Jurnal Sains Akuakultur Tropis
Departemen Akuakultur
Fakultas Perikanan dan Ilmu Kelautan – Universitas Diponegoro
Jl. Prof. Soedarto, SH, Tembalang,Semarang 50275
Telp. (024) 7474698, Fax.: (024) 7474698
Email: sainsakuakulturtropis@gmail.com, sainsakuakulturtropis@undip.ac.id

THE EFFECT OF ADDING SHRIMP SHELL MEAL IN FEED AS AN ADDITIONAL MINERAL SOURCE IN AQUACULTURE VANNAMEI SHRIMP (*Litopenaeus vannamei*) IN FRESHWATER

Hasan Murtadha[1], Andre Rachmat Scabra*[1], Damai Diniariwisan[1]

1) Department of Aquaculture, Faculty of Agriculture, University of Mataram, Jl. Pendidikan No 37 Mataram, Nusa Tenggara Barat
* Corresponding author: andrescabra@unram.ac.id

Abstrak

Udang vannamei memiliki sifat euryhaline, yaitu biota yang dapat bertahan hidup pada salinitas yang luas, kemampuan ini membuka peluang besar bagi para pembudidaya untuk mengembangkan budidaya udang vannamei di air tawar. Namun, masalah yang dihadapi oleh para pembudidaya udang vannamei di media air tawar adalah pertumbuhannya yang kurang optimal karena kekurangan mineral. Kebutuhan mineral pada biota air tergantung dari jenis, reproduksi, lingkungan dan kemampuan biota dalam menyerap mineral dari lingkungannya. Biota air memiliki kemampuan untuk menyerap mineral yang ada di dalam air namun tidak secara optimal, sehingga sangat penting untuk menambahkan kandungan mineral di dalam pakan, salah satunya kalsium. Kalsium dapat diperoleh dari cangkang atau kulit udang yang dapat digunakan sebagai sumber mineral tambahan yang dapat diaplikasikan dalam pakan udang komersial karena mengandung 25-40% protein dan 45-50% kalsium karbonat. Penelitian ini bertujuan untuk mengetahui pengaruh penambahan tepung cangkang udang dalam pakan terhadap pertumbuhan dan kelangsungan hidup udang vannamei air tawar. Perlakuan pada penelitian ini adalah P1 tanpa penambahan tepung cangkang udang, P2 dengan penambahan tepung cangkang udang 1%, P3 dengan penambahan tepung cangkang udang 2%, P4 dengan penambahan tepung cangkang udang 3% dan P5 dengan penambahan tepung cangkang udang 4%. Dimana perlakuan terbaik pada penelitian ini untuk pertumbuhan, rasio konversi pakan dan sintasan terdapat pada perlakuan 5 (4%) dengan penambahan tepung kulit udang. Perlakuan P5 (4%) memiliki berat spesifik sebesar 3,32%, panjang spesifik sebesar 3,32%, rasio konversi pakan sebesar 1,13 dan tingkat kelangsungan hidup sebesar 35%.
Kata kunci: Udang vannamei, mineral, cangkang udang, tepung kulit udang

Abstract

Vannamei shrimp have euryhaline properties, which are biota that can survive in a wide salinity, this ability opens up great opportunities for farmers to develop vannamei shrimp farming in freshwater. However, the problem faced by vannamei shrimp farmers in freshwater media is that their growth is less than optimal due to mineral deficiencies. The need for minerals in aquatic biota depends on the type, reproduction, environment and the ability of biota to absorb minerals from the environment. Aquatic biota has the ability to absorb minerals in the water but not optimally, so it is very important to add mineral content in the feed, one of which is calcium. Calcium can be obtained from shrimp shells or shells which can be used as an additional mineral source that can be applied in commercial shrimp feed because it contains 25-40% protein and 45-50% calcium carbonate. This study aims to determine the effect of the addition of shrimp shell flour in feed on the growth and survival of freshwater vannamei shrimp. The treatments in this study were P1 without the addition of shrimp shell meal, P2 with the addition of 1% shrimp shell meal, P3 with the addition of 2% shrimp shell meal, P4 with the addition of 3% shrimp shell meal and P5 with the addition of 4% shrimp shell meal. Where the best treatment in this study for the growth, feed conversion ratio and survival rate was in treatment 5 (4%) with the addition of shrimp skin flour. Treatment P5 (4%) has a specific weight of 3.32%, specific length of 3.32%, feed conversion ratio of 1.13 and survival rate of 35%.
Keywords: Vannamei shrimp, minerals, shrimp shells, shrimp shell flour.

