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FEED INTAKE AND GROWTH OF VANNAMEI SHRIMP (*Litopenaeus vannamei*) WITH THE ADDITION OF DIFFERENT ATTRACTANT SOURCES IN SELF-PREPARED FISH FEED

Konsumsi Pakan Dan Pertumbuhan Udang Vaname (*Litopenaeus vannamei*) Dengan Penambahan Sumber Atraktan Berbeda Dalam Pakan Mandiri

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ABSTRACT

One of the issues in aquaculture activities is the high cost of commercial feed, and self-prepared feed can be one of the solutions. Efforts to improve feed utilization in cultured organisms include the use of stimulants known as attractants. The objective of this study is to observe the use of different attractant sources in self-prepared feed for whiteleg shrimp (*Litopenaeus vannamei*) by examining feed consumption, feed conversion ratio (FCR), and the growth of the shrimp. The treatments in this study consisted of feed without the addition of attractants (A), feed with the addition of squid meal attractant (B), shrimp head meal (C), and rebon (small shrimp) meal (D). Whiteleg shrimp (DOC 30) with an average weight of 2.96±0.21 g were reared in aquariums, with each treatment consisting of four replicates. After the rearing period, the feed intake for treatments A, B, C, and D was 0.156 g/shrimp, 0.184 g/shrimp, 0.181 g/shrimp, and 0.167 g/shrimp, respectively. The feed conversion ratio (FCR) obtained was 1.8, 1.4, 1.2, and 1.3, respectively. The absolute growth for the four treatments was 1.092 g/shrimp, 1.632 g/shrimp, 1.779 g/shrimp, and 1.506 g/shrimp, respectively. Statistical analysis showed no significant differences among the four treatments ($P>0.05$) in terms of feed consumption, FCR, and growth. The results of this study highlight the potential use of shrimp head meal, which is a waste product, as an attractant and a protein source.

Key words: Attractant Source, *Litopenaeus vanname*, Self-Prepared Fish Feed

ABSTRAK

Salah satu masalah dalam kegiatan budidaya perikanan adalah harga pakan komersial yang tinggi dan pakan mandiri dapat menjadi salah satu solusi. Upaya meningkatkan pemanfaatan pakan pada organisme budidaya salah satunya adalah dengan penggunaan stimulan yang

disebut dengan atraktan. Tujuan penelitian ini adalah untuk mengobservasi penggunaan sumber atraktan berbeda dalam pakan mandiri bagi udang vaname dengan mengamati konsumsi pakan, FCR, dan pertumbuhan udang vaname. Perlakuan dalam penelitian ini terdiri dari pakan tanpa penambahan atraktan (A), pakan dengan tambahan atraktan tepung cumi (B), tepung kepala udang (C) dan tepung rebon (D). Udang vaname DOC 30 dengan bobot 2,96±0,21 g dipelihara dalam akuarium dengan masing-masing perlakuan yang terdiri dari empat ulangan. Setelah pemeliharaan, diperoleh konsumsi pakan pada perlakuan A, B, C dan D sebesar 0,156 g/ekor, 0,184 g/ekor, 0,181 g/ekor, dan 0,167 g/ekor. FCR yang diperoleh berturut-turut yaitu 1,8, 1,4, 1,2, dan 1,3. Pertumbuhan mutlak untuk keempat perlakuan berturut-turut yaitu 1,092 g/ekor, 1,632 g/ekor, 1,779 g/ekor, dan1,506 g/ekor. Tidak ada perbedaan signifikan (P>0,05) dari keempat perlakuan terhadap parameter pengamatan. Hasil ini memberikan gambaran potensi pemanfaatan tepung kepala udang yang merupakan limbah sebagai atraktan sekaligus sumber protein.

