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The Use of Different Types of Natural Feeds to Enhance Growth and Survival Rates of Freshwater Lobsters (Cherax quadricarinatus)

Penggunaan Jenis Pakan Alami yang Berbeda untuk Meningkatkan Pertumbuhan dan Kelangsungan Hidup Lobster Air Tawar (Cherax quadricarinatus)

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Abstract

The freshwater lobster (*Cherax quadricarinatus*) is a precious commodity within the freshwater aquaculture sector. It is essential to investigate the effects of different natural feeds on lobster growth to enhance aquaculture practices. This study aimed to identify the types of natural feed that influence and improve freshwater lobster juveniles' growth and survival rate. This study was conducted from January to February 2024 at the Kasih Karunia Suwawa Aquaculture Hatchery. A Completely Randomized Design (CRD) was applied, with four treatment groups: Treatment A (bean sprouts), Treatment B (*Tubifex sp*.), Treatment C (tofu residue), and Treatment D (a combination of bean sprouts, *Tubifex sp*., and tofu residue). The feed was administered daily at 7% of the total biomass, with a feeding frequency of twice per day. Data were analyzed using ANOVA with SPSS software. The observed parameters included length growth, weight growth, survival rate, and moulting frequency. The results showed that Treatment B (*Tubifex* sp.) yielded the best growth and moulting frequency, with length growth at 0.76 cm, weight growth at 0.70 g, and moulting frequency at 0.67. The highest survival rate, at 96.67%, was observed in Treatment D (bean sprouts + *Tubifex* sp. + tofu residue). ANOVA results indicated that different types of natural feeds did not significantly impact the growth and survival of freshwater lobsters.

Keywords: Freshwater Lobster, Natural Feed, Growth, Survival

Abstrak

Lobster air tawar (*Cherax quadricarinatus*) merupakan salah satu komoditi perikanan air tawar yang memiliki nilai ekonomis tinggi. Untuk mendukung produksi budidaya maka perlu dilakukan penelitian mengenai penggunaan pakan alami berbeda untuk mengetahui pakan yang memberikan pertumbuhan terbaik. Penelitian ini bertujuan untuk mengetahui jenis pakan alami yang berpengaruh dan dapat meningkatkan pertumbuhan dan kelangsungan hidup benih Lobster air tawar. Penelitian ini telah dilaksanakan dari bulan Januari hingga Februari 2024 yang bertempat di Usaha Pembenihan Ikan *Aquaculture* Kasih Karunia Suwawa. Penelitian ini menggunakan Rancangan Acak Lengkap (RAL). Dengan penggunaan pakan alami yang berbeda perlakuan A adalah Tauge, Perlakuan B adalah *Tubifex* sp., Perlakuan C adalah Ampas Tahu, Perlakuan D adalah Tauge+*Tubifex* sp.+Ampas Tahu. Dengan dosis pemberian pakan per hari sebanyak 7% dari bobot biomassa dan frekuensi pemberian pakan sebanyak 2 kali/hari. Analisi data yang digunakan yaitu

ANOVA dengan menggunakan aplikasi SPSS. Parameter yang diamati selama penelitian yaitu Pertumbuhan panjang, Berat, Tingkat Kelangsungan hidup, dan Frekuensi moulting. Hasil penelitian menunnjukan perlakuan B (*Tubifex* sp.) memberikan respon pertumbuhan dan frekuensi moulting terbaik yaitu Pertumbuhan panjang = 0.76 cm, pertumbuhan berat = 0.70 gr, dan Frekuensi moulting = 0.67. sedangkan untuk tingkat kelangsungan hidup yang terbaik terdapat pada Perlakuan D (Tauge+*Tubifex* sp.+Ampas Tahu) yaitu 96.67%. Berdasarkan hasil ANOVA Pemberian jenis pakan alami yang berbeda tidak memberikan pengaruh terhadap pertumbuhan dan kelangsungan hidup lobster air tawar.

