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# THE EFFECT OF FERMENTED BRAN TIME ON IMPROVING WATER QUALITY AND GROWTH OF VANNAME SHRIMP (Litopenaeus vannamei)

## Pengaruh Waktu Pemberian Fermentasi Dedak Terhadap Peningkatan Kualitas Air dan Pertumbuhan Udang Vanname (Litopenaeus vannamei)

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**ABSTRACT**

Vannamei shrimp is a commodity with high economic value in Indonesia and the world. This study will determine when to feed fermented bran to vannamei shrimp to improve quality and development. The experimental method used was 4 treatments repeated 3 times. P1 was given fermented bran on day 0 before spreading, P2 on day 10 after spreading, P3 on day 20, and P4 on day 30. These treatments significantly affected absolute length, weight, and daily growth rate. While survival, feed conversion ratio, and air quality had no effect. In general, air quality was not affected by the treatments given. The highest absolute length growth was produced in treatment P3 of 4.1 ± 0.01 cm, while the lowest absolute length growth was obtained in P1 with a result of 3.6 ± 0.0. The highest absolute weight growth was obtained in P3 with a result of 2.61 ± 0.01 gr, while the lowest absolute weight growth was produced in P1 of 2.13 ± 0.03 gr. Likewise, the highest daily growth rate produced in P3 was 5.69%, while the lowest daily growth rate was in P1, namely 5.28%.

Keywords: Vanname shrimp, fermentation, rice bran, water quality, growth

**ABSTRAK**

Udang vannamei merupakan komoditas bernilai ekonomis tinggi di Indonesia dan dunia. Penelitian ini akan menentukan kapan waktu pemberian pakan bekatul fermentasi pada udang vannamei untuk meningkatkan kualitas dan perkembangan. Metode percobaan yang digunakan adalah dengan 4 perlakuan yang diulang sebanyak 3 kali. P1 diberikan bekatul fermentasi pada hari ke-0 sebelum penebaran, P2 pada hari ke-10 setelah penebaran, P3 pada hari ke-20, dan P4 pada hari ke-30. Perlakuan tersebut berpengaruh nyata terhadap panjang mutlak, berat, dan laju pertumbuhan harian. Sedangkan kelangsungan hidup, rasio konversi pakan, dan kualitas udara tidak berpengaruh. Secara umum kualitas air tidak dipengaruhi oleh perlakuan yang diberikan. Pertumbuhan panjang mutlak tertinggi dihasilkan pada perlakuan P3 sebesar 4,1±0,01cm, sedangkan pertumbuhan panjang mutlak terendah diperoleh pada P1 dengan hasil 3,6±0,0. Pertumbuhan bobot mutlak tertinggi diperoleh pada P3 dengan hasil 2,61± 0,01gr,

sedangkan pertumbuhan bobot mutlak yang paling rendah dihasilkan pada P1 sebesar 2,13±0,03gr. Demikian pula laju pertumbuhan harian tertinggi dihasilkan di P3 yaitu 5,69%, sedangkan laju pertumbuhan harian terendah di P1 yakni 5,28%.

Kata kunci: Udang vanname, fermentasi, dedak padi, kualitas air, pertumbuhan

## INTRODUCTION

Exports of fishery products such as vannamei shrimp (Litopenaeus vannamei) have quite large commercial value and attractive potential. The national fisheries economy greatly benefits from vannamei shrimp (Tohari *et al.,* 2020). The selling price and market demand from year to year are also very high. In Indonesia, subtropical shrimp from Mexico and Latin America are called vannamei shrimp. Vannamei shrimp originate from subtropical areas, but can be cultivated in tropical areas in large quantities using basic to extensive technology. Compared to other shrimp, vannamei shrimp can adapt to low temperatures, salinity variations, fast growth rates in months I and II, and increase survival.