INTRODUCTION

Shrimp is one of the main products in the field of aquaculture in Indonesia today. Vaname shrimp is one type of shrimp that has high economic value compared to other types of shrimp, vaname shrimp is in great demand by farmers because it is easy to cultivate. The advantages of vaname shrimp are sensitive to food, high appetite and resistance to disease and poor water environment quality. In addition, the advantages of vaname shrimp are fast growth, high survival, high stocking density and relatively short cultivation period, about 100-120 days per cycle. Vaname shrimp also has the advantage of being euryhalin, which is a biota condition that is able to live in a wide salinity range, vaname shrimp can live in a salinity range of 0,5 - 40 ppt, so it can live in fresh, brackish and sea water (Febriani *et al.,* 2018). This advantage is an opportunity for farmers to develop freshwater vaname shrimp farming. However, the problem in freshwater vaname shrimp farming is that the medium lacks minerals, so the growth is not maximized. Kaligis (2015), stated that the availability of minerals in the waters and the lack of mineral composition in low salinity waters are the two main factors affecting the success of vaname shrimp farming with low salinity. Widodo *et al*. (2011), stated that vaname shrimp may lack important minerals necessary for its survival in freshwater media.

The need for minerals in aquatic biota depends on the type, reproduction, environment and the ability of biota to absorb minerals from their environment. Aquatic biota has the ability to absorb minerals in the water but not optimal, so it is very important to add mineral content in feed. Generally, the addition of minerals to feed ranges from 2-5% of the total amount of feed raw materials (Yulianto, 2021). Calcium can be obtained from shrimp shells or shells which can be used as an additional mineral source that can be applied in commercial shrimp feed, where according to Agustina *et al*. (2015), shrimp shells contain a main composition consisting of 45-50% calcium carbonate, 25-40% protein and 15-30% chitin. Meanwhile, according to Yulianto (2021), the nutritional content contained in shrimp shells consists of protein 27.81%, fat 2%, carbohydrates 14.42% and ash 47.20%.

Therefore, this study was conducted by utilizing shrimp shell waste as an additional source of minerals in feed. In addition to the direct addition of minerals to the cultivation media based on previous research, this research is a novelty from previous research. The feed will be added with shrimp shell flour which is a producer of minerals (calcium and phosphorus) and protein. This study is expected to provide information to readers about the effect of the addition of shrimp shell flour in feed on the growth rate and survival of vaname shrimp reared using freshwater media.

MATERIALS AND METHODS

Location and time of research

This research was conducted for 45 days, at the Fish Production and Reproduction Laboratory. Aquaculture Study Program, Department of Fisheries and Marine Science, Faculty of Agriculture, Mataram University. This research was conducted with an experimental method using a completely randomized design (CRD). The aspect studied was how the effect of the addition of different shrimp shell flour on feed with 5 treatments and 3 replicates so that 15 experimental units were obtained, where treatment 1 was without the addition of shrimp shell flour, treatment 2 added 1% shrimp shell flour, treatment 3 added 2% shrimp shell flour, treatment 4 added 3% shrimp shell flour and treatment 5 added 4% shrimp shell flour.

Data analysis

The test parameters in this study were specific weight, specific length, FCR, survival rate, total bacterial count, alkalinity and other water quality. Data analysis using ANOVA and if significantly different will be tested further Duncan.

Preparation of Research Containers

Total of 15 maintenance containers, each with a capacity of 40 liters, will be used. Clean the maintenance containers under running water. The containers are then placed according to the specified location, each container is filled with 20 liters of fresh water, equipped with an aerator to supply oxygen and labeled according to its treatment.

Preparation of Test Animals

The vannamei shrimp larvae used as experimental animals were obtained from Sumbawa. The larvae used were 5,000 PL 10 shrimp larvae. Before starting the study, the test animals were first acclimatized to their environment. Salinity acclimatization was carried out by gradually reducing the salinity. After fasting, feeding was carried out little by little to prevent shrimp stress and death. The shrimp at the time the study began were PL 20 years old.

Salinity Reduction

Salinity reduction was carried out by diluting the salinity. This can be done using the formula by Sahir (2022), as follows:

$$M1 \text{ X } V1 = M2 \text{ X } V2$$

Description:
M1 = Initial substance concentration
V1 = Initial volume
M2 = Concentration after dilution
V2 = Volume after dilution

Shrimp Shell Flour Making Process

The shrimp shells used are obtained from shrimp shell waste in ponds. First, the shrimp shells are washed and dried in the sun until dry. After that, the shrimp shells are steamed first over medium heat until cooked, then dried in the sun for 2 to 3 days until the material is dry. When the material is dry, it is continued with flouring. The material is then ground with a blender and sieved until ready to use (Efianda *et al*., 2020).

