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SHRIMP VANNAMEI CULTURE *(Litopenaeus vannamei)* IN LOW SALINITY MEDIA ON BIOFLOC SYSTEM WITH DIFFERENT C/N RATIO MEDIA INTAKE

Budidaya Udang vannamei PADA MEDIA BERSALINITAS RENDAH DENGAN SISTEM BIOFLOK DENGAN RASIO C/N yang Berbeda

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ABSTRAK

Udang vannamei (*Litopenaeus vannamei*) merupakan salah satu biota komoditas unggulan di sektor perikanan dengan salah satu kemampuan etihalinnya yaitu mampu bertahan hidup pada kisaran salinitas yang luas, sehingga berpotensi untuk dibudidayakan pada media air tawar. Salah satu sistem budidaya yang saat ini berkembang adalah sistem bioflok dengan keunggulan dapat meningkatkan kapasitas produksi biota yang padat namun tetap mampu menjaga kualitas air melalui flok yang dihasilkan, selain itu dapat meningkatkan produksi biota dimana flok tersebut mampu menjadi pakan alami bagi biota yang dipelihara. Pengembangan budidaya udang vaname air tawar dengan menggunakan sistem bioflok belum pernah dilakukan, dimana salah satu faktor penting dari bioflok itu sendiri adalah rasio C/N untuk pertumbuhan flok, oleh karena itu perlu diketahui rasio C/N yang tepat untuk diberikan pada media bioflok udang vaname air tawar. Tujuan dari penelitian ini adalah untuk menganalisis pemeliharaan udang vaname salinitas rendah menggunakan sistem bioflok pada rasio C/N yang berbeda. Metode penelitian yang digunakan adalah metode eksperimen dengan rancangan acak lengkap (RAL) yang terdiri dari 4 perlakuan dan 3 kali ulangan yaitu P1 C/N 6, P2 C/N ratio 12, P3 C/N ratio 18, dan P4 C/N ratio 18. N 24. Hasil penelitian menunjukkan adanya perbedaan nyata pada laju pertumbuhan berat spesifik dengan nilai tertinggi pada P3 yaitu 9,0%/hari dan terendah pada P1 yaitu 0%/hari. Laju pertumbuhan panjang spesifik pada P3 menunjukkan nilai tertinggi yaitu 4,18%/hari dan terendah pada P1 yaitu 0%/hari. Nilai FCR pada penelitian juga menunjukkan hasil terbaik pada P3 dengan nilai sebesar 1,57.

ABSTRACT

Vannamei shrimp (*Litopenaeus vannamei*) is one of the superior commodity biota in the fisheries sector with one of its etyhaline abilities, namely that it can survive a wide salinity range, so it has the potential to cultivate vannamei shrimp in fresh water media. One of the cultivation systems that is currently developing is the biofloc system with the advantage of increasing the production capacity of dense biota but still being able to maintain water quality through the floc produced, apart from that it can increase biota production where the floc is able to become natural food for the biota being reared. The development of freshwater vaname shrimp cultivation using a biofloc system has never been carried out, where one of the important factors of biofloc itself is the C/N ratio for floc growth, therefore it is necessary to determine the correct C/N ratio given to the freshwater vaname shrimp biofloc media. The aim of this research is to analyze the maintenance of low salinity vaname shrimp using a biofloc system at different C/N ratios. The research method used was the experimental method with a completely randomized design (CRD) consisting of 4 treatments and 3 replications, namely P1 C/N 6, P2 C/N ratio 12, P3 C/N ratio 18, and P4 C/N ratio 18. N 24. The results of this study show a real difference in the specific weight growth rate with the highest value at P3, namely 9.0%/day and the lowest at P1, namely 0%/day. The specific length growth rate in P3 shows the highest value, namely 4.18%/day and the lowest in P1, namely 0%/day. The FCR value in the study also showed the best results at P3 with a value of 1.57.

Kata Kunci	Udang vannamei, Bioflok, Flok, Rasio C/N
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INTRODUCTION

Whiteleg shrimp (*Litopenaeus vannamei*) cultivation is a preference proposed by the government as a substitute for tiger shrimp (Penaeus monodon) cultivation commodities. This aims to increase shrimp production in Indonesia so that there is an increase in welfare and income from farmers through the exploration of white shrimp (L. vannamei) as a superior variety of shrimp (Ningsih, 2021). Based on statistical data from the Indonesian Ministry of Fisheries and Maritime Affairs in 2022, the production of whiteleg shrimp cultivation in 2018 with a volume of 130,422 tons continued to increase to reach 177,514 tons in 2021. This increase in whiteleg shrimp production is of course due to the high consumer demand for whiteleg shrimp in all regions. To maximize the availability of whiteleg shrimp stocks, intensive cultivation activities need to be carried out.

Whiteleg shrimp (*L. vannamei*) is a practical biota group and has a level of innovation in its cultivation due to its significant productivity level and can be implemented with high stocking density. In addition, this shrimp has euryhaline properties, namely being able to grow in a range of salinity, thus encouraging farmers in Indonesia to cultivate whiteleg shrimp. According to Riani *et al.,* (2012), whiteleg shrimp is a biota that has many advantages in cultivation activities compared to other biota such as high survival rates, relatively high appetite followed by low feed conversion, able to survive and grow in areas with a wide range of salinity.

One of the cultivation systems that has great potential in improving the quality of vaname shrimp cultivation production is the biofloc system. The advantage of this system is that it can maintain water quality and provide quality production results by maximizing nutrients. According to Nugraha *et al.,* (2022) that the use of biofloc media in vaname shrimp cultivation activities is a millennial pond program by utilizing floc media in decomposing organic material content during maintenance activities to continue to circulate so as to concentrate the nutrients formed as intake for cultivated biota. The results of research by Dahlan *et al.,* (2019) show that the biofloc system in vaname shrimp maintenance has been able to improve growth and better survival in vaname shrimp maintenance.

