

Minireview Article

RELATIONSHIP BETWEEN FEEDING REGIME AND FISH GROWTH

ABSTRACT

Feeding regime or feeding rate? is how much to feed the fish. From how much or portion used for fish feed can affect fish growth. Feeding regime is the determination of the amount of feed per day based on the feeding rate (FR). Feeding rate is the feed requirement per day based on fish biomass and weight.

Aims: This research aims to find out how the relationship between feeding regime and fish growth and development.

Study design: journal review.

Methodology: The research method used was descriptive analysis method or library research by collecting data from written sources, namely journals that are relevant to the topic of the writing being carried out. After the data was collected, the next was the data selection in accordance with the research objectives. The selected data was then processed systematically and structured while data analysis was carried out using a descriptive approach by presenting the data obtained in narrative form.

Results: The result of this research indicated that fish growth and development are influenced by internal and external factors, one of which is the fish feeding regime.

Conclusion: Feeding regime or rate? is an important factor in aquaculture. This feeding regime includes how to feed and the portion that will be given to the fish being cultured. Good feed contains sufficient nutrients as needed for fish growth. In addition to the feed factor, growth is also influenced by internal and external factors such as the type of fish, type of feed, environment and others. A good feeding regime or rate? must be adjusted to the nutritional needs of fish, each type of fish has different nutritional needs.

Keywords: feeding, feed portioning, fish development, feed restrictions, fish growth

1. INTRODUCTION

One of the determining factors in fish farming is feed. Starting from the quality of feed, the right proportion of feed, and the frequency of feeding. Feed dosing is very important, in an effort to minimize excessive or wasted feed. Feed also affects water conditions, excessive feed can result in increased ammonia content from the resulting sediment (Taufiqurrahman *et al.*, 2022). Feed is one of the important aspects that must be considered in aquaculture

activities, because feed is a source of energy to support growth. Good feed is feed that suits the physiological needs and species of fish cultivated (Niode *et al.*, 2014).

Besides being able to meet the nutritional needs of the fish, feeding with good quality and quantity can optimize fish farming efforts. Feed must be available in sufficient quantities, continuously, and have the nutritional content needed for fish growth (Haetami, 2022). Feed is an important nutrient in supporting the growth and survival of cultivars, especially in fish hatcheries. Feeding will follow the age or life stage which is in line with how much nutrition the fish needs. In the larval stage, fish are usually given natural food such as rotifers. At a certain age, fish are then fed according to their mouth opening. This stage or strategy in feeding is then known as the feeding regime. (Susila, 2018).

One of the factors affecting fish farming is feeding. Good feeding is done regularly and routinely according to scheduling. Feed that is given too little will result in optimal fish growth because the fish are malnourished. Conversely, feed that is given too much will be able to cause pollution from connected food scraps (Ximenez *et al.*, 2021). Feed is one of the factors that can affect the growth and survival of fish, the provision of different types of feed as well as a combination of frequency and type of feed has a very real effect, because in the provision of different types of feed, the effect is very significant.

Fish growth requires the right frequency and the right feed (Rangkuti and Aminah 2018). Artificial feed is feed that is deliberately made from several raw materials, good artificial feed is feed that contains important nutrients for fish, and has a taste that is favored by fish and easily digested by fish (Akbar, 2001). Appropriate feeding will prevent fish from various diseases, while feed that contains nutrients that meet the needs of fish will accelerate growth.

2. METHODOLOGY

2.1 Data Collections

The research method used is descriptive analysis method or library research by collecting data from written sources, namely journals that are relevant to the topic of the writing being carried out. After the data was collected, the next step was to select the data in accordance with the research objectives. The selected data was then processed systematically and structured while data analysis was carried out using a descriptive approach by presenting the data obtained in narrative form.