These advantages make vannamei shrimp a promising commodity (Febri *et al.,* 2022). Vannamei shrimp grow best at 15-25 ppt and can survive below 5 ppt (Soermadjati & Suriawan, 2007). According to Rusmiyati (2012), salinity affects water quality and harvest yields. In addition, temperature greatly affects the development and survival of shrimp. The ideal temperature for shrimp production is 28-30 ºC (Rusmiyati, 2010). High temperatures stimulate chemical processes such as pH, which increases $NH_3$ in pond water. According to Haliman and Adijaya (2005), the pH of shrimp pond water should be 7.5-8.5. Plants and aquatic biota, such as vannamei shrimp, require dissolved oxygen in water for respiration (Fadir *et al.,* 2022). Good pond water has a dissolved oxygen of 4–6 ppm. Vannamei shrimp grow best with nitrite of 0.01-0.05 ppm (Dede *et al.,* 2014). The ideal nitrate range for shrimp production is <1 ppm (Dewi *et al.,* 2019). The range of phosphate values in pond waters that can support vannamei shrimp cultivation activities is no more than 0.5-5 gr/L (Scabra *et al.,* 2021). Ammonia compounds found in pond water for vannamei shrimp cultivation are no more than 0.1 ppm (Febri *et al.,* 2022).

During the process of vannamei shrimp cultivation activities, obstacles often occur, even causing failure in the process of cultivating vannamei shrimp caused by various factors, including diseases in shrimp, one of the causes of which is the suboptimal quality of the cultivation water environment, so that if the environmental conditions where the shrimp media are used to develop and grow are disturbed, it can affect the condition of the shrimp themselves.

To maintain good pond water quality and help the development of vannamei shrimp, farmers process water with organic materials and probiotics. Fermented bran is an air treatment. With natural fermented feed and probiotic components, fermented bran can help vannamei shrimp develop and improve water quality. Fermented bran helps improve natural feed, improving air quality organically.

## METHODS

This research was conducted at the Seed Laboratory of the Aquaculture Study Program, Faculty of Agriculture, Samudra University in November 2022 - January 2023. The tools used in this study were jars, blowers, pH meters, refractometers, DO meters, lux meters, 1x2 m fiber tanks, aerator hoses, 600 ml sample bottles, aeration stones, plastic bottles, and digital scales. This study used an experimental approach with 4 replications carried out 3 times. The provision

of bran fermentation was carried out at different times according to the treatment. The research treatments tested during the study were: P1 = (Provision of bran fermentation on day 0 before stocking), P2 = (Provision of bran fermentation on day 10 before stocking), P3 = (Provision of bran fermentation on day 20 before stocking), and P4 = (Provision of bran fermentation on day 30 before stocking).

**Research Procedures**

**Container Preparation**

Before conducting the research, 12 units of containers were prepared first, the jars used as containers were sterilized using detergent solution and rinsed with clean water, then the containers were dried in the sun. The water to be used during maintenance was sterilized first by being stored in a water tank and aerated for 24 hours so that the dissolved oxygen in the container increased. The volume of water used was 15 liters/maintenance container.

**Maintenance of Vaname Shrimp Fry**

The shrimp used in this study were PL18 shrimp with an average weight of 0.22 grams. The shrimp were first kept in a maintenance container as an acclimatization effort after 4 days, then the shrimp were put in a maintenance container with a density of 15 shrimp/container and kept for 40 days.

**Feeding**

During the research, the feed for vannamei shrimp was commercial feed with a protein content of 30%, the frequency of feeding was 3 times a day. The feeding time was at 08.00, 12.00 and 17.00 WIB. Feeding was done by at satiation.

**Making Bran Fermentation Solution**

The preparation of bran fermentation solution is done by mixing several ingredients consisting of rice bran, fishery EM4, molasses, tape yeast and fresh water, all ingredients are weighed beforehand before the ingredients are mixed together with a measure of 3 kg of bran, 30 mg of molasses, 10 mg of yeast and 30 mg of EM4 mixed with 5 L of fresh water after mixing, then stirred until homogeneous. The mixture is fermented for 2 days. During the fermentation process, the container is tightly closed with plastic and aerated so that the bacteria can grow quickly.

**Providing Fermented Bran**

The provision of bran fermentation is done by first filtering the fermentation results to obtain a cleaner bran fermentation solution that is free from fermentation residue, then the bran fermentation solution that is taken is put into a container for maintaining vannamei shrimp that has been determined. The time for providing bran fermentation is based on the treatment. The provision of bran fermentation is done slowly using a measuring cup that is poured into each maintenance container. The solution from the bran fermentation given is 1 ml/L. According to Gunarto (2009), the increase in weight of vaname shrimp occurs faster in ponds given 1 mg/L probiotics.