Kata kunci: Lobster Air Tawar, Pakan Alami, Pertumbuhan, Sintasan.

1. Introduction

Freshwater lobsters represent a precious commodity within the freshwater aquaculture sector. The increasing market demand has led to a rise in production, highlighting the need for strategic actions, such as developing large-scale freshwater lobster farming initiatives (Lesmana et al., 2022). Freshwater lobsters are a promising commodity for development, owing to their tender meat and savoury flavour. They are also well-suited for aquaculture due to their omnivorous diet, resistance to disease, and high fecundity. These characteristics make them an attractive option for economic development. Furthermore, they exhibit resilience to stress and disease when their nutritional, water quality and oxygen requirements are appropriately managed (Lengka et al., 2013).

The international demand for freshwater lobsters is steadily increasing, yet current production levels fall short of meeting this demand. To address this gap, adopting intensive farming practices and reducing reliance on costly artificial feeds is essential. Natural feed emerges as a viable alternative, providing necessary nutrients for the growth and survival of aquatic organisms. Additionally, natural feed is both nutritionally rich and cost-effective, making it an accessible and economical option for aquaculture (Pasi et al., 2022).

Despite the relative ease of farming freshwater lobsters, their growth in length and weight remains slow. This slow growth is primarily due to inadequate nutrition in the feed provided. Feed management is critical, as feed constitutes 60-70% of production costs (Yusuf & Alimuddin, 2022). Given the high expense of artificial feeds, there is a need to implement intensive farming practices that reduce reliance on costly artificial feed.

2. Material and Method

2.1. Time and Place

This study was conducted over a period of one month, from January to February 2024, at the Kasih Karunia Suwawa Aquaculture Hatchery, located in Bube Baru Village, Suwawa Sub-district, Bone Bolango Regency, Gorontalo Province.

2.2. Methods

This study employed an experimental design using a Completely Randomized Design (CRD), with four treatments and three replicates. The treatments applied were as follows: Treatment A : Bean sprouts (Control); Treatment B : *Tubifex* sp.; Treatment C: Tofu residue; Treatment D : Combination (33.33% Bean sprouts + 33.33% *Tubifex* sp. + 33.33% Tofu residue)

2.3. Procedures

The study utilized 12 aquariums, each measuring 40 x 30 x 30 cm, equipped with aeration systems and shelters made of 1-inch PVC pipes. The test subjects were 120 freshwater lobster juveniles measuring 3-4 cm, obtained from breeders, and stocked at a density of 80 individuals/m². The feed consisted of bean sprouts, *Tubifex* sp., and tofu residue, administered at a rate of 7% of the biomass twice daily. Weekly measurements were taken to assess growth in length and weight and water quality parameters, including temperature, pH, and dissolved oxygen (DO). Survival rates and moulting frequency were observed daily.

2.4. Observed Parameters

2.4.1. Absolute Weight Growth

The absolute weight growth rate was calculated using the formula provided by Everhart & Rounsefell in Hadijah (2015):

$$Wm = W_t - W_0$$

Description:

Wm : Absolute weight growth (g)
Wt : Final average weight (g)
Wo : Initial average weight (g)

2.4.2. Absolute Length Growth

The absolute length growth rate was determined using the formula provided by (Akbar et al., 2020):

$$Pm = P_t - P_0$$

Description:
Pm : Absolute length growth (cm)
Pt : Final average length (cm)
Po : Initial average length (cm)

2.4.3. Survival Rate

The survival rate was calculated using the formula provided by (Effendi in Imran et al., 2023):

$$SR = N_t/(N_0) \times 100\%$$

Description:
SR : Survival rate (%)
Nt : Number of individuals at the end of the rearing period
No : Number of individuals at the start of the rearing period

2.4.4. Frequency of Moulting

The frequency of moulting for freshwater lobsters was determined by dividing the number of lobsters that moulted during the rearing period by the number of lobsters used as samples, as described by Handayani & Syahputra (2018). The formula for moulting frequency, according to Kibra in Lesmana & Mumpuni (2022), is:

$$FM\ (\%) = M/N \times 100\%$$

Where:
FM : Frequency of Molting (%)
M : Number of lobsters that moulted
N : Total number of lobsters in each Treatment

2.5. Data Analysis

Data analysis was performed using both descriptive and quantitative methods. Data from each parameter observation were tabulated and analyzed using ANOVA (Analysis of Variance) at a 95% confidence level.

