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OPTIMIZATION OF DIFFERENT TYPES OF ATTRACTANTS IN COMMERCIAL FEED TO INCREASE ABSOLUTE WEIGHT GROWTH AND MOLTING FREQUENCY OF FRESHWATER LOBSTER (*Cherax quadricarinatus*)

Optimasi Jenis Atraktan yang Berbeda pada Pakan Komersial untuk Meningkatkan Pertumbuhan Berat Mutlak dan Frekuensi Molting Lobster Air Tawar (*Cherax quadricarinatus*)

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ABSTRACT

This study aimed to analyze the effect of different types of attractants added to commercial feed on the absolute weight growth and molting frequency of freshwater lobster (*Cherax quadricarinatus*). Freshwater lobster is a fishery commodity with high economic value, high protein content, and low fat and cholesterol levels. Attractants are added to feed to stimulate the senses of smell and taste, thereby increasing palatability and growth rate. This research was conducted for one month in Kletek Village, Taman District, Sidoarjo Regency using a Completely Randomized Design consisting of 4 treatments and 6 replications. The treatments were control feed without attractant (A), feed supplemented with 2% betaine (B), feed supplemented with 2% lysine (C), and feed supplemented with 2% rebon shrimp paste (D). Lobsters were maintained in 10-liter plastic tanks at a density of 5 individuals per tank. Feed was provided twice daily at a dose of 3% of body weight. Parameters observed included absolute weight growth, molting frequency, and water quality (temperature, pH, DO). Data were analyzed using ANOVA followed by Duncan's test at 95% confidence level. The results showed that different types of attractants significantly affected the absolute weight growth and molting frequency of freshwater lobster (sig. = 0.000 < α = 0.05). Treatment B (2% betaine) produced the highest absolute weight growth and molting frequency compared to all other treatments, while water quality parameters remained within normal ranges and showed no significant differences among treatments, with water temperature ranging from 26.3–28.9°C, pH ranging from 7.3–8.3, and dissolved oxygen (DO) ranging from 6.5–7.2 mg/L.

Keywords: Absolute Weight Growth, Attractant, *Cherax quadricarinatus*, Commercial Feed, Molting

ABSTRAK

Penelitian ini bertujuan untuk menganalisis pengaruh perbedaan jenis atraktan yang ditambahkan ke dalam pakan komersial terhadap pertumbuhan berat mutlak dan frekuensi molting lobster air tawar (*Cherax quadricarinatus*). Lobster air tawar merupakan komoditas perikanan bernilai ekonomis tinggi dengan kandungan protein tinggi serta lemak dan kolesterol rendah. Atraktan ditambahkan ke dalam pakan untuk merangsang indra penciuman dan pengecapan, sehingga meningkatkan palatabilitas dan laju pertumbuhan. Penelitian dilaksanakan selama satu bulan di Desa Kletek, Kecamatan Taman, Kabupaten Sidoarjo menggunakan Rancangan Acak Lengkap (RAL) yang terdiri dari 4 perlakuan dan 6 ulangan. Perlakuan meliputi pakan kontrol tanpa atraktan (A), pakan dengan penambahan betain 2% (B), pakan dengan penambahan lisin 2% (C), dan pakan dengan penambahan terasi udang rebon 2% (D). Lobster dipelihara dalam bak plastik berkapasitas 10 liter dengan kepadatan 5 ekor per bak. Pakan diberikan dua kali sehari dengan dosis 3% dari bobot tubuh. Parameter yang diamati meliputi pertumbuhan berat mutlak, frekuensi molting, dan kualitas air (suhu, pH, DO). Data dianalisis menggunakan uji ANOVA dan dilanjutkan dengan uji Duncan pada taraf kepercayaan 95%. Hasil penelitian menunjukkan bahwa perbedaan jenis atraktan berpengaruh nyata terhadap pertumbuhan berat mutlak dan frekuensi molting lobster air tawar (sig. = 0,000 < α = 0,05). Perlakuan B (betain 2%) menghasilkan pertumbuhan berat mutlak dan frekuensi molting tertinggi dibandingkan perlakuan lainnya, sedangkan parameter kualitas air selama penelitian berada dalam kisaran normal dan tidak berbeda nyata antar perlakuan, dengan nilai suhu berkisar 26,3–28,9°C, pH berkisar 7,3–8,3, dan oksigen terlarut (DO) berkisar 6,5–7,2 mg/L.