Key words: Sumber Atraktan, *Litopenaeus vanname*, Pakan Mandiri

INTRODUCTION

The availability of feed that meets quality requirements and affordable prices will support the achievement of a productive and productive aquaculture system. Appropriate and quality feed plays an important role because it determines the biomass of production results and uses large production costs, namely 60% -70% (Khasani, 2013). In addition to being beneficial for shrimp growth, providing quality feed and given with proper management can also prevent a decline in water quality (Budiardi, 2008). With the provision of proper feed, it is hoped that the level of feed utilization by shrimp will be better and the water quality will remain suitable for increasing survival so that it will ultimately increase production and benefit farmers economically.

One of the problems in fisheries cultivation activities is the high price of commercial feed and independent feed can be one solution (Sinaga *et al.,* 2021). Budiyati *et al.,* (2024) stated that the use of independent feed that utilizes local raw materials can support the growth of tilapia body weight and length. The use of independent feed from local raw materials can reduce dependence on expensive commercial feed, reduce production costs, increase growth rates and increase productivity (Amin *et al.,* 2020; Nugroho *et al.,* 2021). The use of independent feed can be tested on whiteleg shrimp by considering its nutritional content so that it can support the growth performance and survival of whiteleg shrimp.

One way to optimize the use of feed for cultivated organisms is to use stimulants called attractants. Attractants are mixed ingredients added to artificial feed with the aim of increasing the response of cultivated animals to the presence of feed. The administration of attractants aims to increase appetite so that it will increase the level of feed consumption (Mulia *et al*., 2021; Qu *et al.*, 2024). Attractants will provide a chemical signal (chemo-attractant) so that cultivated animals recognize the feed as their food (Li *et al.,* 2025). Khasani (2013) stated that the addition of attractants to feed can increase the attractiveness of fish to the feed, which can have an impact on shorter feeding times and nutrients that enter the digestive tract are not wasted.

Research on the addition of attractants to feed to increase growth and survival has been conducted on several species, for example on white snapper *Lates calcalifer* (Izal *et al*., 2019), *Channa striata* snakehead fish seeds (Arditya *et al.*, 2019), tiger grouper fish seeds *Epinephelus fuscoguttatus* (Ismi & Khalil, 2014), and *Anguilla bicolor* eel (Turrizqi, 2017). The results of studies on several species showed that the addition of attractants increased palatability, growth, and survival. Based on previous research findings, the effectiveness of attractants in whiteleg

shrimp feed is worth studying, especially because whiteleg shrimp is one of the priority commodities in the national fisheries cultivation sector. The study aims to determine the effect of adding attractants from different sources to independent feed for whiteleg shrimp on feed consumption, FCR, and whiteleg shrimp growth.

RESEARCH METHODS

Research Material

The test animals were vannamei shrimp (*Litopenaeus vannamei*) DOC 30 with an average weight of 2.96 ± 0.21 g. The test animals were obtained from the Mallari pond installation of the Bone Marine and Fisheries Polytechnic. The maintenance container was an aquarium with a volume of 40x30x30 cm^3 equipped with an aeration system. The maintenance medium was brackish water with a salinity of 27-28 ppt. The water used had gone through a sedimentation process, chlorine treatment for sterilization with a dose of 20 ppm and was filtered with a filter bag when flowing into the aquarium.

The test feed was an independent feed produced using local raw materials (Table 1). In addition to these ingredients, additional ingredients were also used as attractants which were also treatments in this study, namely squid flour, shrimp head flour and rebon flour, the addition of which was based on the research treatment.

The feed formulation was prepared using the trial and error method (Rustandi *et al.*, 2021) with a dose of each squid flour, shrimp head flour, and rebon flour of 15%. This dose was chosen because of the high chitin content in shrimp head flour which can limit digestibility, and based on Nastiti *et al.*, (2020), tilapia growth was better with the addition of shrimp head flour of 15%. The results of the preparation of the independent feed formulation are presented in Table 1. The test feed that had been made was then analyzed for its proximate content at the BRPBAPPP Maros Nutrition Testing Laboratory (Table 2).

