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Application of Different Feeding Rate to the Growth and Survival Rate of *Garra rufa*

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ABSTRACT

Garra rufa fish from the Cyprinidae family are known as "doctor fish" in the context of health tourism due to their use as an alternative medicine to help cure various skin diseases. *Garra rufa* are benthic fish or freshwater bottom dwellers that naturally live in rocky rivers and feed on microscopic organisms. *Garra rufa* culture in Indonesia is still limited due to the lack of technical information regarding cultivation aspects such as water quality management, feeding, and maintenance techniques. The purpose of this activity is to determine the *Garra rufa* culture techniques with different feeding rate on their growth and survival rate. The method applied in this research was a descriptive experimental method using two different percentages of feeding rate, namely 3% and 5% of the fish's body weight, kept in an aquarium for 21 days. The parameters observed were growth and survival rate. The results obtained were *Garra rufa* maintained with a 5% feeding rate had higher growth but were not more efficient when viewed from their higher FCR values. The survival of both feeding rate treatments was at high figures, namely 87% and 95%.

INTRODUCTION

Garra rufa fish is a species of freshwater fish from the Cyprinidae family that is naturally distributed in Turkey. This fish has a unique behavior in the form of a habit of eating dead human skin cells, so it is widely used in fish spa therapy and pedicures. In the context of health tourism, this fish is referred to as the "doctor fish" because of its use as an alternative medicine to help cure various skin diseases such as psoriasis and eczema (Aydin & Khan, 2020). Morphologically, *Garra rufa* has a relatively small body size, with an average length ranging from 7 to 13 cm with a cylindrical and elongated body shape. Its body color is generally greenish brown, with a yellowish belly, and there are black spots at the base of the tail (Prasetyarti & Rokhmani, 2018).

Garra rufa is a benthic, or bottom-dwelling, fish that naturally lives in rocky rivers. This species has a distinctive feeding habit, consuming microscopic organisms attached to the surfaces of rocks and gravel. These fish are known to be primarily herbivorous, but they are also known to consume carnivorous or detritivorous foods (Celik *et al*., 2023). This also aligns

with the opinion of Demirci *et al*. (2016), who stated that the types of natural food consumed include phytoplankton, cyanobacteria, diatoms, and detritus found in the water.

In general, the optimal daily feed amount for *Garra rufa* is approximately 0.042 grams per fish per day, equivalent to 3.2% of the fish's body weight. This amount is considered sufficient to meet nutritional needs and promote good growth without overfeeding, which can pollute the water. Feeding three times daily has been shown to produce good growth results (Catarino *et al*., 2019). *Garra rufa* cultivation in Indonesia, particularly at the laboratory and small-scale levels, is still relatively limited and underdeveloped. This fish is a freshwater fish that can potentially be cultivated in pond culture (budikdamber) alongside aquatic plants or vegetables (Affandi *et al*., 2023). This is due to the limited technical information on cultivation aspects such as water quality management, feeding, maintenance techniques, and reproduction in an artificial environment. Therefore, research is needed to determine *Garra rufa* cultivation techniques, with varying feeding percentages, for growth and survival.

METHODS

Time and Place

This activity will be conducted for one month, or 30 days, from June 13th to July 12th, 2025. Activities include preparation and maintenance. The research location is the Wet Laboratory of the Marine and Land Bioindustry Research Center, National Research and Innovation Agency (BRIN), North Lombok.

Tools and Materials

The tools used in this research included aquarium, aerators, writing tools, air stone, plastic cup, aeration hose, brush, digital scale, sieve and ruler. The materials used in this research were freshwater, *Garra rufa* fish, commercial fish feed, sponge and tissue.

Research Design

The method applied in this research was a descriptive experimental method using two different feeding rate: 3% and 5% of the fish's body weight. The feed provided was commercial feed, fed three times daily. This experiment was used to determine which feeding rate was more effective and efficient for *Garra rufa* growth. This feeding rate refers to Akbar *et al*. (2020), which states that feeding rate can be given during maintenance is 3%, 5%, and 7% of the biomass weight of the fish, with a feeding frequency of 3 or 4 times a day.

Research Procedures

Preparation of Culture

The cultivation process begins with container preparation, which involves washing two aquariums measuring 40 x 25 x 28 cm using detergent. This step removes dirt and microorganisms that could be detrimental to the cultivation process. This stage is part of the fish farming process. Preparing the containers or ponds is essential to prevent disease outbreaks during the cultivation process (Hifzon & Aminullah, 2024).