Acclimatization of Test Animal

Before spreading, the acclimatization process was first carried out on the whiteleg shrimp larvae. The whiteleg shrimp larvae were placed in a temporary maintenance pond filled with seawater. Acclimatization is in the form of reducing salinity to 0 ppt. The decrease in salinity occurs gradually over 10 days, reduced by 10% every day. The purpose of this acclimation is to adapt the whiteleg shrimp larvae so that they can live at a salinity of 0 ppt and prevent the shrimp from becoming stressed and dying due to a sudden decrease in salinity. Hadi *et al*. (2018) stated that shrimp become stressed when salinity concentration drops rapidly.

Preparation of Cultivation Media

Minerals CaO, MgSO4, KH2PO4, KCl and NaCl Before being added to the maintenance container, dissolve in three 150L buckets depending on the number of experiments, before putting them in a bucket of water, CaO, MgSO4, and KH2PO4, KCl and NaCl weighed first with the dosage according to Scabra *et al*. (2024) as follows :

Table 1. Mineral Dossage

Mineral	Dose	gram/100 L	gram/20 L
CaO	80 ppm	8	1.6
MgSO4	40 ppm	4	0.8
KH2PO4	45 ppm	4.5	0.9
KCL	15 ppm	1.5	0.3
NaCL	1 ppt	100	20

Then placed into each 3 liter bucket and then poured into a 150 L bucket. For all treatments using the same dose in the use of additional minerals.

Research Parameters

a. Specific Weight Growth Rate

The specific growth rate is the % of the difference between the final weight and the initial weight, divided by the length of maintenance time. According to Ridwan, (2019) the formula for calculating the specific growth rate is:

$$SG = \frac{LnWt - LnWo}{t} x\ 100\%$$

Information:
SGR = Specific weight growth rate (%/day)
Wo = Average weight of seeds at the beginning of the study (g),
Wt = Average weight of seeds on the last day (g),
t = Maintenance time (days).

b. Specific Length Growth Rate

The daily specific length growth rate is the % of the difference between the final length and the initial length, divided by the length of maintenance time. According to Putra, (2018), the formula for calculating the specific length growth rate is:

$$SGR = \frac{LnLt - LnLo}{t} x\ 100\%$$

Information:
SGR = Specific growth rate (%/day)
Wt = Average length of shrimp at the end of the study (cm)

Wo = Average length of shrimp at the beginning of the study (cm)
t = Maintenance time (days)

c. Feed Conversion Ratio (FCR)

Feed Conversion Ratio (FCR) is the comparison between the amount of feed given and the shrimp meat produced. The FCR calculation is done at the end of maintenance. The calculation of the feed conversion ratio is carried out using Yusuf, (2019), as follows:

$$FCR = \frac{F}{(Wt+D)-Wo}$$

Information:
FCR = Feed conversion rate
Wt = Final fish weight (grams)
Wo = Initial fish weight (grams)
F = Feed given (grams)
D = Weight of dead fish during rearing (grams).

d. *Survival Rate*

The survival rate (SR) of shrimp is calculated using Yusuf, (2019) as follows:

$$SR = \frac{Nt}{No} x\ 100\ \%$$

Information:
SR = Fish survival rate (%)
No = Number of fish at the beginning of the study (tail)
Nt = Number of fish at the end of the study (tail).

e. ***Total Bacteria Count***

Total bacterial count obtained using the TPC (*Total Plate Count*) calculation method taken from a sample of shrimp rearing media of 0.1 mL each with a dilution factor of 10^6 (Hapizah *et al*., 2024).

f. *Alkalinity*

The alkalinity of the waters can be calculated using the formula Hariyadi *et al*, (2010) as follows:

$$Alkalinity = \frac{A\ x\ N\ titran\ x \frac{100}{2} x\ 1000}{ml\ sampel}$$

RESULTS AND DISCUSSION
Results

a. Specific Weight Growth

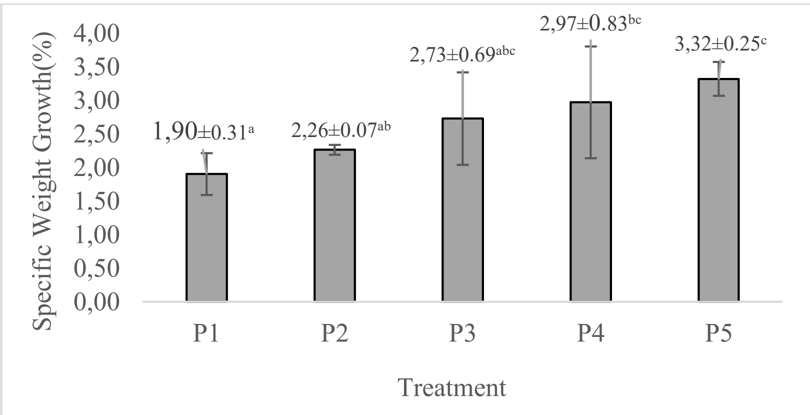


Figure 1. Specific Weight Growth (%/day)