Table 1. Independent feed formulation for *L. vannamei* maintenance using different feed attractants

	Percentage of Raw Materials (%)			
Raw material	**A**	**B**	**C**	**D**
Fish meal	35	30	30	25
Squid Flour	0	15	0	0
Shrimp Head Flour	0	0	15	0
Rebon Flour	0	0	0	15
Soybean Flour	31	20	20	20
Fine Bran	15	15	15	16
Corn Flour	10	11	11	13
Tapioca	5.5	5.5	5.5	7.5
Vitamin Mix	3	3	3	3
CMC	0.5	0.5	0.5	0.5
TOTAL	**100**	**100**	**100**	**100**

Table 2. Proximate content of test feed in L. vannamei maintenance with different feed attractant sources

Test Feed Treatment	Parameter (%)				
	Ash Content	Water content	Fat Content	Protein Content	Crude Fiber Content
A	10,66	9,94	5,33	33,55	2,40
B	10,36	9,21	4,82	32,65	1,95
C	11,99	10,09	5,45	36,25	3,62
D	11,41	5,27	5,20	37,33	2,14

Treatment

This research was conducted with two feed treatments with different attractant sources, namely:

Treatment A = Without adding attractants
Treatment B = Addition of 15% squid flour
Treatment C = Addition of 15% shrimp head flour
Treatment D = Addition of 15% rebon flour

The research was designed using a Completely Randomized Design (CRD) with four treatments and 3 replications, so there were 12 experimental units.

Research Procedures

Before being stocked, the test animals were acclimatized for 3 days and weighed. The number of stockings was 20 per aquarium. The test animals were then adapted to the feed for 2 and after that fasted for 24 hours with the aim of emptying the digestive tract from feed. Maintenance was carried out for 21 days with a feeding rate of 7% and a frequency of 3 times per day, namely at 07.00, 12.00, and 17.00. The remaining feed was siphoned every day, dried, then weighed to determine the amount of feed consumption. The maintenance water was replaced by 50% per day through siphoning.

Observation Parameters

1. Daily Feed Consumption Amount

The amount of daily feed consumption is measured to assess the palatability of shrimp or the level of shrimp's preference for the feed given. Every day, the remaining feed is siphoned off, then dried, and then weighed. The amount of feed consumption is the difference between the amount of daily feed and the amount of daily remaining feed.

2. Feed Conversion Ratio (FCR)

FCR is calculated using the formula according to Effendie (2002):

$$FCR = \frac{F}{W_t - W_o}$$

FCR is Feed conversion ratio, F is Amount of feed consumed (g), Wt is Weight of test animal at time t (g) and Wo is Initial weight of test animal (g).

3. Absolute Weight Gain

Absolute weight growth was measured using the formula according to Effendie (Effendie 2002):

$$W=Wt-Wo$$

where W is the absolute weight of the shrimp (g), Wt is the weight at time t and Wo is the weight of the shrimp at the beginning of the study.

Data Analysis

Feed consumption data, FCR and absolute growth were analyzed statistically using ANOVA test. Data were processed using IBM SPSS 21. Homogeneity test and normality test were conducted previously to see whether the data were homogeneous and normally distributed.

RESULT

Average Daily Feed Consumption (Fc)

The results of the calculation of average daily feed consumption are shown in Figure 1. During the maintenance period, it was found that the highest feed consumption was obtained in the squid flour attractant treatment (B), followed by the treatment of adding shrimp head flour attractants (C), rebon flour (D) and without adding attractants (A). However, the results of statistical analysis showed that the treatment of adding attractants to the independent feed did not significantly affect the average feed consumption of *L. vannamei* (P>0.05).