Garra rufa Fish Maintenance

The maintenance process begins with the distribution of 1-2 cm fish juvenile in each aquarium as part of the acclimatization process. Acclimatization is the process of adapting fish to changes in environmental conditions, particularly water conditions. The goal is to adjust the water parameters from the old environment to the new one so that the fish doesn't stress (Rumasukun *et al*., 2022). The fish are then raised and fed according to the feeding rate of 3% and 5%. This maintenance treatment generally presents a problem, such as the water becomes dirty more quickly due to leftover food and feces (Diniariwisan *et al*., 2022), so that

siphoning and water changes are required.

Feed Management

The type of feed provided in this activity is artificial feed under the Royal Seafood brand. This feed is in powder form with a particle size of 100-200 microns, containing protein (54%), fat (8%), ash (12%), fiber (2%), and water content (8%). Feeding frequency is twice daily, in the morning and evening. During cultivation activities, the feeding rate used is 3% and 5% per day of the fish biomass weight. The feed is pre-weighed according to the fish's biomass requirements and stored in small cups for easy feeding. Proper feeding management is one way to support optimal growth of fish and increase feed efficiency. This aligns with Sonovel *et al*. (2020), who stated that feeding is a crucial aspect of fish cultivation because it impacts growth and environmental quality.

Research Parameters

Absolute Weight Growth

Absolute weight growth can be calculated using the formula (Nasir & Khalil, 2016) as follows:

$$\mathbf{W = Wt - Wo}$$

Where:

W = Absolute weight growth (g)
Wt = Final fish weight (g)
W0 = Initial fish weight (g)

Absolute Length Growth

Absolute length is the change in length of the fish from the beginning to the end of the maintenance period, and is usually measured in centimeters (Nasir & Khalil, 2016). The formula used is as follows:

$$\mathbf{Pm = Pt - P0}$$

Where:

Pm = Absolute length growth (cm)
Pt = Final fish length (cm)
P0 = Initial fish length (cm)

Spesific Weight Growth Rate

The specific weight growth rate (SWGR) is calculated using the formula modification from Hidayatullah *et al*. (2025):

$$\mathbf{SGR} = \frac{\mathbf{\ln Wt - \ln W0}}{\mathbf{T}} \mathbf{x\ 100\%}$$

Where:

SGR = Specific growth rate (% body weight per day)
W0 = Average fish weight at the start of the research (g)
Wt = Average fish weight at the end of the research (g)
T = Duration of the research (days)

Survival Rate

Survival Rate is a parameter used to determine the percentage of survival of fish during maintenance which can be calculated using the formula (Buwono *et al*., 2019):

$$\mathbf{SR} = \frac{\mathbf{Nt}}{\mathbf{N0}} \mathbf{x\ 100\%}$$

Where:

SR = Survival Rate (%)
Nt = Total of living fish at the end of research(cm)
N0 = Total of fish at the start of research (cm)

Feed Conversion Ratio

The feed conversion ratio (FCR) is calculated using the formula referenced from Hidayatullah *et al*. (2025):

$$\mathbf{FCR} = \frac{\mathbf{F}}{(\mathbf{Wt} + \mathbf{D}) - \mathbf{W0}}$$

Where:

FCR = Feed conversion ratio
W0 = Biomass weight of fish at the start of the research (g)
Wt = Biomass weight of fish at the end of the research (g)
F = Total feed consumed by the test fish (g)
D = Total weight of the dead fish during the research (g)

Water Quality

Various metabolic processes essential for fish survival are significantly influenced by water quality, encompassing both physical and chemical factors. Generally, physical water quality parameters include temperature, pH, and dissolved oxygen (DO). However, in this activity, the water quality parameters measured were limited to temperature and pH. Water quality measurements were conducted in the *Garra rufa* aquarium once a week.

Data Analysis

The data obtained during this activity will be analyzed descriptively. This descriptive technique involves detailing and systematically describing the entire series of activities undertaken, supported by relevant literature studies. This is intended to provide the clearest possible information regarding the process and results of these activities.

RESULTS

Absolute Weight Growth

The absolute weight graph during the maintenance days can be seen in Figure 1 below.