One of the main challenges in cultivation activities using the biofloc system is determining the right C/N ratio. According to Hidayat *et al.,* (2014) that the C/N ratio is an application in the application of activating the work of heterotrophic microbes where bacteria obtain food intake from carbon and nitrogen sources with the right ratio so that bacteria can work optimally to change suspended toxic components into non-toxic organic N and are able to maintain water quality and create flocs that can be a source of natural protein. This is also supported by the statement of Erlangga *et al.,* (2021) that carbon sources are the most important ingredients in the growth of heterotrophic bacteria with the support of nitrogen from feed, where these bacteria will later play a role in breaking down inorganic materials into flocs as organic intake for biota in the water media.

Several previous research results showed that the provision of different C/N ratios affected the development and survival of tiger shrimp where the C/N ratio of 24 gave maximum results in tiger shrimp maintenance (Hidayat *et al.,* 2014). These results are in line with the research of Imron et al., (2014) regarding the effect of different C/N ratios on the growth of catfish where the study showed the best results at a C/N ratio of 24. Different results were shown in the research of Erlangga et al., (2021) that the provision of a C/N ratio of 15 in the cultivation of vaneme shrimp using the biofloc system gave optimal results with wheat carbon sources. The research of Pantjara et al., (2010) regarding the cultivation of seawater vaname shrimp with the biofloc system showed that biofloc was able to maintain water quality which had a good impact on the growth of shrimp maintained by determining the C/N ratio of 12.

Based on the description above, it is necessary to conduct research to analyze the effect of providing different C/N ratios on the maintenance of vaname shrimp in low salinity media using the biofloc system.

METHOD

This research was conducted for 60 days at the Production and Reproduction Laboratory of the Aquaculture Study Program, Faculty of Agriculture, University of Mataram, West Nusa Tenggara. Analysis of ammonia parameters was conducted at the Fish Health Laboratory of the Aquaculture Study Program, Faculty of Agriculture, University of Mataram, West Nusa Tenggara.

This study used a Completely Randomized Design (CRD), namely a field design in a homogeneous location. The homogeneous location in question is a container with a volume of 20 L of fresh water using a biofloc system. The treatment given is the difference in C/N ratio with 3 replications, as follows:

P 1 : C/N Ratio 6
P 2 : C/N Ratio 12
P 3 : C/N Ratio 18
P 4 : C/N Ratio 24

The tools used during the research include Aerator, Stationery, Aeration Stone, DO Meter, Erlenmeyer, 150L Bucket, Measuring Cup, Camera, Container, pH Meter, Dropper Pipette, Diesel Pump, Refractometer, Sedimentation Cone, Spectrophotometer, Brush, Hose, Siphon Hose, Syringe, Test Tube, 1200L Tank, Thermometer, Analytical Scale, Jar.

The materials used during the study included Sea Water, Fresh Water, Aquades, Aeration Stone, Ketapang Leaves, Detergent, Phosphorus (KH_2PO_4), Salt, Calcium Oxide (CaO), Dolomite Lime, Aeration Tap, Chlorine, Chlorox, Magnesium Sulfate ($MgSO_4$), Manganese Sulfate ($MnSO_4$), Molasses, Sodium Hydroxide (NaOH), Sodium Thiosulfate, Mesh & crumble feed, EM4 Probiotics, Aeration Hose, Sodium Thiosulfate ($Na_2S_2O_3$), Vannamei Shrimp

Preparation Stage

a. ***Preparation of Acclimatization Container***

The acclimatization container used is a concrete tub that is washed first with a brush and detergent then dried for 1 day. Next, 1,200 L of seawater is put into the container, then 20 ppm chlorine is added with the use of strong aeration for sterilization for 3 days. Furthermore, dechlorination with 10 ppm thiosulfate and left for 1 day until it evaporates.

b. ***Preparation of Maintenance Container***

The maintenance container used is a 45 L container that is first washed using detergent and a brush then soaked in water for 1 day. Furthermore, it is dried in the sun for 1 day to remove detergent residue. Each clean container is filled with 20 L of water and equipped with aeration to supply oxygen. Furthermore, the disinfection process is carried out using 20 ppm chlorine for 3 days and dechlorinated with 10 ppm thiosulfate for 1 day. The disinfected media water is then added with 80 ppm Calcium Oxide (CaO), 45 ppm Phosphorus (KH_2PO_4), 40 ppm Magnesium Sulfate ($MgSo_4$) minerals to supply seawater replacement minerals accompanied by soaking ketapang to stabilize the pH.

c. ***Biofloc Media Water Preparation***

Biofloc media is prepared by dissolving ingredients in the form of 3 kg/m3 salt, 100 gr/m3 dolomite lime, 100 ml/m3 molasses, and 10 ml/m3 probiotics used as a starter in biofloc media. (Pratama *et al.,* 2018)

d. ***Preparation of Test Animals***.

After all sterilization stages are complete, shrimp are spread. The shrimp used come from the Hisenor hatchery with a size of PL 10. The shrimp are acclimatized first, then spread and fasted for 1 day. Furthermore, salinity acclimatization is carried out by reducing the salinity level from 30 ppt to 0 ppt using fresh water for 10 days slowly by adding fresh water to the initial maintenance medium of seawater using a siphon hose so that the shrimp are not stressed and are able to adapt to an environment with low salinity levels by adding 36,000L of fresh water into a container containing 1,200 L of seawater using the siphon method. This process is carried out until the shrimp enter the PL 20 phase.

