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# Growth and Survival of Vaname Shrimp (*Litopenaeus vannamei*) Fed with *Gracilaria verrusca*

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**Abstract**. This study aims to determine the effect of the addition of *Gracilaria verrucosa* flour with different doses on the growth and survival of vannamei shrimp. This research was conducted in May-June 2023 at the Dryland Laboratory of the Faculty of Marine and Fisheries Animal Husbandry, Nusa Cendana University, Kupang. This research method uses a completely randomized design with 4 treatments and 3 replicates; Treatment A: Control (Without *G. verrucosa* flour). Treatment B: Addition of 4% *G. verrucosa* flour. Treatment C: Addition of *G. verrucosa* flour 8%. Treatment D: Addition of *G. verrucosa* flour 12%. The results showed that the addition of *G. verrucosa* flour in feed was able to increase the growth and survival of vannamei shrimp significantly compared to the control treatment. Treatment D (12% g/kg) addition of *G. verrucosa* flour, gives the best results to increase the growth and survival of vannamei shrimp. The results of the analysis of variance showed that the addition of *G. verrucosa* flour had a significant effect on the growth and survival of vannamei shrimp.

***Keywords*:** growth; *Gracilaria verrucose*; vannamei shrimp

## I. INTRODUCTION

Shrimp is one of the growing aquaculture commodities in aquaculture with a total production of about 4.5 million (Renteria et al., 2020). Vanamei shrimp (*L. vannamei*) accounts for 52.9% of global shrimp farming production, making it one of the most important crustacean species for aquaculture (FAO, 2020). As such, L. vannamei shrimp is a major aquaculture commodity in the world (Kurniaji et al., 2021). The high value of vannamei shrimp production still experiences obstacles, namely the low growth of vannamei shrimp (Linayati et al., 2022).

One of the efforts that can be done is to add natural ingredients using natural immunostimulants mixed into feed to improve feed quality to support the growth of vannamei shrimp (Muahiddah et al., 2022).

The seaweed genus Gracilaria has the potential to be one of the alternative natural ingredients for shrimp growth and survival, one of which is *G. verrucosa* (Jasmanindar, 2009; Saraswaty et al., 2015). *G. verrucosa* has the potential of active ingredients as immunostimulants (Purbomartono et al., 2023). Some previous studies have shown that *G. verrucosa* seaweed can increase the growth and survival of shrimp. Research (Jasmanindar et al., 2018) the addition of 2 g/kg of *G. verrucosa* extract can increase the survival and growth of L. vannamei against V. harveyi. In research (Safavi et al., 2019) that the addition of 1.5 g/kg Ulva. intestinal and G. persica in rainbow trout feed can improve growth performance and improve the immune system and stress tolerance of fish. This research is intended to show that the addition of *G. verrucosa* flour in shrimp feed is expected to increase the growth and survival of vannamei shrimp.

## II. RESEARCH METHODS

### *A. Time and Place*

This research was conducted in May-June 2023 at the Dryland Laboratory of the Faculty of Marine Animal Husbandry and Fisheries, Nusa Cendana University, Kupang.

### *B. Tools and Materials*

The tools used in this study include: an aquarium, an aerator, an aeration stone, aeration hose, digital scales,

fiber, a fine sieve, a blender, a thermometer, a pH meter, a refractometer, a ruler, and a camera. The materials used include vannamei shrimp and red seaweed flour (*G. verrucosa*).

*C. Research Design*

This research method uses a completely randomized design with 4 treatments and 3 replications. The treatments in this study were: Treatment A: Control (Without *G. verrucosaa* flour). Treatment B: Addition of 4% *G. verrucosa* flour. Treatment C: Addition of *G. verrucosa* flour 8%. Treatment D: Addition of *G. verrucosa* flour 12%.

*D. Work Procedure*

*1. Animal test preparation*

The test animals used in the study were vannamei shrimp obtained from Situbondo, as many as 120 heads, which were kept in aquariums measuring 60×30×30 cm, where each aquarium was filled with 7 shrimp weighing 0.10-0.13 g. Before entering the aquarium, the shrimp were acclimatized for one month until the required size for the given commercial feed. Before being entered into the aquarium, the shrimp were acclimatized for one month until the required size with commercial feeding. The frequency of feeding is in the morning and evening, with a feeding dose of 5% of the total body weight of the shrimp.

*2. Preparation of G. verrucosa flour*

The *G. verrucosa* seaweed used in this study came from Sulawesi. Seaweed was collected and washed thoroughly to remove dirt attached to the seaweed. After cleaning, the seaweed was dried or aerated for 7 days. After drying, the seaweed is ground using a blender until it becomes flour (fine powder).

*3. Preparation of Test Feed*

The feed used in this study was commercial shrimp feed (PSP). The feed mixing method followed the method of (Salam, 2014). Then, the shrimp feed was mixed evenly on the feed with *G. verrucosa* seaweed flour according to the specified dose. The doses of *G. verrucosa* seaweed flour used were 4%, 8%, and 12%.