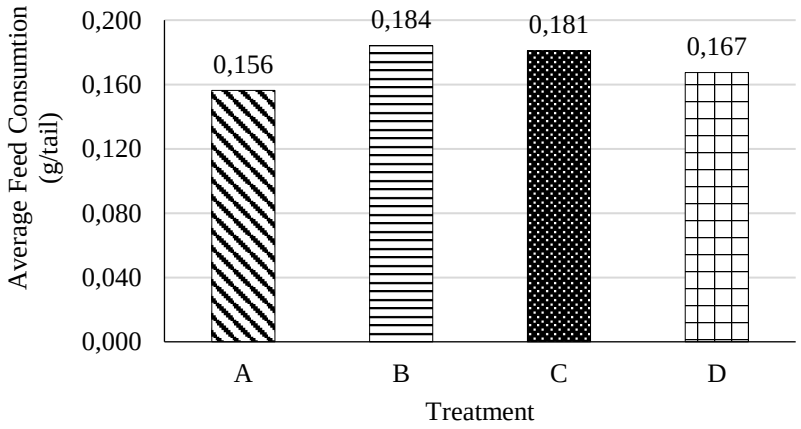

Figure 1. Average daily feed consumption of L. vannamei reared with different feed attractants.

Feed Conversion Ratio (FCR)

The feed conversion ratio (FCR) of *L. vannamei* reared using feed with different attractant additions is presented in Figure 2. The lowest FCR was obtained from the treatment of shrimp head flour attractant addition (C), followed by the treatment of rebon flour attractant addition (D), squid flour (B) and the highest was the treatment without attractant addition (A). The results of statistical analysis showed that the addition of attractants did not have a significant effect on the feed conversion ratio (P>0.05).

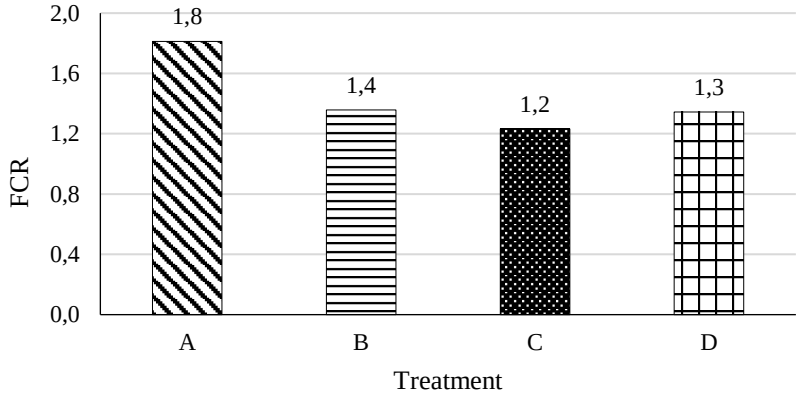

Figure 2. Feed conversion ratio (FCR) of L. vannamei reared with different feed attractants.

Average Absolute Weight Growth (W)

The average absolute weight growth (W) of *L. vannamei* maintained with different attractants is presented in Figure 3. The highest average absolute growth was obtained in the shrimp head flour attractant treatment (C), followed by squid flour attractant treatment (B), rebon flour (D) and the lowest was without the addition of attractants (A). The results of statistical analysis showed that the addition of feed attractants for *L. vannamei* did not have a significant effect on growth (P>0.05).

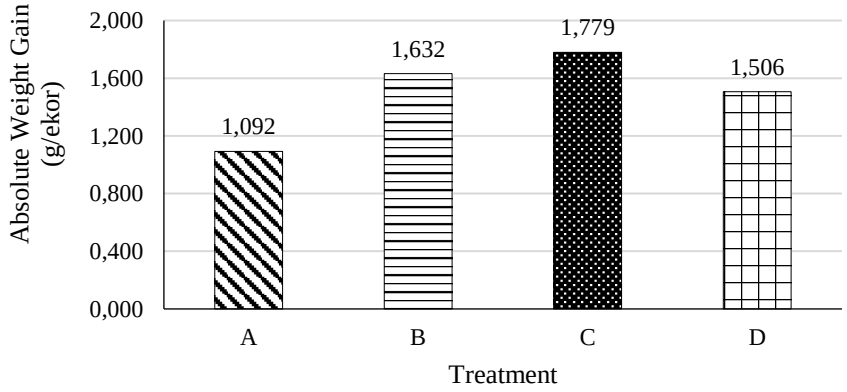

Figure 3. Absolute weight growth of *L. vannamei* reared with different feed attractants.