Implementation Stage

a. **Vaname Shrimp Maintenance**

Shrimps were stocked with a density of 20 in a container containing 20 L of water. Furthermore, they were maintained with a biofloc system for 50 days using different C/N ratio treatments. During maintenance, feeding was carried out 3 times a day as much as 10% of body weight accompanied by the addition of minerals with the doses with a frequency of once every 3 days as much as 10% of the media water (Scabra, Murthada, et al., 2024). Before the stocking was carried out, initial weight and length measurements were first carried out and during the study, measurements were carried out on several supporting parameters for research data.

b. Probiotic and Mineral Administration

The provision of probiotics type EM 4 with Lactobacillus sp bacteria content is added as much as 10 ml/m3 within a period of 7 days once along with the addition of minerals type CaO 80ppm, $MgSO_4$ 45ppm, Kh_2PO_4 40ppm with a frequency of once every 3 days, in order to supply minerals for shrimp intake in growth and moulting activities.

c. Provision of Carbon and Nitrogen Sources

The carbon source used in this study was molasses with a dose ratio given according to the determination of the treatment while the nitrogen source used was feed with a proximate protein content of 30%, fat 6%, crude fiber 4%, ash content 15%, water content 12%, and nitrogen content 4.8%. The flow of carbon administration refers to the calculation of Pantjara *et al.,* (2010) as follows:

Table 1 Carbon Source Calculation Flow

Feed Protein = % Feed Protein x Amount of Feed
= 30 % x 100 = 30gr

N Feed = % N Feed x Feed Protein
= 4,80 % x 30 = 1,44

N Total = % Shrimp excretion x N Feed
= 75% x 1,44 = 1,08

C Needed = N Total x Ratio (Treatment)
= 1,08 x Rasio (Treatment)........................(Equality 1)

Molasses Given = (Equality 1) x % C in Molasses
= (Equality 1) x 30% = ...(Equality 2)

Equality 2 = ...ml/100 gr Feed

Based on the calculations above, the value of providing molasses as a carbon source according to the treatment given is as follows.

Table 2. Amount of Carbon Source Provision

C/N RATIO	AMOUNT OF MOLASSES
P1 C/N 6	21,6 ml/ 100 gr pakan
P2 C/N 12	43,2 ml/ 100 gr pakan
P3 C/N 18	64,8 ml/ 100 gr pakan
P4 C/N 24	86,4 ml/ 100 gr pakan

s

RESULTS

Survival Rate

The results of this study indicate that the survival rate of whiteleg shrimp with various treatments of different C/N ratios in low salinity biofloc media decreased in line with the increase in the maintenance period ranging from 0% to 50%. (Figure 1.)

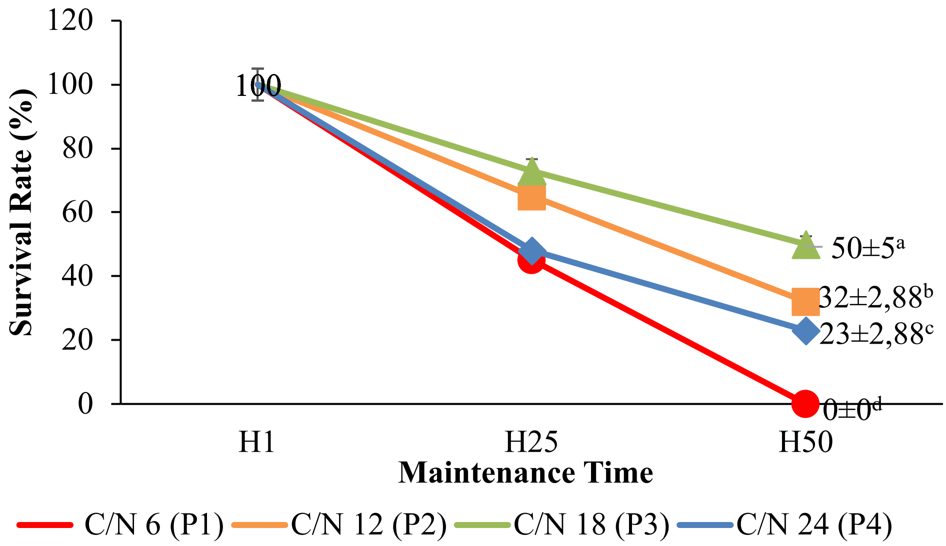

Figure 1. Survival Rate

Figure 1 shows that the C/N ratio treatment of 18 (P3) gave the highest survival rate at the end of the maintenance period, namely 50%, followed by the C/N ratio treatment of 12 (P2) at 32%, the C/N ratio treatment of 24 (P4) with a value of 23% and the lowest in the C/N ratio treatment of 6 (P1) with a value of 0%.

The results of the ANOVA test showed that the provision of different C/N ratios had a significant effect ($p<0.05$) on the survival rate of vaname shrimp at the end of the maintenance period. The results of Duncan's further test showed that the provision of a C/N ratio of 18 (P3) provided the highest survival rate of vaname shrimp at the end of the maintenance period and was significantly different from all other treatments.

Specific Weight Growth Rate

The results of this study indicate that the specific weight growth rate of whiteleg shrimp in various treatments with different C/N ratios in low salinity biofloc media ranges from 0%-9%/day (Figure 2).