Based on Figure 1. the best value specific weight growth was found in the P5 (4%) treatment namely 3.26 g while the lowest specific weight growth was found in the P1 (0%) treatment, namely 1.9 g.

b. Specific Length Growth

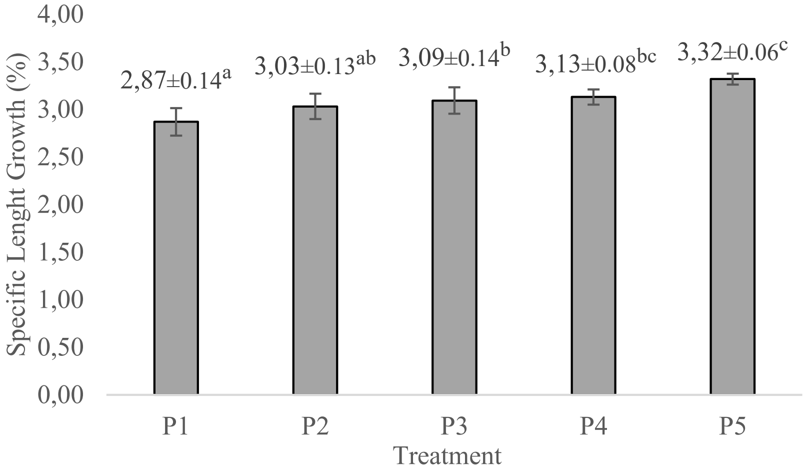


Figure 2. Specific Length Growth (%/day)

Based on Figure 2, the best value specific length growth was found in the P5 (4%) treatment namely 3.32% and the lowest specific length growth was found in the P1 (0%) treatment, namely 2.87%.

c. *Feed Conversion Ratio* (FCR)

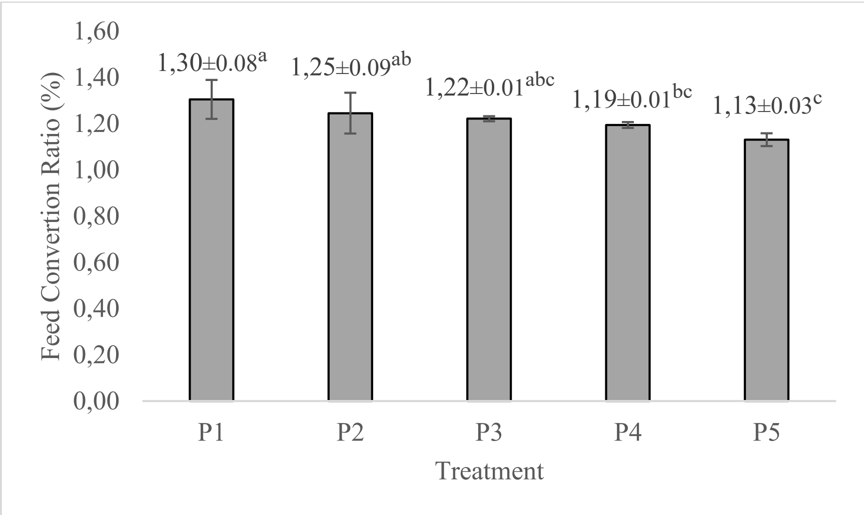


Figure 3. Feed Conversion Ratio

Based on Figure 3, the best value feed conversion ratio was found in the P5 (4%) treatment, namely 1.13 however, it is not significantly different from the treatment P4(3%) and the lowest feed conversion was found in the P5 (4%) treatment namely 1.13.

d. Survival Rate (SR)

