

**UTILIZATION OF FEED WITH ADDED PEDADA LEAF EXTRACT
(*Sonneratia alba*) TO INCREASE THE GROWTH RATE OF VANNAMEI
SHRIMP (*Litopenaeus vannamei*)**

Pemanfaatan Pakan yang Ditambahkan Ekstrak Daun Pedada (*Sonneratia alba*) untuk Meningkatkan Laju Pertumbuhan Udang Vanname (*Litopenaeus vannamei*)

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ABSTRACT

Vannamei shrimp, one of the successors to global food security, faces several problems, especially the increasing use of feed. The use of pedada leaves is an alternative supplement to optimize the absorption of vannamei shrimp feed. The purpose of this study was to obtain the best dose of pedada leaf extract (*S. alba*) that can be added to feed to provide the highest growth rate effect on vannamei shrimp. Seed samples using vannamei shrimp PL-20 were maintained in a 10 L jar with a quantity of 1 shrimp/L. This study used a completely randomized design (CRD) experiment consisting of 4 treatments with 3 replications. A (0 mL pedada leaf extract/kg feed), B (5 mL pedada leaf extract/kg feed), C (10 mL pedada leaf extract/kg feed), and D (15 mL pedada leaf extract/kg feed). The addition of pedada leaf extract had a significant effect on growth, FCR value, and EPP percentage. The best dose produced by this study was treatment D with an average biomass growth of 5.79 g with an FCR value of 1.06 and a feed efficiency percentage of 86%. However, the addition of pedad leaf extract did not provide a significant difference in the SR value. The results of observations of water quality results at a temperature of 27–28°C, pH 8.2–8.5, DO 4.23–5.42 mg/L, and salinity of 32–33 ppt.

Keywords: Pedada leaves, EPP, FCR, Growth, Vannamei shrimp

ABSTRAK

Udang vanname menjadi salah satu suksesor terhadap ketahanan pangan global mengalami beberapa permasalahan terutama penggunaan pakan yang semakin meningkat. Pemanfaatan daun pedada menjadi alternatif sebagai supplement untuk mengoptimalkan penyerapan pakan udang vanname. Tujuan penelitian ini mendapatkan dosis ekstrak daun pedada (*S. alba*) terbaik yang dapat ditambahkan ke pakan untuk memberikan pengaruh laju pertumbuhan tertinggi pada udang vanname. Sampel benih menggunakan udang vanname PL-20 dipelihara didalam toples 10 L dengan kuantitas 1 ekor/L. Penelitian ini menggunakan Experimen rancangan acak lengkap (RAL) yang terdiri dari 4 perlakuan dengan 3 kali pengulangan. A (0 mL ekstrak daun pedada/kg pakan), B (5 mL ekstrak daun pedada/kg pakan), C (10 mL ekstrak daun pedada/kg pakan), dan D (15 mL ekstrak daun pedada/kg pakan). Penambahan ekstrak daun pedada memberikan pengaruh nyata terhadap pertumbuhan, nilai FCR, dan persentase EPP. Dosis terbaik yang dihasilkan penelitian ini yaitu perlakuan D dengan rata-rata pertumbuhan biomassa sebesar 5,79 g dengan nilai FCR 1,06 dan persentase efisiensi pakan mencapai 86%. namun penambahan ekstrak daun pedad tidak memberikan perbedaannya nyata terhadap nilai SR. Hasil pengamatan hasil kualitas air suhu 27–28°C, pH 8.2–8.5, DO 4.23–5.42 mg/L, salinitas 32 -33 ppt.

Kata kunci: Daun pedada, EPP, FCR, Pertumbuhan, Udang vannamei

INTRODUCTION

Global food security faces a number of serious challenges, including population growth and high malnutrition rates in various developing countries. This also threatens Indonesia, a country with a relatively high population growth rate (Winata et al., 2024). The UN's Zero Hunger goal, through the Sustainable Development Goals (SDGs), seeks to foster innovation and alternatives in providing affordable and nutritious sources of animal protein.

The aquaculture sector plays a strategic role in supporting the Zero Hunger goal through its product, whiteleg shrimp, which boasts high protein content, complete essential amino acids, important minerals, and healthy fats that support human health and development (Ramli et al., 2025). Therefore, whiteleg shrimp production must be increased. Increasing whiteleg shrimp production can be successful if all the shrimp's growth needs are met, one of which is adequate feeding. However, high feed costs, which can account for up to 70% of total operating costs, necessitate alternatives to maximize shrimp growth through efficient feeding and feed consumption (Kamil et al., 2023). Supplements made from natural ingredients can be used as alternative stimulants to improve feed quality and growth, and are generally safe for shrimp because they contribute to various biological activities. Natural ingredients have antioxidant, anti-inflammatory, and natural antibacterial properties. One example is *S. alba* mangrove leaves (Mairing & Ariantari, 2022).