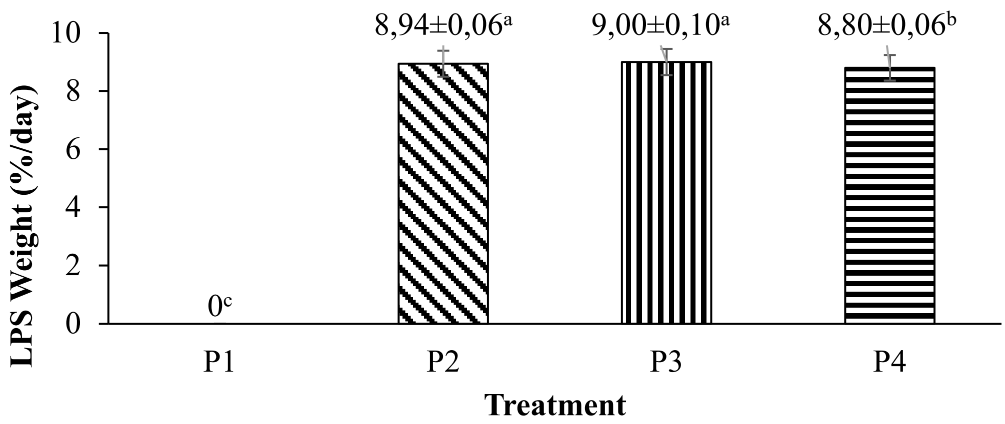

Figure 2. Specific Weight Growth Rate

Figure 2 shows that the C/N ratio treatment of 18 (P3) gave the highest specific weight growth rate of 9%/day, followed by the C/N ratio treatment of 12 (P2) of 8.94%/day, the C/N ratio treatment of 24 (P4) with a value of 8.80%/day and the lowest in the C/N ratio treatment of 6 (P1) with a value of 0%/day.

The results of the ANOVA test showed that the provision of different C/N ratios had a significant effect ($p<0.05$) on the specific weight growth rate of whiteleg shrimp. The results of Duncan's further test showed that the provision of a C/N ratio of 18 (P3) provided the highest specific weight growth rate and was significantly different from the C/N ratio treatment of 6 (P1) and the C/N ratio treatment of 24 (P4) but was not significantly different from the C/N ratio treatment of 12 (P2).

Specific Length Growth Rate

The results of this study indicate that the specific growth rate of vaname shrimp with various different C/N ratio treatments in low salinity biofloc media ranges from 0-4.18%/day (Figure 3).

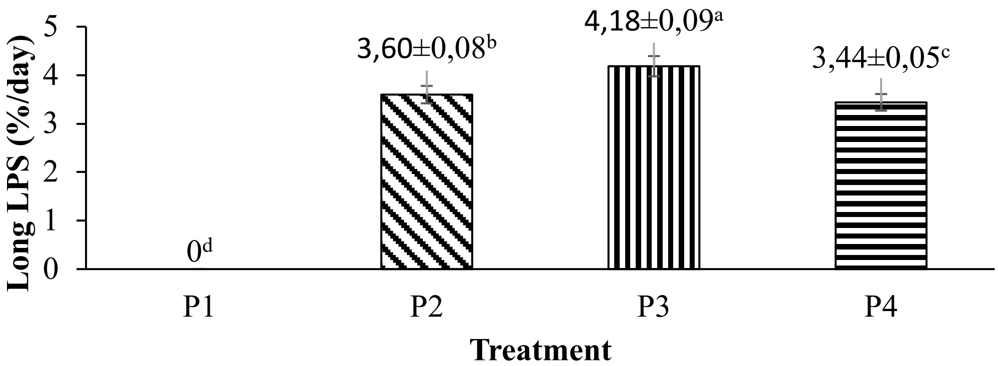

Figure 3. Specific Length Growth Rate

Figure 3 shows that the C/N ratio treatment of 18 (P3) gave the highest specific length growth rate of 4.18%/day, followed by the C/N ratio treatment of 12 (P2) of 3.60%/day, the C/N ratio treatment of 24 (P4) with a value of 3.44%/day and the lowest in the C/N ratio treatment of 6 (P1) with a value of 0%.

The results of the ANOVA test showed that the provision of different C/N ratios had a significant effect ($p<0.05$) on the specific length growth rate of whiteleg shrimp during maintenance. The results of Duncan's further test showed that the provision of a C/N ratio treatment of 18 (P3) provided the highest specific growth rate and was significantly different from all other treatments.

Feed Convertion Ratio

The results of this study indicate that the feed conversion ratio of whiteleg shrimp with various different C/N ratio treatments in low salinity biofloc media ranges from 0-1.68 (Figure 4).

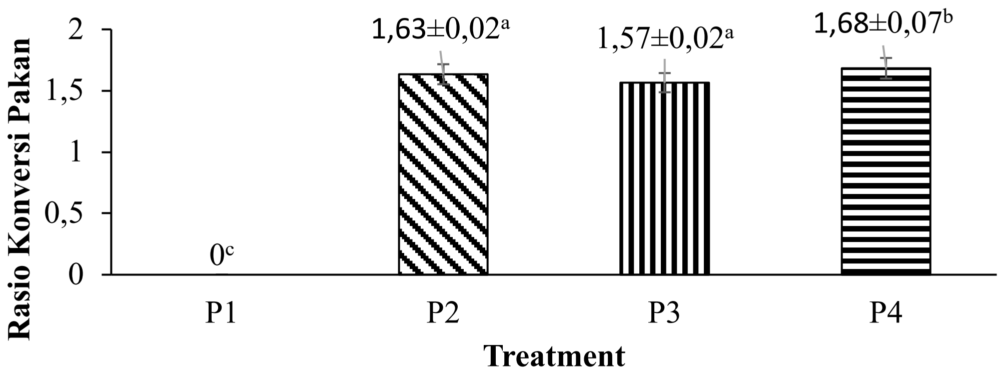

Figure 4. Feed Conversion Ratio

Figure 4.4 shows that the C/N ratio treatment of 24 (P4) provided the highest feed conversion ratio level, namely 1.68, followed by the C/N ratio treatment of 12 (P2) of 1.63, the C/N ratio treatment of 18 (P3) with a value of 1.57 and the lowest in the C/N ratio treatment of 6 (P1) with a value of 0%.