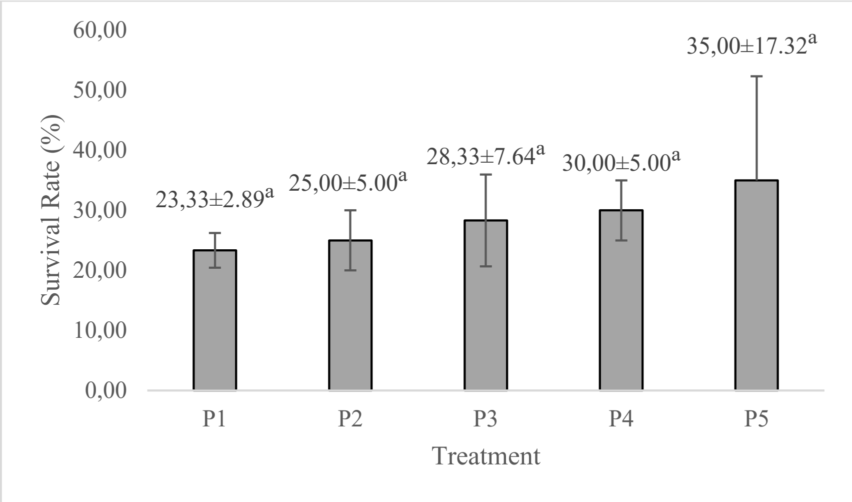


Figure 4. Survival Rate (%)

Based on figure 4. The best value survival rate was found in the P5 (4%) treatment which was 35%, while the lowest survival rate was found in the P1 (0%) treatment, which was 23%. However, in each treatment there is not significantly different

e. Total Bacteria Count

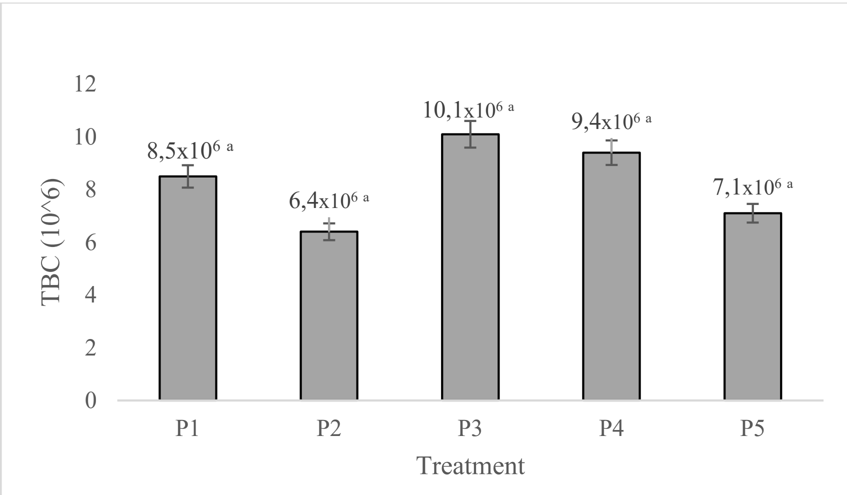
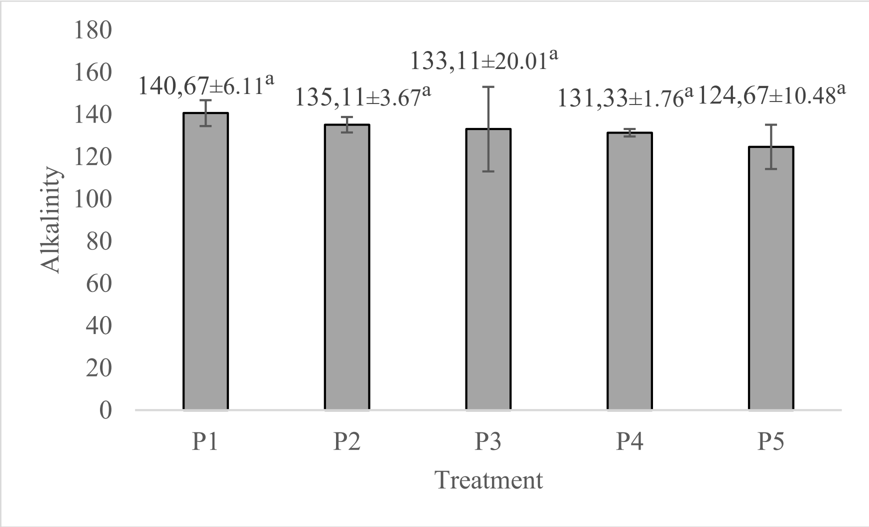


Figure 5. Total Bacteria Count

Based on Figure 5. the highest total bacterial count value was obtained in the P3 (2%) treatment namely 8.5 x 10^6 and the lowest total bacterial count value was 7.1 x 10^6.

f. Alkalinity



Picture 6. Alkalinity

g. **Water Quality**

The quality of the water as a living medium (growth and development) of the shrimp that is raised is one of the parameters that must be considered and must be balanced. The water quality of shrimp live media in this study is presented in table 1 as follows.