**Water Quality Measurement**

This study examines temperature and chemical characteristics such as pH, DO, salinity, nitrate, nitrite, ammonia, and phosphate to assess air quality. Thermometers, pH meters, DO meters, and refractometers monitor temperature, acidity, dissolved oxygen, and salinity. Water

quality checks including nitrate, nitrite, ammonia, phosphate were carried out at the Medan Baristand Laboratory with a titration method.

**Absolute Weight Gain**

Absolute weight growth is calculated to obtain the value of the weight gain of the vannamei shrimp being farmed. The absolute weight growth value is calculated using the formula (Syahfrizal *et al.,* 2021):

$$\text{AWG} = Wt - W0$$

Description:
AWG: Absolute weight gain (g); Wt: Biomass of vaname shrimp at the end of maintenance (g); W0: Biomass of vaname shrimp at the beginning of maintenance (g)

**Absolute Length Increase**

Absolute length measurement is calculated to see the value of shrimp length increase from the beginning of maintenance to the end. Absolute length measurement is calculated using the formula (Simamora *et al.,* 2021), namely:

$$\text{AL} = \text{Lt} - \text{Lo}$$

Description:
Pm: Absolute length (cm); Lt: Final length (cm); Lo: Initial length (cm)

**Specific Growth Rate**

Weight growth measurements were carried out to obtain data on the percentage of development of vannamei shrimp fry every 10 days. The specific growth rate uses the formula (Dahlan *et al.,* 2017):

$$\text{SGR} = \frac{LnWt - LnWo}{t} 100$$

Description:
SGR: Specific growth rate (%); W: Average weight of shrimp at the end of maintenance; (g); W0: Average weight of shrimp at the beginning of maintenance (g); T: Length of maintenance

**Survival Rate**

The survival rate is the total shrimp fry from the initial distribution to the end of the maintenance period, survival is calculated using the formula (Pratama *et al.,* 2017).

$$\text{SR} = \frac{Nt}{No} x100$$

Description:
SR: Survival rate (%); Pt: Total debt at the end of treatment (tail); No: Total shrimp at the beginning of treatment (tail)

**Feed Conversion Ratio**

After conducting research, the feed conversion ratio will be determined by comparing the amount of feed given during maintenance using the formula (Phonna *et al.,* 2022):

$$FCR = \frac{Weight\ of\ feed\ given}{(Bt+Bm)-B0}$$

Description:
FCR: Feed conversion ratio; Bt: Shrimp biomass at the end of the study (g); Bm: Dead shrimp biomass (g); B0: Shrimp biomass at the beginning of the study (g)

**Data Analysis**

All research data were processed using SPSS and analyzed using ANOVA to determine actual differences and Duncan's test at a 95% confidence level. Air quality statistics were tabulated and described.

## RESULT

**Absolute Weight Gain**

Anova test showed a significant effect ($P < 0.05$) of bran fermentation time on absolute weight gain. Duncan's test on the development of absolute weight of vannamei shrimp showed a significant difference between treatments P1 and P2, but not between P2 and P3 (Table 1).

Table 1. Absolute Weight Gain of Vaname Shrimp during maintenance

| Treatment | Initial Weight (g) | Final Weight (g) | Absolute Weight Gain (g) |
|---|---|---|---|
| P1 | 0,29 ±0,00 | 2,42 ± 0,02 | 2,13 ± 0,03[a] |
| P2 | 0,29 ±0,02 | 2,79 ± 0,06 | 2,50 ± 0,09[c] |
| P3 | 0,30 ±0,00 | 2,90 ± 0,00 | 2,61 ± 0,01[c] |
| P4 | 0,28 ±0,01 | 2,56 ± 0,06 | 2,28 ± 0,06[b] |

Description: Mean values followed by the same letter are not significantly different according to Duncan's multiple range test with 95% confidence interval.

**Specific Growth Rate**

The specific growth rate of vannamei shrimp produced during the maintenance of the results of the maintenance for 40 days showed an effect between treatments ($P < 0.05$). The results of the Duncan test showed that the specific growth rate of vannamei shrimp in treatments P1 and P4 was significantly different from P2 and P3, but P2 and P3 did not show any difference (Table 2). The highest specific growth of vannamei shrimp given bran fermentation treatment was obtained in treatment P3 of 5.69 ± 0.04%, namely the provision of bran fermentation on day 20 after spreading, then the next best treatment was produced in treatment P2 of 5.68 ± 0.02%, followed by treatment P4 with a value of 5.49 ± 0.07% and the lowest specific growth rate was in treatment P1, namely 5.28 ± 0.07%.

