berkisar 28,1 – 28,3°C, derajat keasaman berkisar 7,16 – 7,19 dan oksigen terlarut berkisar 5,39 – 5,57 ppm.

Kata Kunci: Frekuensi, Ikan Komet, Pakan Komersial, Pertumbuhan Panjang Mutlak

INTRODUCTION

Potency of ornamental fish in Indonesia reaches 300 million individuals per year, consisting of 226 freshwater fish species and 240 marine fish species. Based on statistical data from the Ministry of Marine Affairs and Fisheries in 2024, ornamental fish production also increased from 1.87 billion individuals in 2023 to 2.33 billion individuals in 2024, indicating that the demand for ornamental fish continues to increase. The attractiveness of ornamental fish is assessed based on color, body shape, behavior, and stamina (Wahidan & Mulyani, 2024). According to Wardaya *et al.*, (2021), comet fish (*Carassius auratus*) are one of the freshwater ornamental fish species with high market demand. Umasugi *et al.* (2022) added that comet fish (*Carassius auratus*) are favored due to their attractive body shape, diverse coloration, docile behavior, and ease of maintenance. The continuously increasing demand for comet fish necessitates the development of more effective aquaculture techniques, particularly feed management as a primary factor influencing growth (Kristiana *et al.*, 2024).

One of the supporting aspects for the success of aquaculture activities is proper feed management so that it can be utilized by fish effectively and efficiently to produce optimal growth. Feed provided to fish must be appropriate in terms of quality, quantity, and feeding time so that it can be used effectively and efficiently to optimize fish growth. According to Setyono *et al.* (2020), aquaculture success requires proper feed management in terms of quality, amount, and feeding time. Feed must fulfill nutritional requirements such as protein, fat, energy, vitamins, and minerals. Feed availability and appropriate nutritional content are also factors that can improve business efficiency (Lainun *et al.*, 2017). Based on the statement of Rahim *et al.* (2025), commercial feed is commonly used because it is easy to obtain and contains balanced nutritional composition.

Feeding frequency plays an important role in growth, where excessively low feeding frequency causes nutritional deficiencies, while excessively high feeding frequency reduces water quality due to uneaten feed residues (Ulum *et al.*, 2020). Information regarding absolute length growth of ornamental fish is very important to obtain, because it can directly affect visual appearance and the economic value of the fish.

Based on these issues, it is necessary to conduct research on the effect of commercial feed feeding frequency on the absolute length growth of comet fish (*Carassius auratus*).

METHODS

This study was conducted for 30 days, from 1 November to 30 November 2025 at Tambak Samudra Sumber Rejeki, Situbondo. This research employed an experimental method using a Completely Randomized Design (CRD), with feeding frequency as the treatment factor,

consisting of three treatments and seven replications, resulting in 27 experimental units. Treatment A consisted of feeding twice daily at 06.00 and 18.00, treatment B consisted of feeding three times daily at 06.00, 12.00, and 18.00, and treatment C consisted of feeding four times daily at 06.00, 12.00, 18.00, and 24.00.

The test animals used in this study were comet fish measuring 2–3 cm in length with an average weight of 1 g per individual. Based on research conducted by Sugihartono *et al.* (2023), the stocking density used for comet fish rearing is 1 individual per liter. Experimental containers consisted of jars with a capacity of 5 liters and were filled with freshwater at a volume of 3 liters per container. During the rearing period, comet fish were fed at a dosage of 5% of their body weight.

There were two variables in this study, namely independent variables and control variables. The independent variable of the study was absolute length growth. The control variables consisted of water quality parameters, including temperature, pH, and DO (Dissolved Oxygen), which were measured daily. According to Santika *et al.* (2021), the method for calculating absolute length growth of the test animals uses the following formula:

$$L = L_t - L_0$$

Information:

L : Average absolute length growth of test animals (cm)

L_t : Average final length of test animals (cm)

L₀ : Average initial length of test animals (cm)

At the end of the study, the data obtained were then analyzed to determine the effect of different feeding frequencies on the absolute length of comet fish. The growth data obtained from the research results were then analyzed using one-way analysis of variance (ANOVA) at a 5% significance level. If the results of the analysis of variance or ANOVA show a significantly different effect or a highly significant difference, then it is necessary to conduct a BNT (Smallest Real Difference) or LSD (Least Significant Difference) test as a calculation tool to analyze the data in the study using the IBM SPSS statistics program 26.