Kata Kunci: Atraktan, *Cherax quadricarinatus*, Molting, Pakan Komersial, Pertumbuhan Berat Mutlak

INTRODUCTION

Indonesia is the fourth largest aquaculture producer in the world, with a potential fishery area of 26,606,000 ha (Akbar et al., 2022). Indonesia is the fourth largest aquaculture producer in the world, with production in 2012 reaching 3,067,660 tons or 4.6% of global fisheries production (Radiarta et al., 2015). Crustaceans are an important commodity in aquaculture, characterized by the presence of an exoskeleton, a hard and rigid outer layer that protects the entire body (Mulyadi, 2019). Freshwater lobsters are a popular type of shrimp (crustacean) and therefore have the potential for cultivation, known for their high protein content, low fat and cholesterol, and good resistance to disease (Faiz et al., 2021). The success of their cultivation is greatly influenced by feed quality, with protein requirements for growth ranging from 30–40% of the total feed (Saepul Miptah et al., 2024).

Freshwater lobster growth is closely linked to the molting process, with higher molting frequency directly proportional to the achieved growth rate (Ahmad, 2026). To support this, according to Qu et al. (2024), feed utilization in cultivated organisms can be optimized by adding stimulants known as attractants to the feed. Attractants are substances added to artificial feed in specific amounts to stimulate the response of cultivated animals, making them more interested in the feed. According to Yacoob & Suresh (2023), attractants release chemical signals that are received by the olfactory (smell) and gustatory (taste) receptors in animals. Adding attractants to feed is an effective strategy. Attractants work by stimulating the olfactory and gustatory receptors of aquatic organisms, thereby increasing palatability and feed consumption, ultimately resulting in increased growth (Roda et al., 2024).

Some commonly used attractants in aquaculture include betaine, lysine, and rebon shrimp paste. Betaine is known to function as a potent attractant and osmoregulator, increasing the efficiency of feed protein utilization. Lysine plays a role in improving palatability and protein

synthesis. Rebon shrimp paste is a local ingredient containing volatile compounds that stimulate crustacean appetite (Conti et al., 2025). However, studies on the effectiveness of these three types of attractants on freshwater crayfish (*Cherax quadricarinatus*) are still limited. Therefore, this study aimed to analyze the effect of different types of attractants in commercial feed on absolute weight growth and molting frequency of freshwater crayfish (*Cherax quadricarinatus*), and to determine the most effective attractant. It is suspected that differences in attractant types have a significant effect on absolute weight growth and molting frequency of freshwater lobsters (*Cherax quadricarinatus*).

RESEARCH METHODS

Research Time and Location

This research was conducted from February 6, 2026, to March 6, 2026, in Kletek Village, Taman District, Sidoarjo Regency.

Materials and Equipment

The materials and equipment used were freshwater lobster, betaine, lysine, shrimp paste, water, Fengli feed, plastic tubs, stationery, mobile phones, pH meters, DO meters, siphon hoses, shelters, sprayers, scales, scoops, fish, and aerators.

Research Method

This research employed an experimental method. A Completely Randomized Design (CRD) was used, consisting of four treatments and six replications. Treatment A was a feed without added attractants (control), treatment B used the attractant betaine added at 2% to the commercial feed, treatment C used the attractant lysine added at 2% to the commercial feed, and treatment D used the attractant shrimp paste added at 2% to the commercial feed.

Research Procedures

Preparation Stage

Preparation began with selecting the container to be used. This was a 10-liter plastic tub equipped with a shelter. It was thoroughly washed with soap, dried, and then filled with 5 liters of water. The well water used as the medium was allowed to stand for 24–48 hours to allow suspended particles to settle. Freshwater lobsters (*Cherax quadricarinatus*), measuring 2–3 inches and weighing approximately 3 grams, were obtained from an Ebster cultivation facility in Kletek Village, Taman District, Sidoarjo Regency. They were then stocked into the aerated tub. Three types of attractants were used: betaine, lysine, and rebon shrimp paste (*Acates* sp.), selected based on their ability to stimulate the lobsters' sense of smell and taste, thereby increasing feed palatability during the rearing period.