Table 2. Specific growth rate (SGR) of vaname shrimp

| Treatment | Specific growth rate (SGR) (%/hari) |
|---|---|
| P1 | 5,28 ± 0,07[a] |
| P2 | 5,68 ± 0,02[b] |
| P3 | 5,69 ± 0,04[b] |
| P4 | 5,49 ± 0,07[a] |

Description: Mean values followed by the same letter are not significantly different according to Duncan's multiple range test with 95% confidence interval.

**Absolute Length Increase**

The results of the Anova test showed that the treatment of giving bran fermentation at different times during maintenance had a significant effect (P<0.05) on the absolute length increase. Duncan's test on the absolute length growth of vannamei shrimp showed that P1 and P4 differed substantially from P2 and P3, but not from P2 (Table 3).

Table 3. Absolute Length Growth Results.

| Treatment | Initial Length (cm) | Final Length (cm) | Final Length (cm) |
|---|---|---|---|
| P1 | 3,18 ±0,04 | 6,8 ± 0,09 | 3,6 ± 0,07[a] |
| P2 | 3,07 ±0,03 | 7,0 ± 0,02 | 3,9 ± 0,07[b] |
| P3 | 3,09 ±0,00 | 6,8 ± 0,08 | 4,1 ± 0,01[b] |
| P4 | 3,12 ±0,05 | 6,9 ± 0,04 | 3,7 ± 0,04[a] |

Description: Mean values followed by the same letter are not significantly different according to Duncan's multiple range test with 95% confidence interval.

**Survival Rate**

Based on the Anova test, the treatment of rice bran fermentation in different vannamei shrimp maintenance media did not significantly affect survival (P>0.05). Survival is the ability of vannamei shrimp to survive with certain treatments, one of the factors that supports survival is the environment. The average survival value of vannamei shrimp is presented in Figure 1.

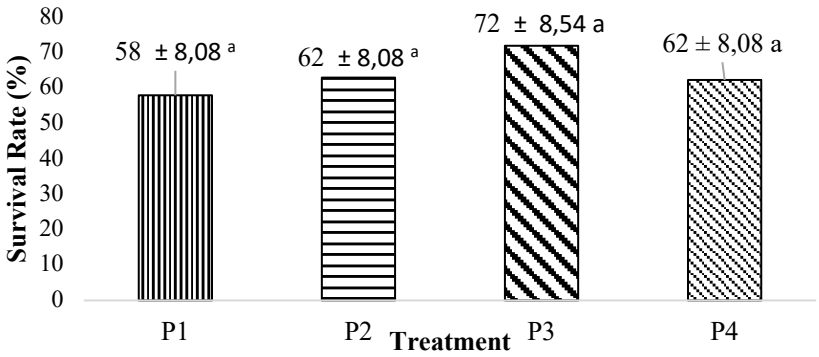



Figure 1. Survival rate of vaname shrimp

**Feed Convertion Ratio**

Based on the Anova test, it shows that the treatment of giving fermented rice bran at a certain time in the vannamei shrimp maintenance media has no significant effect on the vannamei shrimp feed conversion ratio (P>0.05) (Table 4). The feed conversion ratio (FCR) is a comparison in determining the amount of feed given with the growth of vannamei shrimp during maintenance.

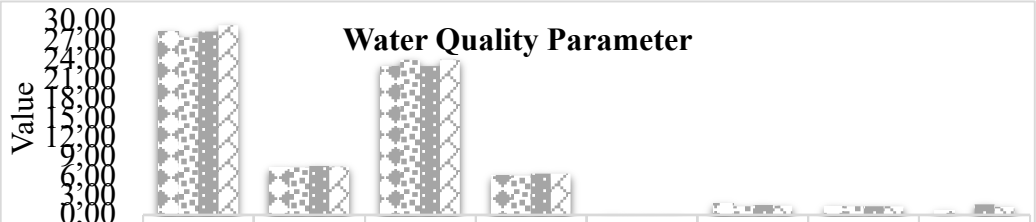
Table 4. Feed Conversion Ratio Given During Maintenance

| Treatment | Feed Convertion Ratio (%) |
|---|---|
| P1 | 1,43 ± 0,05[a] |
| P2 | 1,41 ± 0,06[a] |
| P3 | 1,35 ± 0,03[a] |
| P4 | 1,40 ± 0,05[a] |

Description: Mean values followed by the same letter are not significantly different according to Duncan's multiple range test with 95% confidence interval.