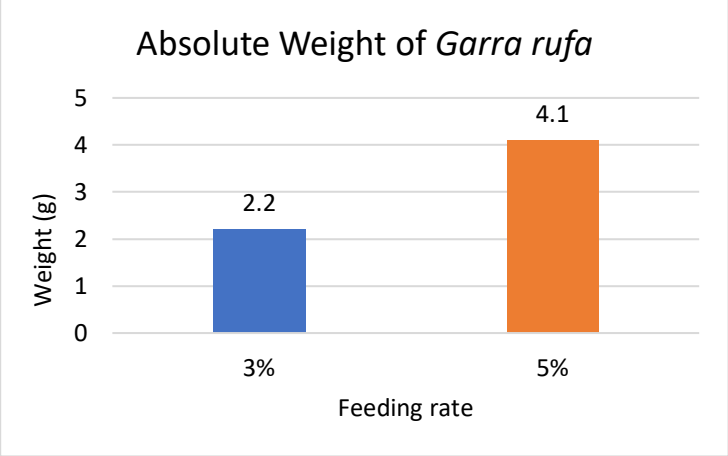

Figure 1. Absolute Weight Growth Graph of *Garra rufa*

Absolute Length Growth

The absolute length graph of *Garra rufa* maintenance during maintenance can be presented in Figure 2 below.

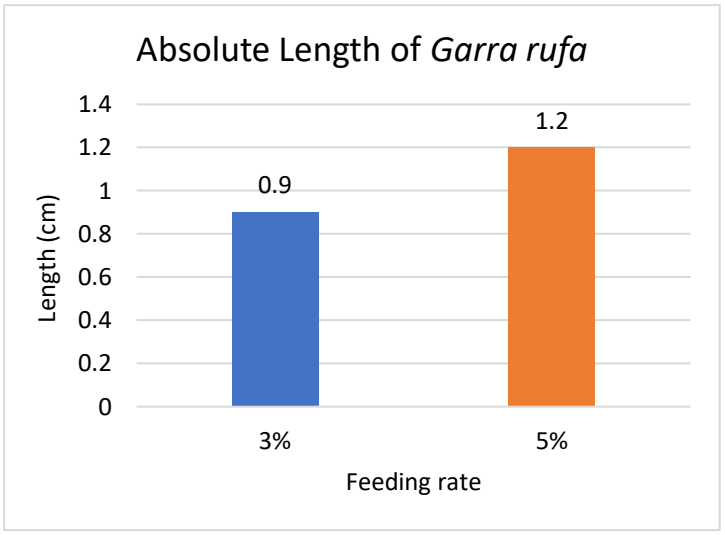

Figure 2. Absolute Length Growth of *Garra rufa*

Spesific Weight Growth Rate

The Specific Growth Rate (SGR) value of *Garra rufa* is shown in Figure 3 below.

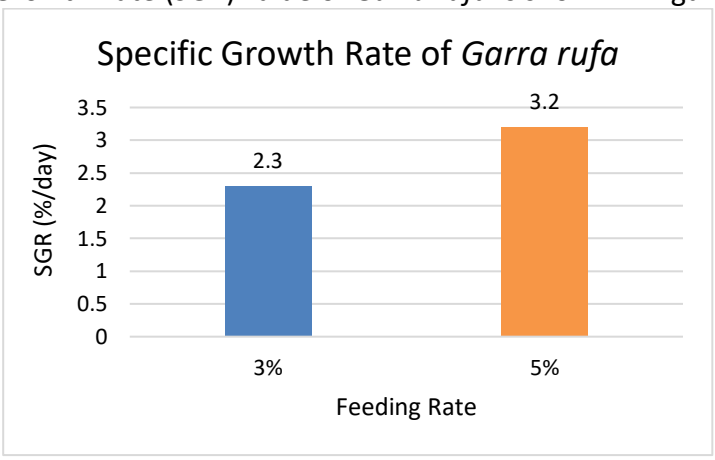

Figure 3. Spesific Weight Growth Rate of *Garra rufa*

Survival Rate

The survival data recorded during the maintenance of *Garra rufa* fish are presented in Figure 4 below.