RESULTS

The parameters observed in this study were absolute length growth and culture water quality (temperature, pH, DO). Based on the results of research on the effect of commercial feeding frequency on the absolute length growth of 2-3 cm goldfish (*Carassius auratus*), different averages were obtained between treatments. The results of observations on the absolute length growth of goldfish are as shown in Table 1.

Table 1. Absolute Length Growth of Comet Fish

Repeat	Absolute length growth		
	Treatment A	Treatment B	Treatment C
1	1.2	2.2	1.7
2	1.3	2.3	1.6
3	1.2	2.0	1.8
4	1.3	2.1	1.7
5	1.2	2.0	1.7
6	1.3	2.4	1.7
7	1.3	2.2	1.8
8	1.3	2.1	1.7
9	1.3	2.3	1.7
Average	1.3	2.2	1.7

The results of the study on the effect of the frequency of commercial feeding on the absolute length growth of comet fish (*Carassius auratus*) measuring 2-3 cm obtained the following data: treatment A; 1.3 cm, treatment B; 2.2 cm, and treatment C; 1.7 cm. The results of the test using ANOVA showed that the frequency of commercial feeding had a significant effect on the absolute length growth of comet fish measuring 2-3 cm ($F > \text{Sign}$).

Throughout the study, water quality remained relatively homogeneous and within the normal range tolerated by goldfish. Based on observations during the study, the results of water quality checks for goldfish cultivation are shown in Table 2.

Table 2. Water Quality

Treatment	A	B	C	Library
Temperature range (°C)	28,1 – 28,3	28,1 – 28,2	28,1 – 28,2	23 – 28,5°C (Ramdhani & Setyono, 2023)
pH range	7,16 – 7,18	7,16 – 7,19	7,16 – 7,18	6 – 8 (Anwar, <i>et al.</i> , 2021)
DO range (mg/L)	5,39 – 5,56	5,40 – 5,57	5,41 – 5,55	4 – 6 mg/L (Agustina, <i>et al.</i> , 2023)

DISCUSSION

Absolute Length Growth

Growth is a biological process influenced by internal and external factors, characterized by changes in body size, both in length and weight, of an organism over a certain period. Fish growth rate is closely related to the balance between the amount of feed provided, the stomach capacity of the fish, and the rate of gastric evacuation after the digestion process occurs. Based on the results of a one-way ANOVA test, it was found that different frequencies of commercial feed administration had a significant effect on the absolute length growth of comet fish measuring 2–3 cm ($P < 0.05$). Further analysis using the 5% LSD test showed that treatment B produced the best result on the absolute length growth of comet fish, reaching 2.2 cm.

When compared with treatments C and A, treatment B resulted in the highest average absolute length growth of comet fish. This was because the feeding frequency was most compatible with the gastric evacuation cycle of the fish. At this frequency, feed could be digested and absorbed optimally, allowing nutrients to be efficiently utilized for new tissue formation. According to Koto *et al.* (2022), feeding schedules that correspond to gastric emptying time allow digestive enzymes such as protease, amylase, and lipase to function optimally in breaking down proteins, carbohydrates, and lipids into simpler molecules that are easily absorbed. Proper gastric emptying plays a crucial role in energy metabolism and new tissue synthesis, thereby optimizing absolute length growth in fish.

In addition, treatment B was proven to be effective in maintaining water quality stability, as the feed could be consumed optimally without leaving residues that could contaminate the culture medium. Consequently, the test animals avoided stress and were able to support optimal physiological functions, ensuring absolute length growth. Appropriate feeding frequency plays an important role in enhancing the growth performance of fish in terms of absolute length.

When compared with treatment B, the average growth in treatment C began to decline. Excessively frequent feeding caused the stomach to have insufficient time to empty, resulting in reduced efficiency of digestive enzyme activity. This condition led to suboptimal nutrient absorption. Furthermore, excessive feeding frequency increased the potential for uneaten feed residues and organic matter accumulation, which subsequently reduced water quality and induced physiological stress in fish, thereby inhibiting growth. When feed is provided too frequently, the stomach of the test animals tends to remain full, causing the digestion process

to be less optimal. The effectiveness of digestive enzymes decreases because the contact time between enzymes and substrates becomes limited, resulting in incomplete nutrient breakdown. According to Islami *et al.* (2017), a stomach that never reaches an empty state or lacks sufficient time for emptying can disrupt digestive function and reduce nutrient absorption efficiency, thereby inhibiting absolute length growth in fish.