DISCUSSION

Feed Consumption (FC)

Feed consumption of *L. vannamei* shrimp has been evaluated as a form of response of *L. vannamei* reared using feed with different attractant additions. Feed consumption is closely related to the reaction of biota to feed that emits chemical signals from attractants which are then received by olfactory receptors until the biota moves towards the feed and ends with the feed being consumed or rejected (Heraud *et al.*, 2022; Pavadi *et al.*, 2012; Qu *et al.*, 2024).

The use of attractants is one way to increase the interest of biota in feed. Animal-based feed raw materials, such as fish meal, squid meal and rebon meal are believed to be effective sources of attractants because they are rich in amino acids, nucleotides and peptides (He *et al.*,

2022). Kurniawan (2013) stated that amino acids contained in feed are components that will trigger the attraction of biota to feed in addition to being a source of energy for growth.

Feed consumption obtained in the results of this study did not show any difference. It is suspected that in feed without additional attractants, feed consumption did not differ because it had a higher fish meal composition (35%) than other test feeds (30% and 25%), where fish meal also acts as an attractant. Nagel *et al.* (2017) stated that protein in fish meal can act as an attractant in feed and when fish meal was replaced with canola meal which is a source of vegetable protein, there was a significant decrease in feed consumption. The results obtained in this study are different from the results of previous studies. Yuan *et al.*, (2021) compared feed added with squid meal, fish meal, casein and hydrolyzed fish protein, and it was found that juvenile *L. vannamei* shrimp fed with additional squid meal had a significantly higher feed consumption rate than those fed fish meal, casein and feed without attractants. In addition, juvenile shrimp fed with fish meal treatment had higher feed consumption than fish not given additional attractants. With every 3% addition of the attractant, a significant increase in the amount of feed consumption was obtained (Yuan *et al.*, 2021).

With the use of different attractants, the nutritional content of the feed was obtained based on the results of the proximate analysis which also varied. It was found that there was a different protein content in each test feed, with a range of 32-37% of the amount of protein. Heptarina (2010) stated from the results of her study that the amount of feed consumption of *L. vannamei* juveniles increased with an increase in the amount of protein. Based on SNI 8037.1-2014, the need for shrimp feed is at least 36%. Although the control test feed (without additional attractants) and with the addition of squid flour attractants had a lower protein content than rebon flour and shrimp head flour, the feed consumption obtained was no different from other feeds due to the use of more fish flour in the control feed, where fish feed also functions as an attractant. Yulianto *et al.*, (2021) and Hadi *et al.*, (2024) stated that protein hydrolysate from shrimp heads has the potential as a source of protein as well as an attractant so that it can increase nutrition and palatability, showing the potential for utilizing shrimp heads which are usually waste. Rebon flour also has high protein, namely 52.35% and is known to increase appetite (Buwono *et al.*, 2024).

Feed given attractants will contain compounds that function as stimulants or stimuli for fish/shrimp so that fish or shrimp will respond to feed including betaine, amino acids, and nucleotides (Khasani, 2013). These compounds stimulate fish/shrimp to eat so that there is an increase in feed consumption. Attractant materials, when given properly, will provide several benefits, including better nutrition because they are eaten more quickly by fish, thus minimizing the occurrence of nutrient leaching into the water, and increasing the nutrient content of feed, especially the protein content needed by fish/shrimp for growth.