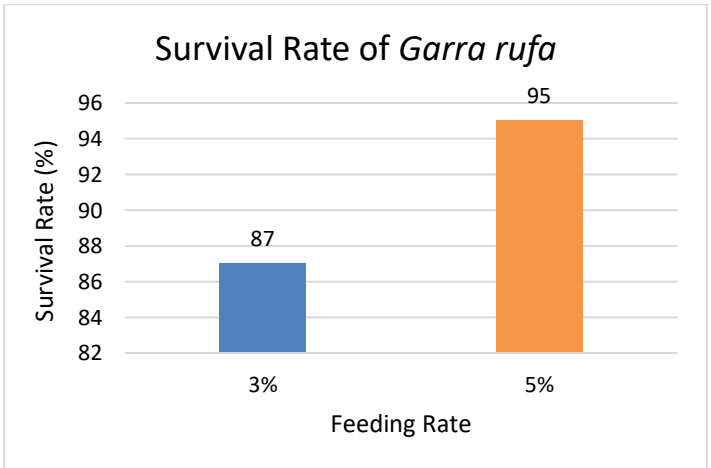

Figure 4. Survival Rate of *Garra rufa*

Feed Conversion Ratio

The FCR values recorded during *Garra rufa* fish maintenance activities are shown in Figure 5 below.

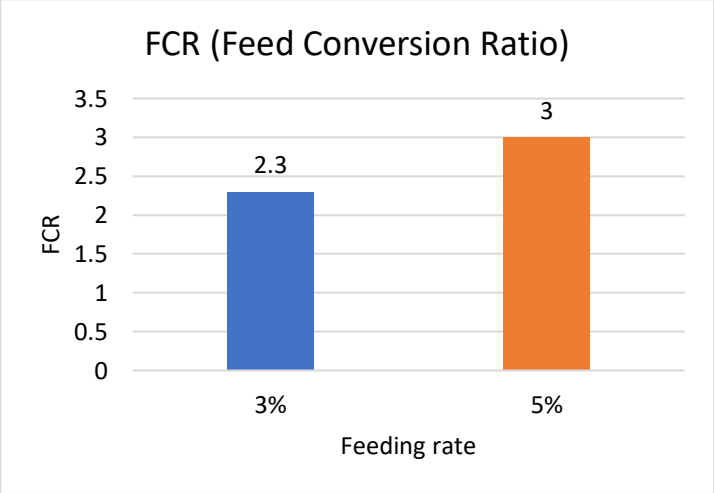

Figure 5. Feed Conversion Ratio of *Garra rufa*

Water Quality

The results of water quality measurements are presented in Table 1. The measured parameters included temperature & pH.

Table 1. Water Quality

Treatment	Temperature (°C)	pH
3%	25 - 28	7.1 – 8.9
5%	25 - 28	7.3 – 8.7
References	24 – 28 (Celik *et al*., 2023)	7.0 – 9.0 (Catarino *et al*., 2019)

DISCUSSION

Absolute Weight Growth

Based on the graph, the average absolute weight of *Garra rufa* fish at a 3% feed concentration was 2.2 grams, while at a 5% concentration it reached 4.1 grams. Absolute weight is calculated as the difference between the final weight and the initial weight of the fish, which indicates the absolute amount of body weight gain during the rearing period. The higher absolute weight value in the 5% treatment indicates that increasing the amount of feed affects fish weight growth. This aligns with the findings of Catarino *et al*. (2019) on *Garra rufa*, which found that higher feeding frequency and quantity significantly increased body weight gain compared to lower feeding rates. Furthermore, research by Ritonga *et al*. (2020) found that fish body weight gain is significantly influenced by optimal feeding, environmental quality, and stocking density.

Absolute Length Growth

Absolute length is calculated based on the difference between the final and initial length of the fish, measured from the tip of the head to the tip of the tail. Absolute length calculations are performed weekly, along with fish body weight measurements, facilitating the determination of daily feed intake and the Feed Conversion Ratio (FCR) calculation. Higher absolute length values in the 5% feed treatment indicate that increasing feed intake can affect

fish growth. Furthermore, environmental influences can influence fish growth rate. This aligns with the opinion of Ritonga *et al*. (2020), who stated that fish growth in length and weight is significantly influenced by optimal feeding and the quality of the rearing medium. Furthermore, fish growth rate is also influenced by internal factors such as heredity and age, as well as external factors such as feed efficiency, environmental quality, and stocking density. Excessively high stocking densities can lead to decreased growth rates due to increased competition for food and oxygen within the rearing medium.