The results of the ANOVA test showed that the provision of different C/N ratios had a significant effect ($p<0.05$) on the feed conversion ratio of whiteleg shrimp during maintenance. The results of Duncan's further test showed that the provision of a C/N ratio treatment of 18 (P3) provided the best level of feed conversion ratio and was significantly different from the C/N ratio treatment of 6 (P1) and the C/N ratio treatment of 24 (P4) but was not significantly different from the C/N ratio treatment of 12 (P2)

Floc Volume

The results of this study indicate that the floc volume in vaname shrimp cultivation with various different C/N ratio treatments in low salinity biofloc media ranges from 30-157.67 ml/L (Figure 5)

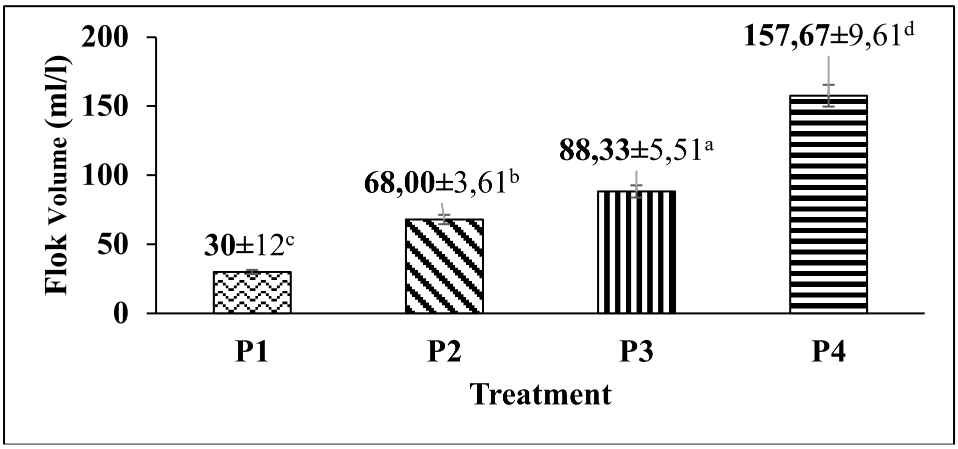

Figure 5. Floc Volume

Figure 4.5 shows that the C/N ratio treatment of 24 (P4) gave the highest floc volume, namely 157.67 ml/L, followed by the C/N ratio treatment of 18 (P2) of 88.33 ml/L, the C/N ratio treatment of 12 (P2) with a value of 68.00 ml/L and the lowest in the C/N ratio treatment of 6 (P1) with a value of 30 ml/L.

The results of the ANOVA test showed that the provision of different C/N ratios had a significant effect ($p<0.05$) on the floc volume in vaname shrimp cultivation in low salinity biofloc media. The results of Duncan's further test showed that the provision of a

C/N ratio treatment of 24 (P4) provided the highest floc volume and was significantly different from all other treatments.

Water Quality

The results of water quality parameter measurements during maintenance, including temperature, pH, dissolved oxygen (DO), and ammonia, are presented in Table 3.

Table 3 Water Quality Parameters

No	Parameter	P1	P2	P3	P4	Optimum value
1	Suhu(°C)	27-28,8	27,8-29	27,8-28,8	27,9-28,9	25-32 (Ningsih, 2021)
2	pH	8,0-8,2	8,0-8,2	8,0-8,2	8,1-8,3	7,5-8,5 (Renitasari *et al,* 2020)
3	DO(mg/l)	5,0-6,4	6,0-6,4	6,0-6,4	4,6-6,0	4-8 (Purnamasari *et al,* 2017)
4	Ammonia(mg/l)	0,10-0,39	0,09-0,30	0,09-0,2	0,18-0,36	<0,1 (Supono, 2018)

Table 3 shows that the temperature, pH and DO values during maintenance in all treatments are still optimal for vaname shrimp cultivation. However, the ammonia parameters in all treatments are not optimal because the range of ammonia values is above <0.1 mg/L.

DISCUSSION

The results of this study indicate that the provision of different C/N ratios can affect SR, LPS weight and length and FCR of vaname shrimp cultivated at low salinity in biofloc media. The provision of C/N ratio 18 (P3) can maintain SR of vaname shrimp and increase LPS length and LPS weight of vaname shrimp better (Figures 1 and 2). Meanwhile, the provision of C/N ratio 18 (P3) has the same ability as the C/N ratio 12 (P2) treatment in increasing LPS weight and FCR of vaname shrimp better (Figures 3 and 4). This is thought to be because the C/N ratio of 18 (P3) can produce better floc as a shrimp feed supplement that can be used for shrimp nutritional intake and can support low salinity environmental conditions during the maintenance process. According to Simanjuntak et al., (2018) floc is the result of suspended material residue in the form of feed residue and feces from biota that has been processed by heterotrophic bacteria through the flocculation stage by digesting carbon and nitrogen materials in the maintenance media which are useful in processing waste to maintain water quality and can be an alternative feed intake.

The flocs formed in all treatments have the same color characteristics, namely having a dark brown color that clumps in the maintenance water media (Figure 7) Mubin et al., (2021) stated that the flocs formed in indoor biofloc media will have a brown color characteristic caused by the dominance of bacteria, while the biofloc media with outdoor locations will be brownish green which is dominated by diatoms and algae due to exposure to sunlight, where the flocs formed due to the accumulation of processed feed and feces will form floc clumps that move along with the movement of the maintenance media water.