In treatment C, fish experienced stress due to a decline in water quality triggered by the accumulation of metabolic waste and uneaten feed. Excessive feeding frequency increased the accumulation of organic materials such as ammonia, nitrite, and nitrate, which are toxic in nature, thereby inducing metabolic disturbances and increasing the physiological burden on fish (Wardhani *et al.*, 2011).

When compared with treatments B and C, treatment A showed the most significant decrease in average length growth. Feeding frequency that was too infrequent caused fish to experience prolonged periods of starvation, leading to reduced metabolism and inconsistent energy availability for growth. Excessively long gastric emptying inhibited protein synthesis, disrupted tissue deposition, and triggered hormonal imbalances involved in appetite regulation and metabolism. Although water quality in treatment A was relatively safer compared to treatment C, this condition was insufficient to compensate for the lack of nutrient intake required for optimal fish growth. According to Haryasakti and Wahyudi (2023), insufficient and uneven nutrient intake throughout the day causes protein synthesis and muscle tissue deposition processes to be suboptimal, thereby slowing absolute length growth in fish. Physiologically, infrequent feeding frequency may also trigger disturbances in hormonal balance that regulate appetite and digestive metabolism.

In terms of water quality, feeding frequency in treatment A tended to be safer compared to treatment C. Nevertheless, the relatively long intervals between feeding events resulted in the longest starvation period for the test animals and uneven nutrient intake, potentially causing metabolic disturbances in the test animals.

Water Quality

An important aspect that must be considered in aquaculture activities is water, which functions as the living medium for cultured organisms. The growth and development of aquatic biota can occur optimally when supported by good water quality, as appropriate water quality in the rearing medium facilitates fish metabolism during physiological processes. Water quality parameters can affect the survival of aquatic organisms. Therefore, maintaining water quality during fish rearing is crucial (Aonullo & Manida, 2022).

1. Temperature

Fish can tolerate water temperatures up to 24°C (Ribeiro *et al.*, 2021). If fish live in water with temperatures below 20°C, they tend to become passive and experience metabolic disturbances, which can make them susceptible to disease or even cause mortality (Putra, 2019). Conversely, excessively high temperatures can lead to fish mortality due to decreased oxygen solubility and increased toxicity levels. The intensity of sunlight reaching the water surface can influence water temperature and fish survival. The ideal temperature range for comet fish fry is 23–28.5°C (Ramdhani and Setyono, 2023).

2. Degree of Acidity (pH)

The degree of acidity (pH) of water indicates the concentration of hydrogen ions or protons present in the water. Water pH can influence the toxicity of certain compounds, fish survival and growth, as well as the processes and rates of chemical reactions within the aquatic environment. Extremely high (alkaline) or low (acidic) pH levels can disrupt the metabolism of aquatic organisms. Fadli (2021) stated that excessively low or high pH levels can reduce fish appetite, decrease metabolic rates, increase susceptibility to disease, inhibit growth, and

ultimately cause mortality. However, each fish species responds differently to pH changes, resulting in varied effects. Water pH is commonly used as an indicator of water quality conditions. The ideal pH range for the rearing and growth of cultured fish is 7–8, while the optimal pH range for comet fish culture is 6–8 (Anwar *et al.*, 2021).

3. Dissolved Oxygen (DO)

Air diffusion into water and photosynthetic activity are the main sources of oxygen in aquatic environments. Many aquatic organisms utilize dissolved oxygen for respiration. Low oxygen levels can affect biological functions, slow growth, and even cause fish mortality. Fish size, water temperature, and activity level influence oxygen requirements. Water temperature is negatively correlated with dissolved oxygen concentration, meaning that higher temperatures can result in lower oxygen levels in water (Nur *et al.*, 2017). According to Agustina *et al.* (2023), comet fish fry can survive optimally in waters with dissolved oxygen concentrations of 4–6 mg/L.

CONCLUSION

Based on the research conducted, feeding frequency of commercial feed had a significant effect on the absolute length growth of comet fish measuring 2–3 cm, with a feeding frequency of three times per day resulting in the highest growth. This outcome is related to the feeding rhythm that allows optimal gastric emptying time, thereby enhancing digestion and nutrient absorption efficiency while reducing feed residues in the rearing containers. Under these conditions, more energy is allocated to growth compared to other treatments. Meanwhile, water quality parameters, including temperature, pH, and dissolved oxygen, remained stable and homogeneous across all treatments, indicating that environmental factors were not differentiating variables. Thus, variations in growth among treatments were entirely influenced by the applied feeding frequency.

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