2.2 Feed Restriction

Restriction of feed consumption can be done periodically (satiation). Satisfaction followed by re-feeding showed higher digestive enzyme activity than fish that did not receive feed restriction (not satisfied). This high activity is thought to be related to the increased efforts of fish to digest the fat, protein and carbohydrate content in food and maximize its use (Rosady *et al.*, 2012). According to Rachmawati *et al.* (2010) satisfying fish can also trigger stress in animals. In stressful conditions, there is a significant change in hematological parameters. Satisfaction can reduce body metabolism so that it will interfere directly with fish growth

2.3 Fish Growth

Growth is defined as changes in fish weight, size, and volume over time (Amalia *et al.*, 2018). Factors that affect fish growth are the protein content in the feed, because protein functions to form new tissues for growth and replace damaged tissues. According to Kordi

(2013), feed nutrition is generally seen from the composition of nutrients and several important nutritional components that must be available in feed, including protein, fat, carbohydrates, and vitamins. According to Kordi (2013), protein deficiency has a negative effect on feed consumption, consequently a decrease in fish weight growth.

Fish growth is influenced by internal and external factors. Internal factors are factors related to the fish itself such as age, and genetic traits of fish that include heredity, ability to utilize food and resistance to disease. External factors are factors related to the environment in which fish live which include physical and chemical properties of water, space for movement and availability of food in terms of quality and quantity (Karimah & Samidjan, 2018)

3. RESULTS AND DISCUSSION

A good feed has a complete composition of nutrients such as protein, fat, carbohydrates, vitamins, and minerals. Feeding with poor nutritional value can reduce fish survival and slow growth (stunted growth), and can even cause diseases caused by malnutrition. The amount of nutrients required by fish for growth varies. Determining the right feeding regime is very important to ensure fish development and fish health.

3.1 Feeding Regime

Feeding regime is the determination of the amount of feed per day based on the feeding rate (FR). Feeding rate is the feed requirement per day based on fish biomass and weight. The feeding regime applied affects the consumption rate of fish development and survival in the larval phase (Dewi, 2019). Feeding amount is the frequency of the amount of feed given in a day. The amount of feed depends on the body size of the fish. Amount of fish feed the right choice can maximize the utilization of feed by fish so that it is expected to achieve maximum growth, reduce operational costs and reduce the impact of declining water quality (Mulyani and Fitriani, 2014).

3.2 Feed Restriction

Satisfaction is one way that can be used to reduce feed consumption and ammonia accumulation (Mulyani dan Fitriani, 2014). Periodic grazing is able to increase the speed of fish growth to be equivalent or even higher when compared to no grazing (Rachmawati et al., 2010). According to Alvarez (2010), this is due to compensatory growth, which is faster growth compared to normal feeding that occurs after fish pass through a period of feeding restriction and are then fed again according to their needs. Periodic feeding can increase appetite due to gastric emptying during the feeding period so that daily feed consumption increases when fish are fed again after being fed (Purba, 2004; Anin and Yuwono, 2007).

Gastric emptying has a strong correlation with feeding frequency and return of appetite. When appetite is at its peak, proper timing and frequency of feeding can improve production efficiency by increasing growth and reducing feed conversion ratio. Based on a study, short-term fasting can improve feeding efficiency in fish. Fasting or diet-treated fish have a high consumption rate in digesting fat, protein, and energy (Booth & Pirozzi, 2021). From the feed formulation given the fish will compensate for nutrient and energy density. A low consumption rate may imply that the fish can physically ingest more feed (dry matter) indicating that the fish require high nutrient and energy intake. (Booth & Pirozzi, 2021). Standard feed restriction will not cause growth stagnation due to prolonged feed deprivation.

3.3 Feed Full Capacity

Tawulo (2004) states that variations in feeding frequency are thought to be closely related to stomach capacity. The smaller the stomach capacity, the more frequent the feeding should be. Feed utilization efficiency is also related to the capacity and rate of gastric emptying. According to Zahrah (2014), feed consumption is directly related to the available gastric capacity, so it is directly related to digestibility and gastric emptying rate. The higher the digestibility of nutrients, the faster the rate of gastric emptying, so that the amount of feed consumption increases. This is thought to slow down the rate of gastric emptying, resulting in decreased feed consumption.