Spesific Weight Growth Rate

The higher SGR value at 5% feed concentration indicates that increasing the amount of feed given directly impacts the daily growth rate of the fish. Although the 5% feed treatment resulted in a higher SGR, feed efficiency must still be considered because FCR tends to deteriorate at excessive doses. Therefore, a comprehensive evaluation of the cultivation strategy is necessary to ensure optimal, economical, and sustainable growth is achieved. The SGR itself is a parameter that describes the relative growth rate of fish in a unit of time, and is calculated based on the percentage increase in daily body weight. This is in line with Marquez *et al*. (2024) that the Specific Growth Rate (SGR) is a parameter used in the field of aquaculture to describe the relative growth rate of an organism (usually fish or shrimp) in a certain unit of time, usually per day. This value is expressed as a percentage (%/day) and indicates how quickly the fish's body weight increases proportionally to its initial weight.

Survival Rate

In an aquarium with a 3% feed concentration, the survival rate reached 87%, while in an aquarium with a 5% feed concentration, it reached 93%. These values indicate success in the initial rearing process of doctor fish in an artificial environment. This aligns with the opinion of Celik *et al*. (2021), who stated that after successful hatching, the survival rate of *Garra rufa* larvae generally ranges from 80% to 90% under normal conditions. Thus, the survival rate obtained in this maintenance is above the average standard, especially in the treatment with a feed concentration of 5%, which shows that feed management and environmental quality during maintenance support larval survival very well.

Feed Conversion Ratio

An FCR of 2.3 indicates that 2.3 grams of feed are required to produce 1 gram of fish weight gain. Conversely, an FCR of 3.0 indicates that 3.0 grams of feed are required to produce the same weight gain. The FCR of 2.3 at a 3% feed concentration in this maintenance is considered more efficient and closer to optimal conditions, compared to the 5% feed treatment, which showed lower efficiency with an FCR of 3.0. Compared with the research results of Catarino *et al.* (2019), it is known that the optimal feed dose for the growth of doctor fish is around 3.2% of body weight per day, which results in optimal growth without wasting feed. Ardita *et al.* (2015) also stated that the Feed Conversion Ratio (FCR) is a figure that indicates how much fish feed can be converted into biomass weight. The lower the FCR, the better or more successful the cultivation. Because the lower the FCR value, it means that the fish are utilizing feed more efficiently for growth.

Water Quality

Water quality management for *Garra rufa* fish farming is carried out to maintain optimal environmental conditions in the aquarium for fish growth and survival. This management involves weekly total water changes during sampling and siphoning approximately 50% of the water volume if the tank begins to appear cloudy due to food residue or feces. According to Diniariwisan *et al*. (2024), organic matter from feces and uneaten feed residue can be a major trigger for deteriorating water quality. Therefore, siphoning and water exchange efforts aim

to reduce the accumulation of organic matter and maintain stable water quality parameters. This aligns with Zaidy's (2022) opinion, which states that water exchange is a crucial aspect of aquaculture activities because it can reduce the accumulation of dissolved organic matter and metabolic waste, such as ammonia, which can negatively impact the health of cultivated organisms. Thus, regular water changes play an important role in maintaining the quality of the cultivation environment that supports optimal growth.

The parameters measured included water temperature and pH, which are important factors in supporting fish metabolism and growth. Measurements showed that the temperature in both treatment aquariums was within the range of 25°C–28°C, while the pH range was between 7.1–8.9. This temperature and pH range is considered optimal for supporting the physiological activity and growth of *Garra rufa* in aquaculture systems. This is in line with the statement of Celik *et al*. (2023) that the optimal temperature for maintaining *Garra rufa* is in the range of 24–28°C with a pH of 6.5–8.5. In addition, Catarino *et al*. (2019) also stated that during the experimental procedure, the physical and chemical parameters of the water were always within the optimal range for the growth of *Garra rufa*, referring to Jarvis (2011) who stated that *Garra rufa* naturally lives in waters with a pH between 7.0 and 9.0 and a temperature ranging from 15 to 31.2°C.

CONCLUSION

Garra rufa fish generally don't require any special care during the growth stage. Feeding rates of 3% and 5% showed relatively high survival rates of 87% and 93%, respectively. This is undoubtedly supported by good and optimal culture conditions. *Garra rufa* growth at a 5% feeding rate was higher, but not more efficient, based on FCR values.

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