Feed Conversion Ratio (FCR)

Feed Conversion Ratio (FCR) or feed conversion ratio is a value that will indicate how much feed is needed to increase the weight of shrimp by 1 kg (Zonneveld *et al.*, 1991). The smaller the FCR indicates better feed quality with a high level of digestibility. This study shows that feed without additional attractants or with additional squid flour, shrimp head flour and rebon flour attractants gave the same results on the FCR value statistically ($P>0.05$). This also indicates that the utilization of feed and digestibility of the four test feeds tend to be the same, although in Figure 2 it appears that the FCR value of the test feed without additional attractants has a higher FCR than the test feed with additional squid flour, shrimp head flour and rebon flour attractants.

The feed conversion value in cultivation activities is attempted to be at a low value. A lower FCR value indicates that the feed has good quality and is optimally utilized by the

cultivated animals, so that to obtain an increase in body weight, less feed is needed. A low FCR value will indirectly provide benefits to the lower costs that need to be spent on feed procurement costs which take up around 50-70% of production costs so that there is efficiency in terms of feed utilization and production costs. A lower FCR value will also encourage better environmental quality, especially in ammonia production, because less feed is used and its utilization is also more optimal. More optimal feed utilization causes lower organic waste from leftover feed and the nutrient load will be reduced.

Absolute Growth (W)

Based on the results obtained, the addition of attractants to the test feed did not have a significant effect on the growth of *L. vannamei*. However, in Figure 3 it can be seen that shrimp that were not given additional attractants had the lowest absolute growth among the test feed treatments with additional attractants. The greater increase in shrimp weight in feed with attractants is thought to be related to the stimulation effect produced by the material. Stimulants in the form of chemicals contained in the feed will stimulate fish to continue eating after the activity of eating their food begins (Lee & Meyers, 1996). With the presence of stimulants, shrimp will respond to feed more quickly so that feed nutrients will be maintained from leaching nutrients due to feed that is too long in the water. This is in accordance with the opinion of Suresh *et al.,* (2011) that optimal fish/shrimp growth can be achieved when the response of fish/shrimp to feed occurs more quickly in addition to the factors of nutritional adequacy and nutrient balance in feed. In addition, with more efficient utilization of nutrients, biota growth will also be more optimal (Noviana *et al.,* 2014).

Shrimp head flour, rebon flour and squid flour all contain amino acids that are essential for growth so that they have the same effect in supporting shrimp growth. Sholichin (2012) stated that the amino acid that plays a major role in growth is the essential amino acid arginine where arginine is known to increase growth hormone by stimulating insulin hormone production. It is known that squid flour, shrimp head flour and rebon flour and including fish flour contain the essential amino acid arginine. In addition, all feeds also contain fish flour which has a composition of the essential amino acids lysine and methionine which are also important for growth so that they can support the growth of shrimp that are kept with different attractant addition treatments. (Kerr *et al.,* 2019) stated that the protein content in feed composed of amino acids will affect growth, where in the formation of new tissue and replacement of damaged tissue adequate protein is needed.

Based on protein content, the four test feeds have a protein content of 32-37% so that the four feeds tested have sufficient protein to support the growth of whiteleg shrimp. Tahe & Suwoyo (2014) stated that the protein requirement of whiteleg shrimp ranges from 28-30% and based on SNI 9043 - 2: 2022 the protein requirement of whiteleg shrimp is 28-32%. Based on this, it is known that the feed used in this study has met the protein requirement of whiteleg shrimp for growth so that the four feeds have no different effect on the growth of whiteleg shrimp.

CONCLUSION

The treatments did not differ significantly on feed consumption, FCR and growth. Thus, shrimp head flour, squid flour and rebon flour have the potential to be used as additional attractants to replace some fish flour. Because the price is cheaper, shrimp head flour is considered potential to be used as a more economical source of attractant. The results of this study provide an overview of the potential use of shrimp head flour as a feed raw material that can be a source of protein as well as an attractant. Further research is needed to assess the optimal dose of shrimp flour use in independent feed.

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