The ability of fish to digest feed ingredients is influenced by several factors, namely, chemical properties of water, water temperature, type of feed, size, age of fish, nutritional content of feed, frequency of feeding, physical and chemical properties of feed and the number and type of digestive enzymes contained in the digestive tract of feed. The ability of fish to digest food is highly dependent on the completeness of the digestive organs and the availability of digestive enzymes (Suryadi et al 2018).

The smaller the volume of the stomach the less feed it can hold, hence the more frequent feeding. This is related to the capacity and rate of gastric emptying. The smaller the stomach capacity, the faster the time to empty the stomach, so the frequency of feeding required is high. Furthermore, it is also said that after a reduction in stomach contents, the appetite of some fish species will increase again if feed is immediately available (Mulyadi et al., 2010).

3.4 Growth

According to Breet (1971), the amount of feed that fish can consume every day is one of the factors that affect the potential of fish to grow optimally. This is also caused by the protein content of the feed given in a certain amount, in accordance with Sugaman's statement (1986), that for growth, feeding must pay attention to the nutritional content provided (Fitra et al., 2022). Each growth stage requires an appropriate pattern of feeding strategies. In the early stages of fish life, the transition from endogenous to exogenous feed is a critical period. The suitability of the feed as an essential energy source for the larvae in terms of size, movement, nutrient content is very important for the initial phase of larval feeding. The size of the mouth opening of larvae is smaller than that of adult fish, so the size of the selected feed should match the size of the mouth opening and the diameter of the larval esophagus. (Imentai et al., 2020).

Improper feeding or feeding ingredients can cause various pathological and morphological changes that can be detrimental to fish growth. However, according to a study, histological examination of the anterior gut did not show any obvious pathological changes related to the feeding strategy applied. However, morphological changes in the gut such as enterocyte height and brush border can reflect the nutritional condition of the fish. Low intestinal fold height, decreased enterocyte profile area and lack of absorptive vacuoles may indicate possible pathologies, from improper nutritional status to starvation (Imentai et. al., 2020). Based on a study, growth will deteriorate rapidly when fish are fed limited and irregularly. This growth deterioration is due to the lack of nutrient and energy intake from low feed intake.

Table 1 Relationship between *feeding regime* and fish growth rate

No.	Fish Species	Feed Regime	Growth rate	Reference
1	<i>Sander lucioperca</i>	Rotifera : 5-8 days	8.57 ± 0.09	Imentai <i>et al.</i> ,

	(larvae stadia)	old		2020
		Rotifera + artemia : age 9 -17 days		
2	<i>Oreochromis niloticus</i>	Regular 2 time a day	29,93 ± 3,82	El-Araby, <i>et al.</i> , 2020
3	<i>Seriola lalandi</i>	High-spec feed : regular 1 time per day	0,82	Booth & Pirozzi, 2021
4	<i>Ctenopharyngodon idellus</i>	Regular 1 time per day 28 of continuous feeding	103,78 ± 1,36	Xu., <i>et al.</i> , 2019
5	<i>Red tilapia</i>	2 time per day feeding	4.58± 0,04	Klahan, <i>et al.</i> , 2023
6	<i>Chanos chanos</i>	Vitamin B12 dose 0,7 µg/ml) D 15 -1 20	2.94±0.039	Salsabila <i>et al.</i> , 2019
7	<i>Epinephelus fuscoguttatus</i>	Feeding at 08.00 and 16.30	2,94	Yin, <i>et al.</i> , 2023

4. CONCLUSION

Feeding regime is an important factor in aquaculture. This feeding regime comprises both rate and frequency that will be given to the fish being cultured. Good feed contains sufficient nutrients as needed for fish growth and development. In addition to the feed factor, growth is also influenced by internal and external factors such as the type of fish, type of feed, environment and others. A good feeding regime must be adjusted to the nutritional needs of fish, each type of fish has different nutritional needs.

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