Table 2. Water Quality Parameters

Parameters	Research Value (Range)	Literature
Dissolved Oxygen (mg/l)	6.5-6.7	> 4 (Tangguda *et al*., 2018)
Degree of acidity (pH)	8.2-8.7	7,4 – 8,9 (Lestari *et al*., 2017)
Temperature (^{O}C)	28-29.5	28 – 31 (Arsad *et al*., 2017)
Ammonia (mg/l)	0.05-0.2	<0,1 (Mangampa & Suwoyo, 2016)
Alkalinity (mg/l)	124.67-140.67	20 – 500 ppm (Sitanggang & Amanda, 2019)

Discussion

Specific Weight Growth

The growth of shrimp given additional shrimp skin flour is better than without the addition of flour. This is thought to be due to shrimp shell flour used as an additional calcium mineral, can increase calcium in the shrimp body so that shrimp calcium to perform growth or maintain the balance of the body with the environment is sufficient. Research conducted by (Scabra *et al*., 2022; Scabra *et al*., 2021; Scabra, Marzuki, & Rizaldi, 2023; Scabra, Nunik, & Yudi, 2023) showed that the addition of different calcium minerals can increase the growth of vaname shrimp reared in freshwater media.The high and low value of specific weight growth is due to the ability of shrimp in the molting process supported by the availability of feed including adequate nutrients, as well as the amount of calcium levels in the shrimp living medium. The availability of calcium in the feed and the availability of calcium in the media should not be less and should not exceed the needs of shrimp because it will interfere with the chemical processes in the shrimp body so that the growth process is disrupted. According to Yulihartini (2016), states that shell formation will be hampered by insufficient calcium levels, and high calcium concentrations will inhibit the balance of calcium ions.

Shrimp growth will be in line with the molting process, the molting process will occur quickly if the growth process is fast, because basically the growth and increase in shrimp size will pass through the molting process as a sign of shrimp growing larger. This is in accordance with the statement of Scabra (2023), which states that the molting process is closely related to growth, where calcium is needed in the molting process, because in conditions of adequate minerals shrimp are easier to carry out the physiological function of molting. The thing that supports shrimp molting activities is the availability of sufficient calcium, the faster the shrimp molt, the faster the shrimp will grow. According to Astifa *et al*. (2022), which states that the addition of calcium can accelerate the mineralization process that makes shrimp bigger. When shrimp absorb calcium, shrimp will store it in body tissues and make shrimp bigger.

Specific Length Growth

Shrimp are aquatic biota that can be said to have a negative allometric growth pattern or it can be said that length growth is more dominant than weight growth seen from the shape of the body. This is in accordance with the opinion of Scabra *et al*. (2024) states that vaname shrimp are allometric negative where length growth is faster than weight growth. growth is influenced by how much nutrients in water and nutrients provided from outside to help the growth process and the shrimp's efforts to respond and process feed into energy for growth and survival. Specific length will be in line with the absolute length of the biota reared. In this study, the high and low specific length is thought to be due to differences in the dose of shrimp skin meal given between treatments. Shrimp growth will accelerate if the nutritional needs of shrimp in feed and media are fulfilled, such as the availability of protein, fat, carbohydrates, vitamins and minerals.

The high and low value of specific length is due to differences in the dose of shrimp shell flour given. Shrimp shell flour is used as an additional calcium mineral in the feed given, sufficient calcium in the feed will help shrimp in the growth process. This is in accordance with the statement of Nurfaidah & Agustono (2021), which states that feeding with optimal calcium content can be utilized by shrimp for the formation of new shells, resulting in additional weight and length of shrimp. The addition of too much calcium can be paradoxical or can cause excess calcium which can cause the process of hardening the skin or the molting process to be inhibited as a result of the carapace being too hard. In addition, excessive calcium makes it difficult for shrimp to release the skin during molting, too hard skin will make it difficult to separate the meat and skin during molting, which requires a lot of energy (Jaganmohan & Kumari, 2018).

Feed Convertion Ratio (FCR)

In this case, the higher the feed conversion value, the less good the maintenance activities, while the lower the feed conversion value, the better the maintenance activities. The feed conversion ratio itself can be interpreted as the amount of feed used to produce or increase the amount of fish/shrimp meat being raised. The high value of feed conversion ratio in P1(0%) indicates that the utilization of feed by shrimp is not good, this is thought to be due to the absence of the addition of shrimp shell flour to the feed. Feed conversion ratio can be said to be interrelated with the process of shrimp growth. This is in accordance with the statement of Fahrudin *et al*. (2023), which states that feed is an indicator in seeing the effectiveness of feed, the smaller the feed conversion value indicates efficiency in the use of feed and vice versa the greater the feed conversion value, the less efficient feed utilization.