Some mangrove leaves can influence the growth of aquatic animals, such as *R. mocronata* leaves, which can increase the growth of grouper (Syakirin et al., 2023). *R. mocronata* leaves are also used as an antibacterial agent for *V. harveyi* and a feed additive for vannamei shrimp (Mardiana et al., 2024; Linayati et al., 2025). *Avicennia* sp. leaves can improve feed ratios and weight gain in milkfish (Wijianto et al., 2023). *R. mocronata* leaves are used as an antibacterial agent for *V. harveyi* and a feed additive for vannamei shrimp (Mardiana et al., 2024; Linayati et al., 2025). In addition, *S. alba* mangrove leaves can be used as a seaweed growth stimulant (Rahman et al., 2021) and have antibacterial activity against *V. harveyi* bacteria (Kurniaji & Idris, 2020). The addition of *S. alba* leaf extract supplements to this feed is expected to support improved feed quality and better growth of vannamei shrimp. The purpose of this study was to determine the best dose of pedada leaf extract (*S. alba*) that can be added to feed to provide the highest growth rate effect on vannamei shrimp.

RESEARCH METHODS

Place and Time

The research was conducted at the Fisheries Research Lab of Pekalongan University, Pekalongan City in June 2024.

Tools and Material

The research equipment included a 10L maintenance jar, aeration equipment, a 2-ton water vibber tank, a water quality meter, a sieve, a digital scale, and stationery. The materials used were PL-20 vannamei shrimp seeds, commercial feed size 1 crumble, egg white, and pedada leaf extract.

Research Design

This study employed a completely randomized design with 4 treatments in triplicate and was experimental in nature. The treatment dosages applied in this study refer to the research by Syakirin et al. (2023), namely:

- Treatment A : 0.0 mL pedada leaf extract/kg shrimp feed
- Treatment B : 5.0 mL pedada leaf extract/kg shrimp feed
- Treatment C : 10.0 mL pedada leaf extract/kg shrimp feed
- Treatment D : 15.0 mL pedada leaf extract/kg shrimp feed

Research Procedures

The research equipment was sterilized by cleaning with soapy water, adding PK (Calcium Permanganate) powder, and drying in direct sunlight. Twelve research containers were prepared, each consisting of 10 L jars, each equipped with aeration equipment. Once the containers were ready, 10 L of sterile seawater with a salinity of 30 ppt was filled. This was previously sterilized using 60% chlorine at a dose of 60 ppm and allowed to settle in a reservoir (Iskandar et al., 2022).

After the rearing medium was ready, the test feed was prepared. The first step was to prepare the pedada leaf extract by cleaning and drying the pedada leaves. The resulting flour was then ground using a grinder. The resulting flour was weighed to determine the amount of solvent used in the maceration process. After 3 x 24 hours of maceration, the resulting solution was filtered to obtain the filtrate and evaporated in a rotary evaporator to obtain a thick extract. The extract was then weighed on an Ohaus balance according to the reference dose and mixed with commercial feed, adding 100 ml of water and 2% egg white as a binder (Linayati et al., 2022). After mixing, the test feed was air-dried to maintain the nutritional balance.

PL-20 vannamei shrimp fry were stocked as test animals at a stocking density of 10 per container with a water capacity of 1 per L (Kusumabhakti et al., 2023) and acclimatization for 2-3 days to allow the test animals to adapt to the rearing environment. Maintenance was carried out for 4 weeks, with daily feeding at a dose of 5% of the biomass to support optimal growth (Mudiarti et al., 2023), divided into three times: morning, afternoon, and evening, with the feed being administered gradually to each rearing container.

Test Parameters

Biomass growth of vannamei shrimp utilizes weight calculations from the formula (Yulfiperius, 2021), namely:

$$G = W_t - W_0$$

Information:

G = Absolute shrimp biomass growth (g); W_t = final shrimp biomass (g); W_0 = initial shrimp biomass (g).

Feed conversion ratio (FCR) and feed utilization efficiency (EPP) were calculated by applying the formula from Lara et al., (2017), namely:

$$FCR = \frac{F}{(W_t + D) - W_0}$$

$$EPP = \frac{(W_t + D) - W_0}{F} \times 100\%$$

Information:

FCR = Feed conversion ratio; EPP = Feed utilization efficiency; F = Accumulation of consumed feed (g); W_t = final shrimp biomass (g); W_0 = initial shrimp biomass (g); D = accumulation of dead shrimp biomass.