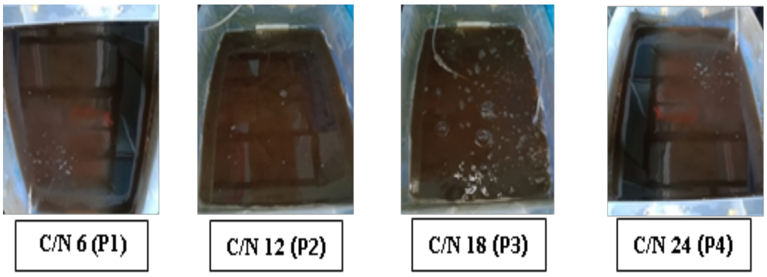

Figure 6. Characteristics of Biofloc Media

Thus, the higher the C/N ratio given, it is expected to optimize floc production. The higher the floc formed, the higher the shrimp growth. This is because the floc formed can be a source of natural feed that is high in protein content. According to Muqaramah (2016), the application of biofloc technology with the right ratio can produce additional feed protein through in situ in the maintenance media by forming flocs to increase the protein content in feed intake, thereby increasing the growth rate of the shrimp being raised. Similar research by Azhar (2013) also explains that providing molasses carbon sources with a ratio according to calculations can increase the availability of natural feed from various types of micro organisms such as plankton, namely zooplankton and phytoplankton, worms, fungi but also increase pathogenic bacteria that can compete with probiotic bacteria. With this natural feed, it can boost the growth of shrimp through the addition of natural feed protein sources during maintenance. The need for nutrition and protein is the main thing that must be available in shrimp maintenance for the weight gain and development of the shrimp being raised (Hidayat et al., 2014)

However, the results of this study indicate that the higher the C/N ratio given, the decrease in LPS weight and LPS length occurred, namely in the provision of a C/N ratio of 24 (P4). This is thought to be because the floc formed in this treatment is too dense so that it has an impact on limited space for movement or inhibits the metabolic process of the shrimp being raised, in addition, low salinity conditions force shrimp to continue to maintain osmoregulation of environmental conditions that are too dense for flocs. This has an impact on the level of shrimp stress so that they are unable to consume the available feed and growth will be disrupted. According to Ekasari, (2009) in Hidayatulloh (2015) the accumulation of organic matter in the form of flocs will continue to increase along with the addition of the applied C/N ratio but will cause an imbalance in the maintenance media if there is no significant utilization of the biota being raised such as increased turbidity which affects the osmoregulation system or metabolism so that the energy used to absorb floc content is used up in the survival process.

The rate of weight growth decreased at a higher C/N ratio also occurred in Hidayatulloh's (2015) study where the C/N ratio of 10 experienced a growth rate of 6%/day and at a C/N ratio of 20 5%/day. The use of floc itself depends on the condition of the maintenance media with the right C/N ratio, the use of the standard C/N ratio in biofloc media ranges from 10 to 20 (Muqaramah, 2016; Azhar, 2013; Erlangga, 2021, Hidayat, 2014; Hidayatulloh, 2015).

Sementara itu pada rasio C/N yang terlalu rendah memberikan LPS yang rendah pada udang It is suspected that the number of heterotrophic bacteria that develop is less able to balance the amount of suspended solids present so that the environment in the maintenance media has a high ammonia content (Table 3) so that the energy that should be used for growth and development is used up for survival. According to Hidayatulloh (2015) the accumulation of residual suspended material that is not balanced by the consumption of heterotrophic bacteria will make the environment unstable, where an unstable environment will have an impact on the energy budget of the biota being maintained, thereby slowing down the ongoing growth. The inability of shrimp to absorb feed and minerals to grow is also caused by the environment not supporting the maintenance media, which has an impact on stress on the shrimp and inhibits growth and eventually dies, where the failure of shrimp growth can be seen from the condition of dead shrimp that do not have shells. According to Handayani (2019) in Scabra et al., (2023) shrimp are able to experience growth if they can absorb and utilize minerals in their living environment and then store and process them in the body for the moulting process. The continuous moulting process can increase the growth rate of shrimp because moulting is an indication of weight gain in the shrimp being maintained.

The C/N ratio treatment of 18 (P3) provided a specific weight growth rate of 9.0%/day and a specific length growth rate of 4.18%/day and this growth rate was better when compared to the study of Supono et al (2021) on the maintenance of vannamei shrimp in the biofloc system, which showed a weight growth rate of 13.98%/day and the study of Scabra et al (2023) on the maintenance of vannamei shrimp in freshwater media which showed the highest weight growth rate was 2.7%/day. This shows that the floc produced in the C/N ratio treatment of 18 (P3) is well consumed and can support environmental conditions for the shrimp being raised.

The better increase in shrimp LPS in the C/N ratio 18 (P3) treatment is in line with the shrimp FCR value of 1.57 in this treatment. The feed conversion ratio is a comparison of the amount of feed (g) needed by biota to grow and produce 1 g of body weight. Erlangga et al (2021) stated that the lower the feed conversion ratio value obtained, the less feed is needed for the shrimp to grow. It is suspected that the floc formed in the C/N ratio 18 (P3) treatment can be digested and absorbed more optimally as a nutritional intake for shrimp. This is possible because the floc formed is composed of a collection of living microorganisms that can produce enzymes to increase the digestibility of feed in the shrimp digestive tract. One of the microorganism contents in the floc that is thought to help feed absorption become more effective is Lactobacillus sp which can help shrimp intestines digest food. According to Dewi et al (2023), the presence of probiotic bacteria Lactobacillus sp is able to produce amylase, a digestive enzyme, and is able to increase the productivity of protease enzymes in the intestines which has an impact on increasing the digestibility of biota so that feed can be absorbed more optimally.