In the P5(4%) treatment, the lowest conversion value was 1,13, the feed utilized by shrimp in the P5(4%) treatment was very good allegedly due to the presence of shrimp shell meal as an additional calcium in the feed. The combination of the best percentage of shrimp shell meal with the amount of feed given gives a good response to shrimp growth and molting power in shrimp. The faster the shrimp molt, the more feed utilization. Feed is used as a growing and developing agent equipped with shrimp shell meal as an additional calcium in triggering and stimulating the rapid molting process in shrimp so as to accelerate growth and support the body in utilizing feed properly. This is in accordance with the statement of Fahrudin *et al*. (2023), which states that high growth and feed efficiency will affect the low feed conversion value, feed that can be utilized properly will be used as energy by shrimp in the growth process.

Survival Rate

Survival rate is one of the benchmarks for the success of a cultivation activity. A high survival rate gives an idea of the success of aquaculture activities carried out, especially in vaname shrimp farming. The value of shrimp survival rate in treatment P1 (0%) without the addition of shrimp flour is very low compared to other treatments, this value is thought to be shrimp still unable to maintain homeostasis (balance) of the body with its environment due to lack of calcium in the shrimp body, this is in accordance with the statement of Maghfiroh *et al*. (2019), which states that shrimp that are unable to maintain the balance of body ions with environmental ions can interfere with the metabolic and physiological processes of shrimp, where the survival of organisms can be influenced by the balance between the ion content of body fluids with environmental ions. This is also reinforced in the research of Scabra *et al*. (2023) which states that insufficient calcium content will interfere with shrimp in maintaining the balance of body calcium ions and the environment which will cause death in shrimp.

The best survival rate in this study was found in the P5 treatment which amounted to 35%, but this value is still relatively low for vaname shrimp farming activities. This is in accordance with the statement of Scabra *et al*. (2024), which states that the survival rate of shrimp is categorized as low if <50%, midle >50% and good > 70%. Cannibalism in shrimp increases during molting, shrimp that undergo molting will emit a distinctive odor that attracts the attention of other shrimp so vulnerable to being preyed upon by other shrimp, especially larger shrimp. This is in accordance with the statement of Handayani *et al*. (2019), which states that when molting, shrimp are in poor performance or body condition and low feed absorption, shrimp secrete fluids containing amino acids, organic compounds and enzymes whose aroma strongly stimulates shrimp appetite.

Total bacteria Count

Total bacteria is a parameter to see the amount of bacterial density in a maintenance medium. The abundance of this bacterial value is high in vaname shrimp farming activities, the high value can be caused by several factors such as water quality. Poor water quality can affect the presence of bacteria in the cultivation media, these bacteria can cause death for cultivation activities. One of them is vibrio sp. As a pathogenic bacterium, vibrio will be very dangerous if the abundance of bacteria exceeds the normal threshold in the waters. This is in accordance with the statement of Utami (2016) which states that in waters if the abundance of vibrio bacteria is more than 1.4 x 104 CFU / ml can reduce shrimp growth and increase mortality in shrimp, besides according to Muliani (2016), stating that in vibrio bacteria there are substances that can damage hemocyte blood cells in vaname shrimp. Prevention of excess bacteria can be done by maintaining water quality remains in optimal conditions both pH, temperature and dissolved oxygen.

Alkalinity

Alkalinity is a description of the capacity of water to neutralize acids or known as acid neutralizing capacity (ANC) or the quantity of anions in water that can neutralize acids without increasing the pH value. Alkalinity can also be interpreted as a buffer capacity (buffer capasity) against changes in pH waters. The main formers or constituents of alkalinity are bicarbonate, carbonate and hydroxide, among the three ions, bicarbonate is the most abundant in waters (Kordi, 2009). In this study, the value of alkalinity obtained ranged from 124.67-140.67 the range is a normal range of alkalinity levels in freshwater and seawater and is the optimal alkalinity levels to support the growth of vaname shrimp.

Optimal alkalinity levels will affect the pH value of the water to avoid high fluctuations, which will affect shrimp appetite and growth. Based on research by Sitanggang & Listia (2019), alkalinity that is too low will affect shrimp molting abnormally, otherwise if alkalinity is too high it will cause shrimp to be difficult to molt. Alkalinity levels in the waters are influenced by the value of calcium minerals in the waters, where the higher the value of calcium dissolved in the waters, the higher the alkalinity value will be. This is in line with Kordi, (2009) calcium carbonate is a compound that gives the largest contribution to the value of water alkalinity. The high level of alkalinity in pond waters is due to an increase in minerals that cause water hardness (Listriyana, 2023).