3. Result and Discussion

3.1. Length and Weight Growth

The study's results on the length growth of freshwater lobsters over 28 days with four treatments are illustrated in the following Figure 1.

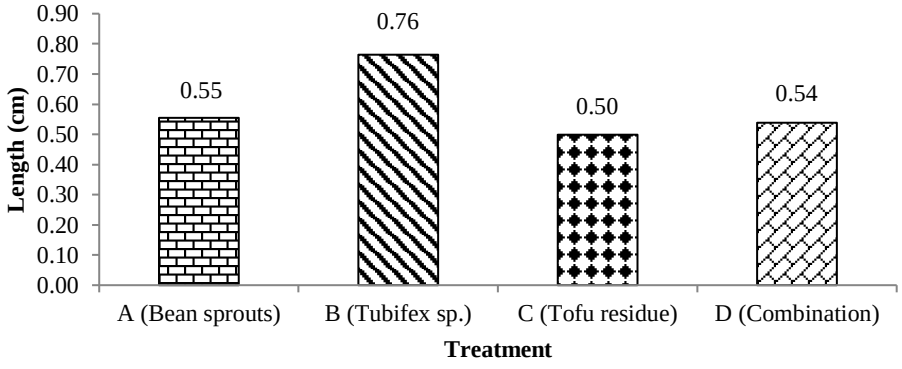

Figure 1. Length growth of freshwater lobster

Figure 1 shows the length growth of freshwater lobster juveniles reared for 28 days with different natural feed treatments. The highest growth was observed in Treatment B (*Tubifex* sp.), with an increase of 0.76 cm. This was followed by Treatment A (Bean Sprouts) with a growth of 0.55 cm, Treatment D (Bean Sprouts + *Tubifex sp.* + Tofu Residue) with a growth of 0.54 cm, and Treatment C (Tofu Residue) with a growth of 0.50 cm. The superior growth observed in Treatment B is likely attributed to the high protein content of *Tubifex* sp., which supports better growth compared to the other treatments. The high protein and moderate fat content of Tubifex sp. make it an excellent feed for promoting the growth and survival of fish juveniles (Mile et al., 2024). Protein plays a crucial

role in the growth of organisms, with higher protein levels typically leading to increased growth rates. According to Masitoh et al. (2015), feed containing high biological value protein results in more significant body protein accumulation than feed with lower biological value protein.

The reduced growth observed in the other treatments is likely due to inadequate protein content in the feed, which is essential for the growth of freshwater lobsters. Freshwater lobsters require a protein content ranging from 20-40%. Feed that promotes optimal growth and health typically includes a balanced combination of protein, carbohydrates, fats, vitamins, and minerals (Taufiq et al., 2016). The study results on the weight growth of freshwater lobsters over 28 days with four treatments are shown in the following Figure 2.