*E. Parameters Observed*

*1. Absolute growth calculation*

The absolute growth of vannamei shrimp can be calculated by the formula (Effendi, 1997) in (Setiawan *et al.*, 2013).

$$W = W\,t - W0$$

Where: W= Absolute growth (g); Wt= Initial fish weight (g); Wo = Final fish weight (g).

*2. Specific growth rate (SGR)*

Specific growth of vannamei shrimp can be calculated by the formula applied by (Miandare et al., 2016):

$$SGR = \frac{lnWt - lnW0}{\Delta t}\ x\ 100\%$$

Where: SGR = Specific Growth Rate (g%/day); Wt is average fish weight at the end of the study (g); W0 is average weight of fish at the beginning of the study (g); and Δt is Maintenance time (days).

*3. Vaname shrimp survival*

The survival rate of vaname shrimp was calculated using the formula (Yustianti, 2013) in (Widyantoko et al., 2015):

$$SR = \frac{Nt}{N0} \times 100\%$$

Where: SR = Survival rate (%); Nt is Number of live fish at the end of the study (g); and N0 is Number of live fish at the end of the study (g).

*4. Water quality*

Water quality measurements were taken by measuring temperature, pH, and salinity. Water quality measurements are taken every week.

*F. Data Analysis*

The final data on the use of *G. verrucosa* seaweed meal for vannamei shrimp growth obtained were analyzed using the ANOVA method with a 95% confidence level (p = 0.05). ANOVA test was followed by the Tukey test comparison test if differences were found

## III. RESULT AND DISCUSSION

*Absolute Growth Rate Vannamei Shrimp*

Growth is a process of growth in size, volume, weight, and number of cells during maintenance. Based on the results of the absolute weight growth of vannamei shrimp, it is shown that the absolute weight growth of vannamei shrimp has increased, as shown in Figure 1. In treatment D (12%), the addition of *G. verrucosa* flour in shrimp feed had a higher growth value of (1.52 g). The lowest absolute weight growth value was found in treatment A (0%/g) with an absolute weight growth of (1.08 g). The addition of *G. verrucosa* flour in vannamei shrimp feed significantly affects the absolute weight growth of vannamei shrimp. Treatment D is significantly different from treatment C, B, and treatment A (Control).

The addition of *G. verrucosa* flour in vannamei shrimp feed gives significant results on the growth of vannamei

shrimp. The highest absolute weight growth results in treatment D, 12%, absolute weight of 1.52 g. It is suspected that the growth of shrimp is influenced by the quality of the feed given and can meet its nutritional needs well. The increase in weight due to the feed given can be responded well by fish and used for metabolic processes and growth (Prajayati et al., 2020).

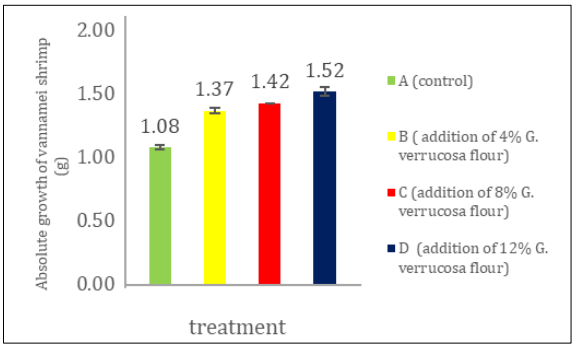


Figure 1. Absolute Growth Chart

Feed is one of the factors that can support the development of shrimp farming; feeding at the level of nutritional needs can support the optimum growth of shrimp (Widyantoko et al., 2015). This can be seen in the highest treatment in the treatment given the addition of *G. verrucosa* flour. The need for feed in shrimp is well fulfilled along with the development of shrimp, therefore, the dose of feed given is also more (Purba, 2012).

*G. verrucosa* seaweed has chemical compounds composed of water 17.61%, protein 3.8%, carbohydrates 55.81%, fat 0.55%, and fiber 9.40% (Fahrudin, 2016). Other contents of *G. verrucosa* include enzymes, nucleic acids, amino acids, vitamins, and macro and micro minerals such as calcium, selenium, magnesium, iron, and sodium, so that the compounds derived from *G. verrucosa* seaweed contained in feed can increase growth optimally (Endraswari et al., 2016).

*Specific Growth Rate Vannamei Shrimp*

Based on the results of the study, the value of the specific growth of vannamei shrimp can be seen in the figure below. The graph of average specific growth shown in Figure 2. shows the daily growth rate, where the highest specific growth rate is seen in treatment D with an average weight of (0.0080 g%/day), followed by treatment C by (0.0069 g%/day), treatment B by (0.0068 g%/day), and the lowest average daily weight is located in treatment A (control) with an average daily weight of (0.0055g%/day). The addition of *G. verrucosa* flour has a significant effect on the specific growth of vannamei shrimp. Tukey test results showed that there were significant differences in each treatment of *G. verrucosa* seaweed flour. Treatment D with a dose of 12% was significantly different from treatment C, B and treatment A (control).