The increase in shrimp LPS and better FCR values in the C/N ratio 18 (P3) treatments have not provided optimal SR values, where the SR value only reached 50% in this treatment. This survival rate is classified as moderate, as stated by Chumaidi (2005) in (Wijayanti & Pebriani, 2019) that the survival rate of biota above 50% is classified as good, 30-50% is classified as moderate and values below 30% are classified as poor. The low SR value in all these treatments is thought to be influenced by the low salinity conditions in this study. Any change in environmental salinity levels can affect the osmotic pressure on shrimp. This osmotic stress will inhibit growth and increase mortality, according to Aziz's research, (2010) regarding the maintenance of vannamei shrimp with different salinity levels, showing that a salinity level of 0 ppt causes the highest mortality with a survival rate of 0% at the end of the maintenance period due to different osmotic pressure conditions between the shrimp body and the environment, forcing the shrimp to carry out excessive osmoregulation and the occurrence of enlargement in the shrimp body. This causes the shrimp to be forced to moult and become weak and unable to survive, especially in poor environmental conditions.

This osmotic stress condition causes the need for energy to increase to offset the adverse effects of the stressor. Organisms usually meet the increasing energy needs by consuming more food (with the consequence of an increase in metabolic rate) or by using the body's reserve energy sources which ultimately reduce growth, immunity, and survival. It is suspected that the C/N ratio of 6 is unable to form optimal flocs in maintaining water quality or as an additional nutritional intake for the shrimp being raised so that they can become an additional source of energy for growth and survival. According to Supono et al (2021), the right C/N ratio will help the growth of heterotrophic bacteria to reduce and process toxic suspended solids into additional nutritional intake for the biota being raised so that the water quality remains in good condition. From this explanation, it is known that poor environmental conditions due to the availability of flocs that are unable to maintain water quality conditions and are unable to provide optimal additional nutritional intake for vaname shrimp are thought to cause shrimp in the C/N ratio 6 treatment to be unable to defend themselves related to osmotic pressure which is much different from the low salinity conditions in the maintenance media which should be able to be done through osmoregulation, so that the energy cannot be optimal in vaname shrimp.

The results of this study indicate that the provision of different C/N ratios can affect the volume of floc formed in vaname shrimp cultivation with low salinity in biofloc media. (Figure 5). According to Azhar (2013) floc volume is an indicator of the level of increase in flocculation or floc density in biofloc water media. Floc growth is a good sign where bacteria grow and process suspended inorganic materials into non-toxic materials so that water quality is maintained and can be an additional nutrient for the biota being maintained.

The results of observations of floc volume based on sampling time showed that at the beginning of maintenance the floc content in all treatments was small, but along with the length of maintenance the floc content formed increased. This shows that the provision of molasses as a carbon source in all treatments of the C/N ratio in the maintenance media can increase the population of heterotrophic bacteria because these heterotrophic bacteria obtain food through carbon and nitrogen substrates with a certain ratio. This certainly causes an increase in bacterial biomass which is useful as a source of protein for shrimp. (Figure 7).

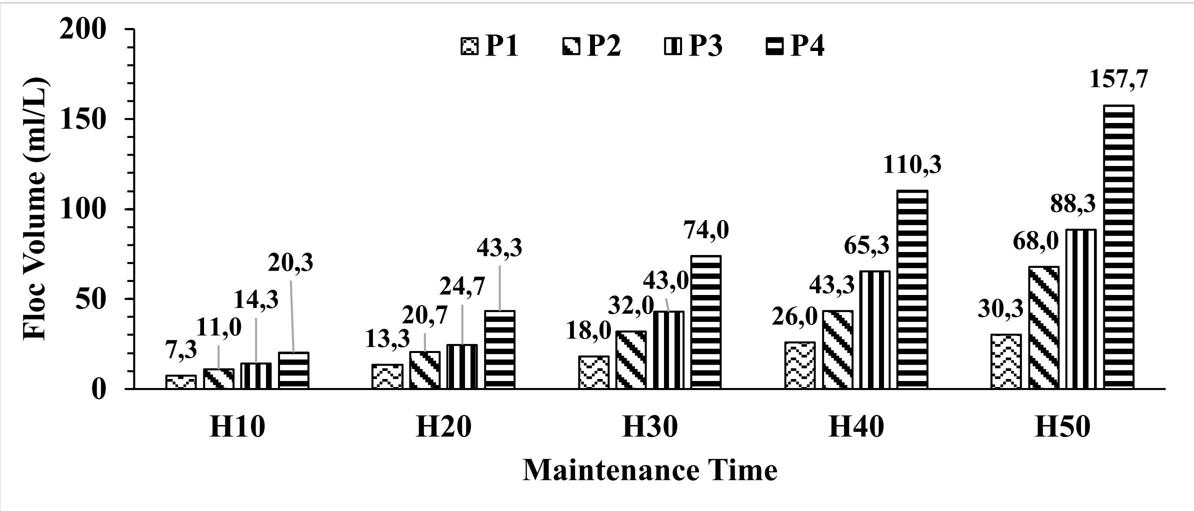

Figure 7. Daily Floc Volume Development

Figure 7 also shows that the higher the C/N ratio given, the greater the volume of floc formed, where the provision of a C/N ratio of 24 (P4) produced the highest floc volume during maintenance, which was 157.67 ml/L. This shows that the higher the molasses given, the better the availability of carbon from the molasses which can be utilized by microorganisms for their growth, resulting in the formation of more floc.

This assumption is supported by the opinion of Supono et al (2021) that the increase in flocs in the maintenance media is related to the increase in bacterial biomass where heterotrophic bacteria and microbes work actively due to the provision of carbon sources with the right C/N ratio to reduce inorganic nitrogen to organic nitrogen so that water quality is maintained, in addition, the presence of carbon sources can also help other microorganisms to grow and develop so that they can become natural food intake for fish or shrimp that are kept. Furthermore, Muqaramah (2016) stated that as the maintenance period increases, the nitrogen content processed by heterotrophic bacteria into floc collections also increases which has an impact on increasing floc volume.