**Water Quality**

Measurement and observation of water quality during the maintenance of vannamei shrimp is in a good range to support the life and growth of vannamei shrimp (optimum tolerance limit). Water quality parameters during the study are presented in (Figure 2).




| | Suhu | pH | Salinitas | DO | NH3 | NO3 | NO2 | Fosfat |
|---|---|---|---|---|---|---|---|---|
| H-0 | 28,34 | 7,34 | 23 | 6,06 | 0,019 | 1,700 | 1,370 | 0,640 |
| H-10 | 27,46 | 7,39 | 24 | 6,09 | 0,024 | 1,380 | 1,320 | 0,080 |
| H-20 | 28,42 | 7,6 | 23 | 6,41 | 0,030 | 1,540 | 1,320 | 1,620 |
| H-30 | 29,36 | 7,5 | 24 | 6,38 | 0,020 | 1,480 | 1,360 | 1,250 |

Figure 2. Water quality in vannamei shrimp maintenance media

## DISCUSSION

In Table 1, the treatment of giving fermented rice bran at different times in the maintenance of vannamei shrimp for 40 days has a good effect on increasing the growth of vannamei shrimp. Giving fermented rice bran in the P3 treatment on the 20$^{th}$ day after spreading is the best treatment with a growth value of 2.61 ± 0.01 g. This is followed by the P2 treatment of 2.50 ± 0.09 g, the P4 treatment of 2.28 ± 0.06 g, while the lowest growth was produced in the P1 treatment of 2.13 ± 0.03 g. This indicates that giving fermented rice bran during the shrimp maintenance process can maintain and help the process of improving physiology, especially in the digestion of food and improving good water quality so that if the water quality conditions are well maintained, it will be able to support the growth of the absolute weight of vannamei shrimp.

Giving the right amount at the right time can also be a natural probiotic that can improve the digestive function of vannamei shrimp so that they can utilize feed effectively. According to Citria et al. (2018), probiotic fermentation regulates the number of bacteria in the intestine, inhibits harmful microorganisms, and releases enzymes that help digest food to improve shrimp development. Shrimp digestive enzymes break down carbohydrates, lipids, and proteins, thereby improving shrimp development. Probiotics improve air quality, improve immunological responses to nutrients, and eliminate harmful microorganisms, according to Dewi *et al.* (2019).

The lowest absolute weight growth was produced in the P1 treatment of giving bran fermentation in the shrimp test maintenance container before spreading with a result of 2.13 ± 0.03 g, the low growth of shrimp in the P1 treatment was due to the lack of bacterial activity that could be utilized by vannamei shrimp so that shrimp were susceptible to attacks by pathogenic bacteria which could eventually interfere with growth and even death. This is in line with the opinion of Ridlo (2009), who stated that disease can inhibit the cultivation of vannamei shrimp (*Litopenaeus vannamei*) because of the high mortality rate due to infection by viruses and dangerous bacteria.

The fermentation given at the beginning of maintenance was less than ideal in breaking down organic matter in the air maintenance media, so that organic matter could accumulate

and increase over time. So based on this statement, it has been emphasized that the level of fermentation given in the maintenance media given at the beginning of maintenance can inhibit the ability of bran fermentation to maintain water quality for longer, so that the shrimp being maintained have not reached the optimal point in utilizing the fermentation given.

Based on Table 2, the best growth rate obtained in the P3 treatment in utilizing bran fermentation to the maximum requires improvement in water quality optimally. This is due to the metabolic ability of the shrimp's body, the metabolic ability or digestive system due to the increase in positive bacteria and microbes in the maintenance media such as *Lactobacillus* sp. which are useful in helping the digestion process (Syadillah, 2020). *Lactobacillus* sp. gram-positive bacteria in whiteleg shrimp feed, can increase growth in certain amounts. Lactobacillus sp. nourishes the intestines and changes protein molecules to increase food absorption and growth (Syadillah, 2020). According to Ghosh et al. (2016), the addition of probiotic bacteria to the maintenance container for giant freshwater prawns (*Macrobrachium rosenbergii* de Man) can supplement feed sources, aid digestion, and reduce pathogenic bacteria.