Water Quality

Dissolved oxygen (DO) or often referred to as dissolved oxygen in waters is one of the water quality that plays an important role in chemical physics processes in waters and in the body of biota (shrimp). Dissolved oxygen which has the main function as a supplier of oxygen for shrimp life also plays an important role in processing waters as a living medium for reared shrimp. Dissolved oxygen in the waters must remain supplied so that the shrimp reared can live and grow. Dissolved oxygen values in this study ranged from 6.5-6.7 mg/l. The value of dissolved oxygen obtained in the research activities is the value of the normal range for the life of shrimp and other aquatic biota. This is in accordance with Muzahar (2022), a good dissolved oxygen concentration for vaname shrimp life is 4-8 mg/l. Low levels of oxygen can affect biological function and slow growth, and can even cause death. Things that cause differences in oxygen consumption rates include shrimp size, temperature, and shrimp activity levels. The minimum limit of oxygen content in the waters is 3 mg/l and oxygen content is considered optimum for shrimp ranging from 4-7 mg/l (Tangguda *et al*., 2018).

The degree of acidity or better known as pH is often interpreted as the condition of a body of water that can be acidic, alkaline and neutral. The degree of acidity or pH of water indicates the activity of hydrogen ions (H) in solution and is expressed as the concentration of hydrogen ions (in moles per liter). The acidity (pH) values obtained in this study ranged from 8.2-8.7 mol/l. The value of the degree of acidity obtained during the research activities is in normal conditions or conditions intended for the life of vaname shrimp. pH is often related to the process of osmoregulation, respiration, oxygen consumption and food absorption process decreases in shrimp, if the pH is too high then the waters are wet and if the waters are too low then the waters are acidic, these conditions can cause shrimp reared difficult to breathe and even experience death. Kordi, (2009) states that the optimal pH range for aquaculture activities is between 7.5-8.7, if the pH is low (acidic) the dissolved oxygen content decreases, the oxygen consumption rate decreases, the respiratory activity increases, and the appetite in shrimp decreases. While according to Purnamasari *et al*. (2017) the normal pH value for vaname shrimp growth is in the range of 7.5-8.5.

Temperature is a state or condition where the water is hot or cold and often uses degrees centigrade (ºC) as a unit in water degrees. Water temperature is one of the factors that must remain stable and must be in accordance with the cultivated biota. Temperature is closely related to oxygen solubility, as well as conditions in responding to food. High water conditions or high temperatures can cause shrimp to experience rapid metabolic processes, respiration and osmoregilation. If the water conditions or temperature in low conditions, it will slow down the metabolic process in the body of shrimp, and lack of appetite in shrimp resulting in slow growth. In this study, the temperature obtained ranged from 28-29.5oC. The temperature is the normal temperature of the waters intended for the growth process of vaname shrimp. The optimal temperature for shrimp growth is between 28-30 ^{0}C (Muzahar, 2022).

Basically, ammonia comes from waste feces and residual feed that is not consumed by shrimp, most of the feed given to shrimp approximately 15% is not consumed and 20-80% of the feed is consumed and will be disposed of through feces, shrimp feces still contain high enough protein (Renitasari & Musa, 2020). According to Pasongli *et al*. (2015), stated that most of the feed eaten by shrimp is used in the metabolic process and the rest is discarded in the form of solid waste (feces) and dissolved (ammonia). Ammonia value in this study ranged from 0.05-0.2 mg/l, the value of ammonia obtained is still classified in the range of good or optimal range for the life of vaname shrimp. This is in accordance with the statement (Mangampa & Suwoyo, 2010), saying that the optimum ammonia concentration for vaname shrimp farming is <0.1 mg/l. For ammonia value of 0.2 is not good in cultivation activities, the high value of ammonia is thought to be a lot of residual feed or feces contained in the maintenance tub due to lack of penyiponan. This is in accordance with the statement of Sari (2017), which states the increase in ammonia concentration due to lack of water change, the presence of remnants of feed and feces.

Conclusion

The conclusion of the study is the addition of shrimp shell flour to feed as an additional mineral in the cultivation of vaname shrimp (*Litopanaeus vannamei*) in freshwater gives significant results on shrimp growth rate while not significant on shrimp survival rate. The best treatment in this study for the growth, feed conversion ratio and survival rate was in treatment 5 (4%) with the addition of shrimp skin flour has an specific weight of 3.32%, specific length of 3.32%, feed conversion ratio of 1.13 and survival rate of 35%. As for the alkalinity value, the range is obtained 124,67-140,67 ppm and for the total value of bacteria obtained in the range $6{,}4 \times 10^6 – 10{,}1 \times 10^6$.

Suggestion

Further research should be conducted on the addition of shrimp shell flour as an additional mineral source in vaname shrimp (*Litopanaeus vannamei*) cultivation so that the optimum percentage is known and also the addition of mineral doses to the cultivation media that must be added as the size of the shrimp increases

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