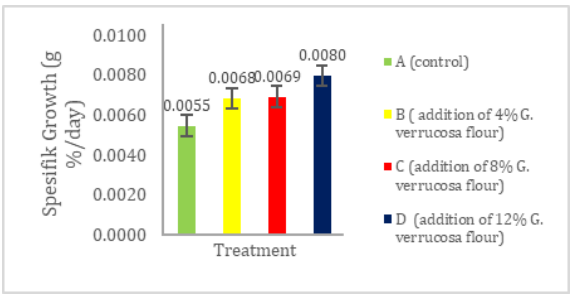


Figure 2. Specific Growth of Vannamei Shrimp

The highest specific growth rate of vannamei shrimp in treatment D with the addition of 12% *G. verrucosa* flour was 0.0080 g%/day, and the lowest specific growth rate was 0.0055 g% in treatment A (control). According to Research (Arisandy, 2016), the addition of Sargassum sp. flour in gourami feed as much as 7.5% with a growth rate of 1.01%, which was maintained for 60 days. This result is greater than this study.

The highest specific growth in treatment D (12%), allegedly due to the digestive process of shrimp to feed digests well. The specific growth rate is closely related to body weight gain derived from consumed feed. The specific growth rate value indicates that the treatment feed consumed by fish can be digested properly and utilized by fish for growth (Burhani et al., 2022).

*Vaname Shrimp Survival Rate*

Survival is the percentage of fish alive at the end of rearing compared to the number of fish initially stocked.

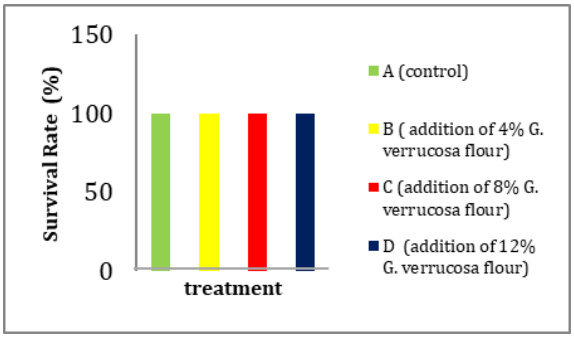


Figure 3. Vannamei Shrimp Survival Rate

The results of observations of the survival rate of vannamei shrimp given the addition of *G. verrucosa* flour in treatments A (control), B (4%/g), C (8%/g), and D (12%) have an average survival rate of 100%, meaning that in this study the shrimp did not experience death. Based on the results of the ANOVA analysis obtained, the addition of *G. verrucosa* flour in each treatment had no significant effect ($p < 0.05$).

The factor that most influences the survival rate of vannamei shrimp is feed quality. According to Lestari et al., (2018) Good feed, as well as the content of nutrients in the feed greatly affects the survival rate. This shows that the addition of *G. verrucosa* flour up to 12% can support the survival of vannamei shrimp.

*Water Quality*

The results of water quality measurements obtained during the study were within the normal range and could support the growth and survival of vannamei shrimp.

TABLE I
WATER QUALITY MEASUREMENT PARAMETERS

| Parameters | Observation value |
|---|---|
| Temperature (º C) | 25-29 |
| pH | 7,5 -7,8 |
| Salinity (ppt) | 34-35 |

Water quality plays an important role in vannamei shrimp farming (Tahe & Suwoyo, 2011). In Table 1, water quality during the study was optimal enough to support the growth of vannamei shrimp. According to the Indonesian National Standard (2014), the water quality for the maintenance of vannamei shrimp is a temperature of 28-33ºC and a pH of 7.5-8.5.

Good water quality can support optimal growth (Renitasari & Musa, 2020). Temperature is a parameter of physical properties that are closely related to the growth and survival of shrimp. (Rum et al., 2022). The results of temperature measurements during the study obtained a range between 25-29 °C. The optimal temperature for shrimp growth ranges from 26-32°C. The pH measurement results of vanamei shrimp rearing media water during the study ranged from 7.5 to 7.8. These results are still at the optimal pH value for vannamei shrimp farming.

Salinity is a water quality factor that strongly supports the growth and survival of vannamei shrimp. Vannamei shrimp have a tolerance limit and optimal conditions for survival and growth. (Rakhfid et al., 2019). Vannamei shrimp can grow in waters with salinity ranging from 0.5-38.3 ppt. (Saoud et al., 2003).. The measurement of water salinity of vannamei shrimp rearing media during the study ranged from 34 - 35 ppt. These results are still at the optimal value for vannamei shrimp farming.

## IV. CONCLUSION

Based on the description of the results and discussion above, it can be concluded that the addition of *G. verrucosa* flour in shrimp feed affects the absolute growth of vannamei shrimp at 1.52 g. While the daily growth rate is 0.0080 g%/day with a 100% survival rate. While the daily growth rate is 0.0080 g% / day with a 100% survival rate.

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