Implementation Stage

Freshwater lobsters were reared in tanks with a water volume of 5 liters, with a stocking density of 5 individuals per tank and an initial weight of approximately 3 grams per individual. Commercial pellet feed was provided at a dose of 3% of body weight. The pellets were sprayed with an attractant solution of 2% of the total feed dissolved in 5% water of the given feed weight, then air-dried until the pellets adhered completely. Feeding was carried out twice daily: 25% in the morning at 9:00 AM and 75% in the afternoon at 7:00 PM, to accommodate the lobster's nocturnal nature. The tanks were siphoned every three days to remove any remaining feed, feces, and debris that had settled on the bottom to maintain optimal water quality. Absolute weight growth was monitored weekly to determine feed and attractant dosage adjustments.

Observation Stage

The parameters observed in this study included absolute weight growth, molting frequency, and water quality. Absolute weight growth data (g) was obtained by measuring the weight of freshwater lobsters at the beginning of the study and reweighing them after 30 days of treatment. The data were then calculated using the absolute weight growth formula according to Muchlisin et al. (2017):

$$W = Wt - Wo$$

Moulting frequency data was obtained by counting the number of freshwater lobsters that molted completely during the rearing process. The number of shells was then calculated using the formula (Handayani & Syahputra, 2018).

The water quality parameters observed included temperature, acidity (pH), and dissolved oxygen (DO). Temperature was measured using a thermometer, pH using a pH meter, and DO using a DO meter. Measurements were made weekly to maintain optimal water quality throughout the freshwater lobster rearing period.

Data Analysis

After the study was completed, data were collected and analyzed. The data observed in this study were the absolute weight growth and molting frequency of freshwater lobsters (*Cherax quadricarinatus*) after being administered different types of attractants in commercial feed. The research data will be presented in tables and histograms to facilitate drawing conclusions. The data were analyzed using ANOVA (Analysis of Variance) using IBM SPSS Statistics 26.

RESULT

Absolute Weight Growth

Based on the results of research on optimizing different types of attractants in commercial feed to increase absolute weight growth in freshwater lobsters (*Cherax quadricarinatus*) over a one-month period, the average absolute weight growth data for each treatment were obtained. The growth of the tested freshwater lobsters (*Cherax quadricarinatus*) yielded data on the range of changes, the average change, and the standard deviation, which are presented in the following table.

Table 1. Range of Average Values and Standard Deviations for Absolute Weight Growth

Treatment	Range	Average (gr)	Standard Deviation
(A) Control	2.6 - 3.6	3.1	0.344
(B) Betaine	4.6 – 6	5.2	0.585
(C) Lysine	4 – 5.6	4.6	0.557
(D) Shrimp Paste	3.4 – 4.2	3.8	0.344

Data on the growth frequency for each treatment within a one-month study can be seen in the following figure:

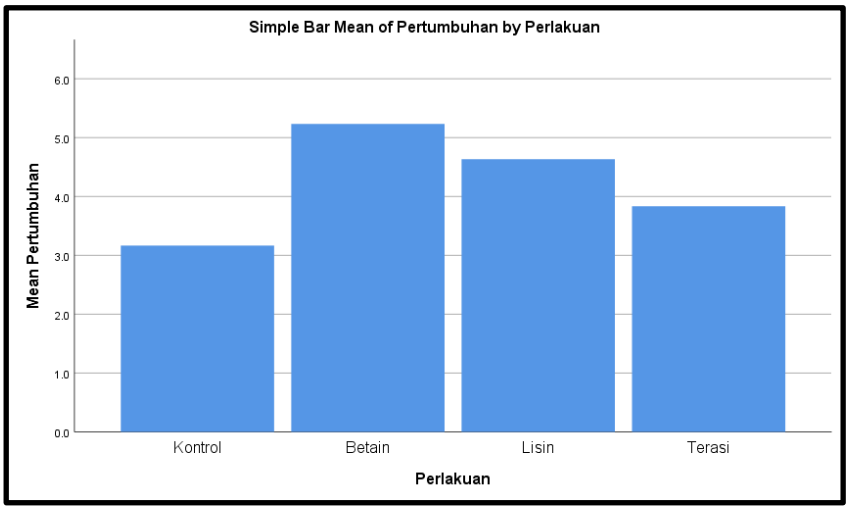

Figure 1. Absolute Weight Growth

To determine whether the absolute weight growth data for freshwater lobsters was normally distributed, a normality test was performed using the Kolmogorov-Smirnov test. The results of the normality test can be seen in Table 2 below:

Table 2. Absolute Weight Growth Normality Test

One-Sample Kolmogorov-Smirnov Test		
		Growth
N		24
Normal Parameters[a,b]	Mean	4.217
	Std. Deviation	.9135
Most Extreme Differences	Absolute	.125
	Positive	.125
	Negative	-.102
Test Statistic		.125
Asymp. Sig. (2-tailed)		.200[c,d]

This was followed by a homogeneity test. The homogeneity of absolute weight growth data can be seen in Table 3 below:

Table 3. Homogeneity Test for Absolute Weight Growth

	Levene Statistic	df1	df2	Sig.
Based on Mean	1.228	3	20	.326
Based on Median	1.173	3	20	.345
Based on trimmed mean	1.200	3	20	.335

To determine the difference in the effect between treatments on the absolute weight growth of freshwater lobsters, see the following table:

Table 4. ANOVA Test (F Test) Absolute Growth of Freshwater Lobsters

ANOVA					
	Sum of Square	df	Mean Square	F	Sig.
Between Groups	14.470	3	4.913	22.066	.000
Within Groups	4.453	20	.223		
TOTAL	19.193	23			

Furthermore, to determine the level of difference between each treatment on the absolute weight growth of freshwater lobsters (*Cherax quadricarinatus*), a Duncan test was conducted.

Table 5. Duncan Test: The Effect of Different Attractant Types in Commercial Feed on the Absolute Growth of Freshwater Lobsters

Treatment	N	Subset for alpha = 0.05			
		1	2	3	4
A	6	3.167			
D	6		3.833		
C	6			4.633	
B	6				5.233
Sig.		1.000	1.000	1.000	1.000

Molting Frequency

Based on the results of research on the optimization of different attractant types in commercial feed on the molting frequency of freshwater lobsters (*Cherax quadricarinatus*) over a period of one month, the average molting frequency data for each treatment is presented. The molting frequency of freshwater lobsters (*Cherax quadricarinatus*) tested yielded data on the range of change values, the average change, and the standard deviation, which are presented in the following table.

Table 6. Range, Average, and Standard Deviation of Molting Frequency

Treatment	Range	Average (gr)	Standard Deviation
(A) Control	2 – 4	2.6	0.816
(B) Betaine	5 – 6	5.5	0.548
(C) Lysine	4 – 5	4.5	0.548
(D) Shrimp Paste	3 - 4	3.5	0.548

Data on the molting frequency for each treatment within one month of the study can be seen in the following figure:

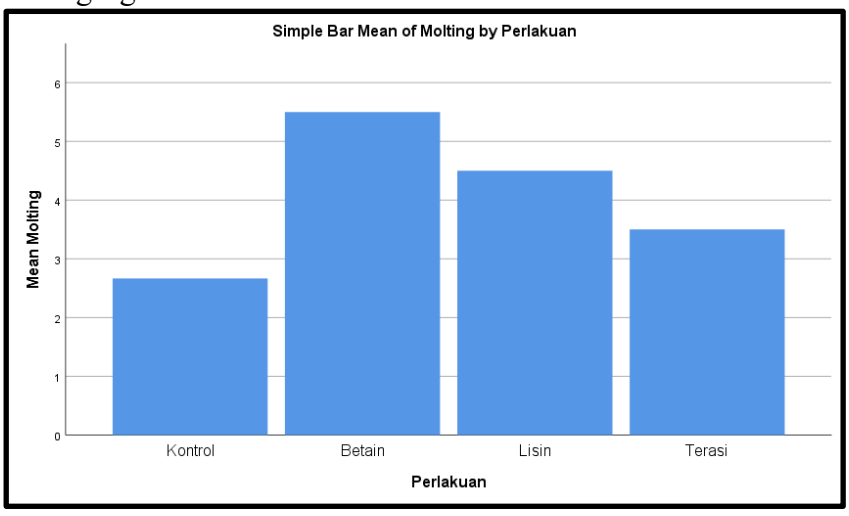

Figure 2. Molting Frequency

To determine whether the molting frequency data for freshwater lobsters was normally distributed, a normality test was performed using the Kolmogorov-Smirnov test. The results of the normality test are shown in Table 7:

Table 7. Normality Test for Molting Frequency

One-Sample Kolmogorov-Smirnov Test		
		Molting
N		24
Normal Parameters[a,b]	Mean	4.04
	Std. Deviation	1.233
Most Extreme Differences	Absolute	.157
	Positive	.138
	Negative	-.157
Test Statistic		.157
Asymp. Sig. (2-tailed)		.133[c]

This was followed by a homogeneity test. The homogeneity of the molting frequency data can be seen in Table 8 as follows:

Table 8. Homogeneity Test for Molting Frequency

	Levene Statistic	df1	df2	Sig.
Based on Mean	1.250	3	20	.318
Based on Median	1.000	3	20	.413
Based on trimmed mean	1.235	3	20	.323

Next, a one-way ANOVA test was conducted at a 5% significance level (α = 0.05) to determine any differences in the effect between treatments on the molting frequency of freshwater lobsters. This is shown in the following table:

Table 9. ANOVA Test (F Test) Molting Frequency

ANOVA					
	Sum of Square	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	27.125	3	9.042	23.085	.000
Within Groups	7.833	20	.392		
TOTAL	34.958	23			

Next, to determine the level of difference between each treatment on the molting frequency of freshwater lobsters (*Cherax quadricarinatus*), a Duncan's test was conducted.

Table 10. Duncan's Test for Molting Frequency

Treatment	**N**	**Subset for alpha = 0.05**			
		1	**2**	**3**	**4**
A	6	2.67			
D	6		3.50		
C	6			4.50	
B	6				5.50
Sig.		1.000	1.000	1.000	1.000

Water Quality

Water Temperature

Based on the research results, the water temperature values in each treatment did not significantly affect the absolute weight growth and molting frequency of freshwater lobsters. To determine whether the water temperature data were homogeneous, a homogeneity test was

conducted using the Levene's test, as presented in the table below:

Table 11. Homogeneity Test for Water Temperature Data

	Levene Statistic	df1	df2	Sig.
Based on Mean	0.325	3	20	0.808
Based on Median	0.267	3	20	0.849
Based on trimmed mean	0.304	3	20	0.822

To determine whether there were significant differences between water temperatures in each treatment, a further test, ANOVA, was conducted. The results of the ANOVA test are shown in the following table.

Table 12. ANOVA Test for Water Temperature Data

ANOVA					
	Sum of Square	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	0.071	3	0.024	0.264	0.850
Within Groups	1.798	20	0.090		
TOTAL	1.870	23			

Water pH

Based on the research results, the water pH values in each treatment did not significantly affect the absolute weight growth and molting frequency of freshwater lobsters. To determine whether the water pH data was homogeneous, a homogeneity test was performed using Levene's test, as presented in the following table:

Table 13. Water pH Data Homogeneity Test

	Levene Statistic	df1	df2	Sig.
Based on Mean	0.338	3	20	.798
Based on Median	0.337	3	20	.799
Based on trimmed mean	0.338	3	20	.798

To determine whether there were significant differences between pH values in each treatment, a further test, ANOVA, was performed. The results of the ANOVA test can be seen in the following table.