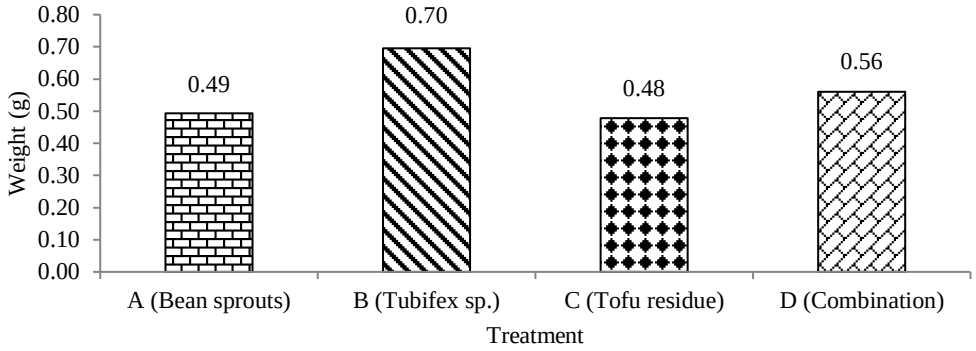

Figure 2. Weight growth of freshwater lobster

According to Figure 2, the weight growth of freshwater lobsters over 28 days with different natural feed treatments showed that the highest growth occurred in Treatment B (*Tubifex sp.*), with a weight gain of 0.70 g. This was followed by Treatment D (Bean Sprouts + *Tubifex sp.* + Tofu Residue) at 0.56 g, Treatment A (Bean Sprouts) at 0.49 g, and Treatment C (Tofu Residue) at 0.48 g. The differences in growth are likely due to variations in the nutritional composition of the feeds. *Tubifex* sp. contains more protein than the other feeds. Its high protein content and moderate fat levels make it an ideal feed for promoting growth and survival in fish juveniles (Mile et al., 2024). Protein plays a vital role in the growth of organisms, with higher protein content in the feed leading to increased growth. Hadijah (2015) reported that higher protein levels can accelerate the growth of freshwater lobsters. Proteins are digested and broken down into amino acids, which are then used by organs and tissues to synthesize new proteins to support growth or replace existing proteins for maintenance functions (Makasangkil et al., 2017).

3.2. Survival Rate

The highest survival rate at the end of the rearing period was observed in Treatment D (Bean Sprouts + *Tubifex* sp. + Tofu Residue) at 96.67%, followed by Treatment A (Bean Sprouts) and Treatment C (Tofu Residue), both at 83.33% and Treatment B (*Tubifex* sp.) at 46.67%. The lower survival rate in Treatment B is likely due to the colony-forming behaviour of *Tubifex* sp., which resulted in uneven feed distribution. Consequently, not all freshwater lobsters had access to the feed, and only those near the feed clusters could consume it (Scabra et al., 2022). Mortality in freshwater lobsters was observed due to their natural cannibalistic behaviour when food was scarce. During the observation period, remnants of lobster bodies that had been consumed were found, particularly during moulting. This occurs because lobsters release an odour during moulting that attracts other lobsters, increasing the likelihood of cannibalism (Santi et al., 2021).

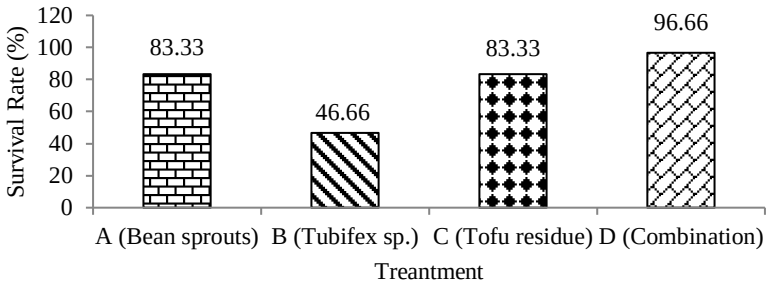

Figure 3. Survival rate of freshwater lobster

The high survival rate in Treatment D is attributed to the well-balanced nutritional content of the feed, which included both animal and plant-based components, with a predominance of plant-based feed. According to Wijaya (2022), lobsters tend to have a herbivorous feeding habit, often consuming particles or seeds. Furthermore, the freshwater lobsters used in the study were accustomed to the provided feed.

3.3. Frequency of Molting

The results of the study on the moulting frequency of freshwater lobsters over 28 days are presented in Figure 4.