This is in line with Ranggayoni *et al.* (2021), who stated that the body's metabolic process uses feed nutrients as energy and growth, thereby improving environmental conditions and feed quality. The second aspect is if the shrimp cannot adjust and control their bodies due to changes in one of these parts or irregular changes and fluctuations, this will directly affect the development of the shrimp.

The P1 treatment of fermented bran on day 0 before spreading resulted in the lowest specific growth rate. Shrimp growth is stunted because they do not get enough nutrition. Several studies have shown that the LPS value is directly related to the easily absorbed nutritional content of shrimp feed and the ability of shrimp to use feed nutrients to grow. According to Suwoyo and Mangampa (2016), genetics, gender, age, density, parasites, diseases, and feed utilization affect shrimp development. Feed consumption affects weight gain because it affects nutrient intake for development and other needs.

Based on Table 3, the results of the study on test shrimp for a period of 40 days of maintenance with the treatment of fermented bran at different times were seen to have a positive impact on the absolute length increase of vannamei shrimp. Determination of the application time in providing bran fermentation in the test shrimp maintenance media showed that the best treatment was obtained in P3 of 4.1 ± 0.01 cm followed by P2 treatment of 3.9 ± 0.07 cm, the next lowest value was produced in P4 treatment of 3.7 ± 0.04 cm, while the lowest absolute length growth was produced in P1 treatment with an average length of 3.6 ± 0.07 cm.

The value of P4 is lower because the provision of fermentation solution at the beginning cannot be utilized optimally by the shrimp, because the shrimp that have just entered the container are still in the adaptation stage so that the solution given at the beginning of maintenance, the probiotic content contained in the fermentation is not optimal. This is in line with (Febri *et al.,* 2021), which states that the content of probiotics in water has a certain life span so that it must be utilized safely.

The absolute length growth of the test shrimp is in line with the growth results obtained in absolute weight growth, this shows that the provision of fermented bran fermented with Em4 probiotics at the right time and applied according to the needs of vannamei shrimp has been able to provide a positive effect in increasing the absolute length growth of vannamei shrimp. Fermented bran at the right time can stimulate growth and improve the immune system of shrimp, making them more resistant to disease and pathogenic bacteria that carry disease. This allows shrimp to consume feed and convert feed into energy, thereby increasing the absolute length growth of vannamei shrimp. Probiotics can also break down organic matter, prevent disease, and accelerate the nutrient cycle (Herdianti *et al.,* 2015).

According to Sihombing *et al.* (2023), probiotics help reduce shrimp farming disorders caused by microorganisms that improve environmental quality. The fermentation process produces probiotics with hemocytes that can protect animals, especially invertebrates that do not have an adaptive immune system. Hemocytes increase cellular immunity through phagocytosis, encapsulation, and nodule formation. The addition of EM4 probiotics to fermentation can increase THC and maintain the health of vannamei shrimp. The addition of THC value after EM4 probiotics can protect vannamei shrimp from pathogens by increasing the immune system and blocking pathogen channels that break down organic components into antibiotic chemicals (Adillah *et al.,* 2023). Based on this statement, the increase in growth and decrease in growth rate are greatly influenced by the time of administration and utilization of vannamei shrimp against the fermentation of rice bran given.

Based on Figure 1, it shows that the maintenance of vannamei shrimp tested for 40 days has different survival rates between treatments, the highest survival rate was produced in P3, namely P3 72% followed by P2 at 62% and P4 at 67% and the lowest value was produced in treatment P1 at 58% but based on the Anova test conducted showed no significant difference between treatments. This means that the fermentation given at different times of administration did not affect the survival rate.