Table 14. Water pH Data ANOVA Test

ANOVA					
	Sum of Square	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	.010	3	.003	.148	.930
Within Groups	.450	20	.023		
TOTAL	.460	23			

Water DO

Based on the research results, the dissolved oxygen (DO) values in each treatment did not significantly affect the absolute weight growth and molting frequency of freshwater lobsters. To determine whether the water DO data was homogeneous, a homogeneity assumption test was performed using Levene's test, as presented in the following table:

Table 15. Water DO Data Homogeneity Test

	Levene Statistic	df1	df2	Sig.
Based on Mean	0.038	3	20	.990
Based on Median	0.094	3	20	.962
Based on trimmed mean	0.034	3	20	.991

To determine whether there are significant differences between DO values in each treatment, a further ANOVA test is required. The results of the ANOVA test are shown in the following table.

Table 16. ANOVA Test for Water DO Data

ANOVA					
	Sum of Square	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	.035	3	.012	.995	.415
Within Groups	.232	20	.012		
TOTAL	.266	23			

DISCUSSION

The test results showed that different types of attractants significantly affected the absolute weight growth of freshwater lobsters (*Cherax quadricarinatus*) with the order B (betaine 2%) = 5.2 g > C (lysine 2%) = 4.6 g > D (shrimp paste 2%) = 3.8 g > A (control) = 3.1 g, and all treatments were significantly different based on the Duncan test. This is also in accordance with previous research by Teoh et al. (2025), which explains that the addition of attractant compounds in the form of amino acids such as betaine in feed can increase the feeding response in crustaceans, so that feed consumption is higher than feed without attractants. Also supported by the opinion of Mahmudin & Idris (2016), that lobsters in searching for food rely more on smell stimulation than on sight so that the high aroma of the feed will stimulate lobsters to approach and consume the feed. Lim et al. (2022), also argue that amino acids act as effective chemostimulants in crustaceans through the activation of gustatory receptors. Arditya et al. (2019) explained that the addition of various types of attractants to feed significantly affected the growth rate of cultivated organisms, with the treatment without attractants producing the lowest growth rate compared to all treatments using attractants.

Different types of attractants significantly affected the molting frequency of freshwater lobsters. Various types of attractants in treatments A, B, C, and D showed significantly different results based on Duncan's test. Lim et al. (2016) explained that betaine, as a feed attractant, can increase the appetite of aquatic organisms. According to Yacoob & Suresh (2023), attractants release chemical signals that stimulate olfactory and gustatory receptors, thus triggering a feed consumption response in aquatic organisms. Conti et al. (2025) also added that activation of these sensory systems results in increased feed consumption, digestive efficiency, and optimized nutrient utilization. This is consistent with Jones (2015) that adequate nutrition accelerates the molting cycle. Furthermore, Mykles & Chang (2020) explained that the hormonal regulation of crustacean molting glands through the ecdysone pathway is strongly influenced by nutrient availability and metabolic status.

Temperature, pH, and DO parameters during the study did not differ significantly between treatments, with a temperature range of 26.3–28.9°C, pH 7.3–8.3, and DO 6.5–7.2 mg/L. Astiyani et al. (2024) stated that the temperature in freshwater lobster (*Cherax quadricarinatus*) rearing ponds ranges from 26–32°C and is still within the physiological tolerance limits of lobsters during the rearing period. Albaab et al. (2023) also argued that lobsters require water conditions with a pH ranging from 7–8.0, and Nizar et al. (2022)

confirmed that the ideal DO level for freshwater lobster cultivation ranges from 6–8 mg/L. This uniformity of water quality confirms that the differences in absolute weight growth and molting frequency obtained are a direct result of the differences in the type of attractant given, not the influence of environmental variations.

CONCLUSION

Different types of attractants in commercial feed significantly affected the absolute weight growth and molting frequency of freshwater lobsters (*Cherax quadricarinatus*). Betaine 2% was the most effective type of attractant that produced the highest absolute weight growth of 5.2 g and the highest molting frequency of 5.5 times/tail/month compared to 2% lysine, 2% rebon shrimp paste, and the control. Water quality parameters during the study including temperature (26.3–28.9°C), pH (7.3–8.3), and dissolved oxygen (6.5–7.2 mg/L) were within the optimal range for freshwater lobster growth and did not differ significantly between treatments, so that differences in growth performance were entirely influenced by the type of attractant given.

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