The survival rate or percentage of survival of vannamei shrimp seeds is calculated using the formula Ly et al., (2019):

$$KH = \frac{N_0 - N_t}{N_0} \times 100$$

Information:

KH = Life sustainability (%); N_t = Accumulation of dead shrimp (tails); N_0 = Initial total shrimp accumulation (tail).

The water quality of vannamei shrimp cultivation was analyzed by taking data on temperature, pH, DO, and salinity for each container every day.

Data Analysis

Data analysis was carried out using Microsoft Excel software to test normality, homogeneity, analysis of variance (ANOVA), and Tukey test.

RESULT

Absolute Growth Performance

The growth performance results of vannamei shrimp seed biomass are summarized in Figure 1.

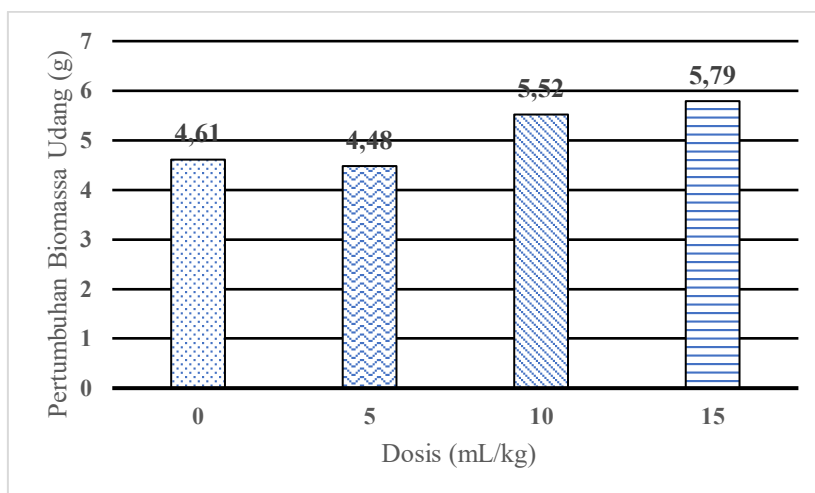


Figure 1. Shrimp Biomass Growth for Each Treatment During the Research Period

S. alba leaf extract added to the feed of vannamei shrimp fry had a significant effect ($p < 0.05$) on the development of shrimp biomass weight. Based on Figure 1, the highest average growth was obtained in treatment D, namely 5.79 grams, then treatment C 5.52 grams, followed by treatment B 4.48 grams, then the lowest treatment was in treatment A with an average of 4.61 grams.

Feed Conversion Ratio and Feed Utilization Efficiency

The feed conversion results for the vannamei shrimp fry that can be used to produce meat can be seen in Table 1.

Table 1. Average FCR and EPP of Vannamei Shrimp Fry at the End of Rearing

Treatment	FCR	EPP
A (0 mL/kg)	1,48	60%
B (5 mL/kg)	1,45	61%
C (10 mL/kg)	1,21	74%
D (15 mL/kg)	1,06	86%

From table 1, the results of *S. alba* leaf extract added to the feed of vannamei shrimp fry had a significant effect on the FCR value and the percentage of EPP of vannamei shrimp fry. Treatment D (15 mL/kg) obtained the lowest FCR value of 1.06 with an EPP percentage of 86% and the treatment that produced the highest FCR value was treatment A which did not provide the treatment of adding *S. alba* leaf extract to the feed given, resulting in an FCR value of 1.48 with an EPP percentage of 60%.

Survival Rate

The results of the study showed that *S. alba* leaf extract treatment did not affect the survival rate of whiteleg shrimp fry. However, the whiteleg shrimp were able to defend themselves well. This can be seen in Table 2.

Table 2. Survival Rate of Whiteleg Shrimp Fry During the Study Period

Replication	Treatment				Total
	A	B	C	D	
1	10	10	10	10	
2	10	10	10	10	
3	10	10	10	10	
Amount	30	30	30	30	120
SR%	100±0.00 ^a	100±0.00 ^a	100±0.00 ^a	100±0.00 ^a	

From Table 2, the results of the percentage of survival of vannamei shrimp seeds in all treatments obtained a percentage value of 100% or there was no death of any vannamei shrimp seeds during maintenance.

Water Quality

The results of quality observations in all rearing media can be seen in Table 3.