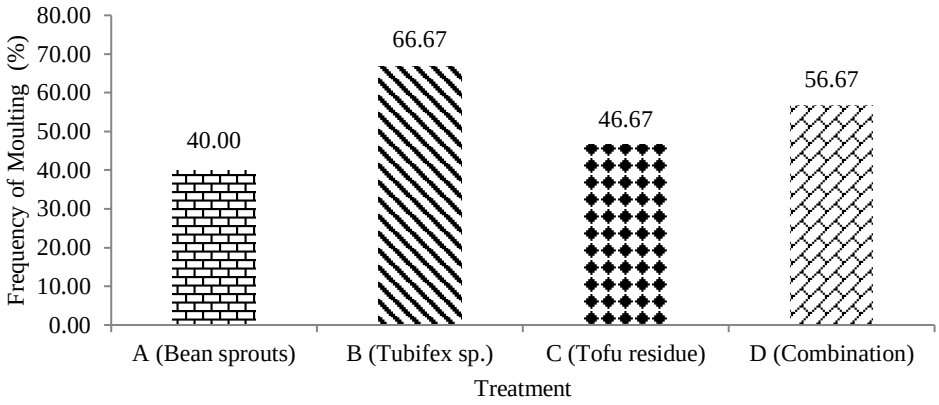

Figure 4. Molting frequency of freshwater lobster

Based on Figure 4, the highest moulting frequency was observed in Treatment B (*Tubifex* sp.) at 66.67%, followed by Treatment D (Combination) at 56.67%, Treatment C (Tofu Residue) at 46.67%, and the lowest in Treatment A (Bean Sprouts) at 40.00%. Moulting is crucial for the growth of freshwater lobsters, with more frequent moulting contributing to better growth. Factors influencing the growth and survival of freshwater lobsters include seed quality, feed type, water quality, disease, and successful moulting. Moulting success mainly depends on the calcium reserves in the lobster's body (Sarmin et al., 2020).

3.4. Water Quality

An organism's environmental conditions or habitat are critical for supporting its life. Water quality is defined by comparing water's physical, chemical, and biological characteristics with the specific requirements for various purposes (Juliana et al., 2018). Water temperature, as an abiotic factor, plays a crucial role in the life of aquatic organisms (Koniyo, 2020) because it influences environmental conditions, including the thermal properties of substances, and affects the metabolic rates of these organisms (Hamuna et al., 2018). Dissolved oxygen is also a crucial limiting factor; if its levels are inadequate, it can hinder the activities of cultured organisms (Koniyo & Juliana, 2018). Dissolved oxygen is the total amount dissolved in the water, necessary for most living organisms for respiration, metabolism, and reproduction (Hamuna et al., 2018). The potential of hydrogen (pH) measures the acidity or alkalinity of a solution and is a critical factor for metabolic and physiological processes in organisms (Juliana et al., 2018).

During the rearing period, the water quality parameters for temperature and dissolved oxygen were within the optimal range, while the pH levels were not optimal, as they exceeded the recommended standards. Poor water quality can lead to suboptimal growth and negatively affect the test organisms. Furthermore, inadequate water quality may reduce appetite and impair the effective utilization of feed.

Table 1. Water quality during the rearing period

Parameter	Unit	Range	References
Temperature	ºC	27.33 – 29.10	24-30 (Mamonto et al., 2023)
pH	-	8.53 – 9.17	6-8 (Mamonto et al., 2023)
Dissolved Oxygen	ppm	5.57 – 6.93	> 3 ppm (Mamonto et al., 2023)

4. Conclusions

The findings of this study indicated that the best growth was achieved with *Tubifex* sp., showing a length growth of 0.76 cm and a weight growth of 0.70 g. The highest survival rate, at 96.67%, was observed with the combination feed treatment. The study concluded that different types of natural feed did not significantly affect either growth or survival rates.

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