In addition to fermentation, the survival of vannamei shrimp is also significantly influenced by environmental adaptation and stress at the time of sampling. According to (Agustama *et al.,* 2015), competition for movement space, poor feed quality and quantity, and negligence especially during sampling affect the survival rate. Because shrimp that are molting are attacked by other shrimp, the survival of the shrimp being tested is also questionable. Previous studies have shown that asynchronous molting can trigger cannibalism and death in shrimp that are molting (Mariska *et al.,* 2019). Table 4 shows no significant difference in treatment. The feed conversion ratio in this study was still good, this is in line with the statement of Arsad *et al.* (2017), which states that the lower the FCR, the lower the feed cost and the higher the profit. The lowest FCR value was found in P3 (1.35 ± 0.03), followed by P1 (1.43 ± 0.05), P2 (1.41 ± 0.06), and P4 (1.40 ± 0.05).

The resulting FCR value was not significantly different, it is suspected that the weight of the shrimp in each maintenance medium tends to be the same size, the quality of the optimum cultivation environment, the provision of proper feeding and good food absorption in the stomach due to the provision of bran fermentation also affect the body so that the feed given is utilized properly. This is in line with (Ridlo *et al.,* 2013) which states that FCR is influenced by survival, density, weight of individuals kept and differences in daily feed percentage, time, and maintenance location. The lower the FCR value, the better because the small amount of food is used to increase shrimp weight.

Based on Figure 2, the low water quality in the vannamei shrimp maintenance media can affect the level of life and growth of vannamei shrimp. The range of water quality obtained in each treatment during the study was still in good water quality conditions and suitable for shrimp life, both to increase growth and maintain the life of vannamei shrimp. The temperature range of 27.46º-28.3ºC shows the optimum range and is still suitable for shrimp life. Based on the statement of Ridlo *et al.* (2013), that the optimum temperature for vannamei shrimp growth is between 26ºC-32ºC. Sudden changes in water quality can affect the growth rate of shrimp being cultivated.

The pH value of water in the vannamei shrimp maintenance media during the study ranged from 7.26-7.63 where this value is still in good condition. The optimal pH range for vannamei shrimp is 7.3-8.5 with a tolerance for change of 6.9-9, (Pasongli and Dirawan, 2016). The salinity value in the vannamei shrimp maintenance media is still in normal condition with

a salinity value of 26 ppt. Tahe and Suwoyo (2011), stated that the optimum salinity to support the growth of vannamei shrimp is 15-27ppt.

The dissolved oxygen content in the maintenance media is in the range of 6-6.41 mg/L, this value is still in optimum condition to support the growth of vannamei shrimp. The optimum dissolved oxygen for vannamei shrimp cultivation is around> 3 mg/L (Tahe & Suwoyo, 2011). The high dissolved oxygen in the vannamei shrimp maintenance media is thought to be due to the addition of dissolved oxygen from the aerator which was continuously flowed during the study. The ammonia levels in each vannamei shrimp maintenance treatment media were in good condition with a range of 0.019 - 0.030. According to Yunarty *et al.* (2022), the ammonia levels that can be tolerated by aquatic biota are only around 0.5-2.0 mg/L. The low ammonia condition is suspected to be due to the positive effects caused by the good bacterial content in the fermentation given so that fermentation with the existing probiotic content can bind bacteria in water containing dirt. Based on the Nitrite ($NO_2$) level test carried out, the range of 1.320 mg/L was obtained, this value indicates that the nitrite content is still in good condition. Nitrite levels below 4.5 mg/L are considered the maximum limit value to support growth (Setijaningsih & Gunadi, 2016).

Phosphate levels are measured to determine feed contamination on the quality of the maintenance media water, the main source of phosphate comes from the artificial feed given. Phosphate is a compound dissolved in water that functions to form proteins due to the photosynthesis process (Adiwijaya *et al.,* 2003). Phosphate levels during the study were in the optimum range of 0.64 mg/L, the phosphate value was at optimum conditions. The maximum phosphate threshold for fisheries cultivation activities is 0.1–5 (Awanis *et al.,* 2017). The concentration content of nitrate values from laboratory test results obtained results ranging from 1.38-1.70, this is still within the tolerance value for the life of vannamei shrimp. Nitrate concentrations below 50 mg/L do not endanger shrimp life. The presence of high nitrate is needed to stimulate the growth of plankton and moss as natural food for shrimp (Sihite *et al.,* 2023).

## CONCLUSION

The conclusion obtained from this study is that the conclusion obtained is that the P3 treatment (giving fermented bran on the 20th day before spreading) is the best time to maintain optimum water quality, increase absolute weight growth by 2.61 g, specific growth rate of 5.69% and absolute length of 4.1%.

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