Table 3. Water Quality Parameter Values for Vannamei Shrimp Rearing Media

Water Quality Parameters	Observation result	Optimal Value
Temperature (°C)	27 – 28	26 – 32 (Supriatna <i>et al.</i> , 2020)
pH	8,2 – 8,5	7,5 – 8,5 (Fadri <i>et al.</i> , 2016)
Dissolved oxygen (mg/L)	4,23 – 5,42	4 – 8 (Yahya <i>et al.</i> , 2025b)
Salinity (ppt)	32 – 33	24 – 33 (Salampessy, 2021)

DISCUSSION

The energy requirements of whiteleg shrimp are determined by the feed they consume. This energy is allocated to regulate the balance of basic metabolism and growth. New tissue deposition occurs when the energy proportion exceeds the requirement to carry out all body metabolism and is sufficient. In this study, treatment with the addition of pedada leaf extract (*S. alba*) to the feed resulted in higher average shrimp growth compared to the control treatment that relied solely on feed. The highest growth rate was 5.79 g and occurred in treatment D (15 mL/kg). This means that pedada leaf extract acts as a supplement that can influence the increase in energy absorbed from the feed. The specific secondary metabolite compounds contained in *S. alba* leaves include several groups of phenolic compounds such as flavonoids and tannins. *S. alba* leaf extract can act as a high source of antioxidants that can inhibit DPPH radicals by up to 74.674% (Aulia & Sulistiyaningsih, 2019). These antioxidants, when absorbed by the shrimp, can help provide a calming effect, producing a successor in the metabolic process, allowing energy to be more effectively used to increase new tissue growth (Yahya et al., 2025a). Flavonoids also function as inhibitors of pathogenic bacteria and modulate the microbiota in the shrimp gut when flavonoids are broken down by gut bacteria, leading to two-way communication through enzymatic processes (Taherkhani et al., 2025). Linayati et al., (2022) added that these flavonoid compounds play a role in stimulating the accumulation of beneficial bacteria such as *Lactobacillus*, which helps optimize energy absorption by simplifying carbohydrates into lactic acid, making them easily consumed by the shrimp, especially for the shrimp growth process.

In line with the increased growth, treatment D also produced the lowest FCR value of 1.06, with an EPP percentage reaching 86%. This feed digestibility value is achieved because the pedada leaf extract has a significant effect on helping to increase the efficiency of feed consumption. According to Astiyani et al. (2022), the alkaloids, flavonoids, tannins, saponins, and several minerals in pedada leaves play a role in increasing the efficiency of shrimp feed consumption. Yahya et al. (2022) added that optimal enzymatic processes, aided by secondary metabolic compounds in natural supplements added to feed, can optimize nutrient absorption, thereby increasing shrimp digestibility. According to Yahya et al. (2025b), the anti-inflammatory properties of phenolic compounds and alkaloids can also regenerate damaged tissue, which can improve metabolic performance, especially in breaking down nutrients into simpler molecules, increasing absorption of consumed feed.

However, treatment A (0 mL/kg), or the control treatment, which relied solely on feed without the addition of pedada leaf supplements, resulted in lower growth and feed efficiency, with the highest FCR value compared to other treatments. Although the complexity of the content in complete feed, if it is not absorbed optimally, the energy produced from consuming the feed will also not be sufficient for the shrimp to grow because the energy is focused on meeting the energy needs for the shrimp's basic metabolism (Yahya et al., 2022).

This study also demonstrated that pedada leaves had no significant effect on the survival rate of whiteleg shrimp fry, as all treatments showed equally good survival rates, reaching 100%. According to Dedi et al. (2018), providing appropriate feed can increase the survival rate of shrimp. In addition to the feed used in this study, which provided sufficient basic metabolic support for all shrimp in each tank to maintain their survival, controlled rearing media, such as good water quality, can stimulate shrimp survival during the rearing period. Windarto et al. (2019) stated that well-controlled water quality, resulting in comfortable rearing conditions, can impact the increase in the number of surviving individual shrimp.

This was evidenced by the optimal water quality analyzed during the rearing period. Temperature measurements obtained during the study ranged from 27 to 28°C. The optimal temperature range for whiteleg shrimp is 26 to 32°C (Supriana et al., 2020). The pH range obtained during the study ranged from 8.2 to 8.5. The optimal pH range for whiteleg shrimp is 7.5–8.5 (Fadri et al., 2016). The DO range obtained during the study ranged from 4.23–5.42. A

good DO range for whiteleg shrimp is 4–8 (Yahya et al., 2025b), and the salinity obtained during the study ranged from 32–33 ppt. The optimal salinity range for whiteleg shrimp is 24–33 ppt (Salampessy, 2021).

CONCLUSION

From research on pedada leaf extract added to vanname shrimp seed feed that has been carried out, the conclusion obtained is that pedada leaf extract is able to significantly influence the growth, FCR value and EPP percentage of vanname shrimp seeds during the research with the best treatment produced in treatment D by administering a dose of pedada leaf extract of 15 mL/kg feed which can produce an average biomass growth of 5.79 g with an FCR value of 1.06 and a feed efficiency percentage reaching 86%.

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