However, overly dense flocs can also affect the environment because the floc content does not only consist of bacteria but also other microorganisms such as plankton. Therefore, overly dense flocs can cause algae blooming which can disrupt the metabolism of the biota being maintained and limit movement space and can be toxic if in uncontrolled amounts. Furthermore, Supono (2018) stated that overly dense plankton blooming has an impact on movement space and oxygen penetration for shrimp which can cause stress, algae bloom levels that are too high will result in death in shrimp caused by high stress levels, easy to get sick, poor feed absorption and other problems that have direct or indirect impacts.

This assumption is in line with the results of this study, where the provision of a C/N ratio of 24 (P4) although it produces the highest floc volume but cannot provide the best growth, as explained in the previous description. According to Suprapto and Samtafsir (2013) that the level of floc volume in good biofloc system cultivation activities is <150 ml/L or 15% of the water volume and if it exceeds this value it will affect the metabolism of the biota so that dilution is needed before the floc becomes too dense.

Thus, the C/N ratio 18 (P3) treatment is the treatment that provides the best floc volume, which is 88.33 ml/L and this value is still below <150 ml/L. The floc volume formed in the C/N ratio 18 (P3) treatment is thought to be optimally utilized by shrimp as additional feed for their growth. This is supported by the best LPS weight and LPS length of shrimp which are also found in the C/N ratio 18 (P3) treatment.

The results of this study indicate that water quality parameters including temperature, pH, DO during the study were still optimum for shrimp growth (Table 3). The temperature values obtained during maintenance ranged from 27 °C to 28.9 °C, where this value is still considered optimal. Scabra, Fatimah *et al.,* (2024) stated that the optimum temperature for maintaining vaname shrimp ranges from 25 °C-32 °C. The pH value obtained during maintenance ranges from 8.0-8.4. According to Renitasari & Musa (2020), the optimum pH value in the development process of vaname shrimp is in the range of 7.5 - 8.5 where the pH level of the water can affect the condition of appetite, shrimp activity and shrimp health. According to Supriatna (2020), the degree of acidity (pH) conditions the activity of hydrogen ions in the water which affects the life of biota where if it exceeds the normal limit it will cause stress, soft carapace skin, loss of appetite and lead to death. The DO value during maintenance ranges from 4.6-6.4 mg/l. This dissolved oxygen condition is still considered optimum for the life of whiteleg shrimp according to the statement from Purnamasari, et al (2017) the standard DO content for shrimp survival is at a value of 4-8 mg/l which is ideal for the growth and metabolism of whiteleg shrimp. Low absorption of dissolved oxygen due to poor environment can cause many problems for shrimp. According to Suwoyo, et al (2013) dissolved oxygen is a limiting factor for shrimp that move in the process of nutrient oxidation to produce free energy in catabolism in cells, and if there is a lack of oxygen it can cause hypoxia in shrimp followed by a decrease in metabolic rate, modification of the acid-base level of hemolymph and changes in ion concentration in the shrimp body. Meanwhile, the ammonia parameters of all treatments ranged from This ammonia level is relatively high and outside the optimum value according to the statement from Supono (2018) that the optimum condition of shrimp maintenance media has an ammonia level of <0.1 mg/l and according to Mangampa & Suwoyo (2016) that the ammonia content value> 1 mg/l can trigger mass mortality in high shrimp cultivation. The non-optimal ammonia levels in this study are thought to be caused by the increasing maintenance period, the increasing feed needed by shrimp to grow, and the increasing feces produced, but the heterotrophic bacteria produced are thought to have not been able to process the suspended material as a whole so that the ammonia level is also getting higher.

In addition to the osmotic pressure that is very different due to low salinity, environmental conditions in the form of high ammonia (Table 3) cause shrimp to be unable to survive because the energy is used up to maintain the osmotic pressure difference through osmoregulation so that shrimp moult when the ammonia level is high. Although according to Tiensongrusme (1980) in Aziz, (2010) that the ammonia level of 0.5 mg/l can still be tolerated by vannamei shrimp, but low salinity conditions have used up the shrimp's energy to maintain the osmoregulation system in order to survive the environment, but coupled with high ammonia levels will result in failure of the metabolism and organ systems in shrimp so that osmoregulation cannot run optimally and cause shrimp to die. According to Boyd (1990) in Aziz, (2010) that ammonia can affect the osmoregulation system due to tissue damage and biota metabolism due to the toxic materials contained.

Ammonia is a suspended waste from the decomposition of organic materials that can come from leftover feed, or shrimp feces with its main content being nitrogen which can come from leftover feed, algae that dies after the mineralization process, or natural waste from shrimp that are kept where the ammonia value can increase over time of maintenance and increase in feed given as well as feed with high protein content where the higher the value of ammonia indicates the higher level of toxicity of free nitrogen that can be produced (Supono, 2018).

CONCLUSION AND SUGGESTIONS

The provision of different C/N ratios can affect survival, specific weight and length growth rates, FCR values and floc volumes in vaname shrimp cultivation with low salinity in biofloc media. The provision of a C/N ratio of 18 (P3) is the best treatment because it can maintain the survival of vannamei shrimp by 50%, a specific weight growth rate of 9%/day, a specific length growth rate of 4.18%/day, an FCR value of 1.57 and a floc volume formed of 88.33ml/L. However, this treatment has not been able to maintain the optimum ammonia levels for vannamei shrimp cultivation.

The researcher's suggestion is that more comprehensive further research is needed to obtain the right cultivation method to maintain the survival of vannamei shrimp at low salinity.

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