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EFFECTIVENESS OF JAMBLANG LEAF EXTRACT (*Syzygium cumini*) IN TREATMENT OF *Aeromonas hydrophila* BACTERIAL INFECTION IN NILE FISH (*Oreochromis niloticus*)

Efektivitas Ekstrak Daun Jamblang (*Syzygium cumini*) dalam Pengobatan Infeksi Bakteri *Aeromonas hydrophila* Pada Ikan Nila (*Oreochromis niloticus*)

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ABSTRACT

The demand for tilapia continues to increase, but the problem of disease caused by the bacterium Aeromonas hydrophila has become a major challenge in tilapia farming, resulting in significant losses due to high fish mortality rates. This study aims to evaluate the effectiveness of jamblang leaf extract (Syzygium cumini) in treating Aeromonas hydrophila infections in tilapia. The study employed an experimental design using a Completely Randomised Design (CRD) involving 5 treatments and 4 replications, namely (A) negative control, (B) positive control, and treatment with jamblang leaf extract (C) at a dose of 18.5 mL/1.5 L, treatment (D) at 26.25 mL/1.5 L, and (E) 33.75 mL/1½ L. The results showed that jamblang leaf extract had a significant impact on the recovery of tilapia. Clinical symptoms of infection included swimming at the bottom, wounds, and excessive mucus. Leukocyte observations showed a spike on the first day, with treatment C showing better results than the positive control. Hemoglobin and haematocrit levels also showed better recovery in treatment C, with hemoglobin levels of 6 g/dL and haematocrit levels of 19% on day 14. The highest fish survival rate was recorded in treatment C (78.33% ± 8.38), while the positive control only reached 28.33% ± 6.38. Water quality during the study indicated conditions favourable for fish survival. In conclusion, the study demonstrated that jamblang leaf extract at a dose of 18.5 mL/1.5 L was effective in improving survival rates and correcting blood parameters in fish infected with bacteria.

Key words: *Aeromonas hydrophila,* hematocrit, tilapia, jamblang leaf extract, survival rate, *Syzygium cumini*, water quality.

ABSTRAK

Permintaan ikan nila terus meningkat, namun masalah penyakit yang disebabkan oleh bakteri *Aeromonas hydrophila* menjadi tantangan utama dalam budidaya ikan nila, menyebabkan kerugian besar akibat tingkat kematian ikan yang tinggi. Penelitian ini bertujuan

untuk mengevaluasi efektivitas ekstrak daun jamblang (*Syzygium cumini*) dalam mengobati infeksi *Aeromonas hydrophila* pada ikan nila. Penelitian menggunakan metode eksperimen dengan Rancangan Acak Lengkap (RAL) yang melibatkan 5 perlakuan dan 4 ulangan, yaitu (A) kontrol negatif, (B) kontrol positif, dan Perlakuan pemberian ekstrak daun jamblang (C) dengan dosis 18,5 mL/1½ L, perlakuan (D) 26,25 mL/1½ L, dan (E) 33,75 mL/1½ L. Hasil menunjukkan bahwa ekstrak daun jamblang memberikan dampak signifikan terhadap pemulihan ikan nila. Gejala klinis infeksi meliputi berenang di dasar, luka, dan lendir berlebih. Pengamatan leukosit menunjukkan lonjakan pada hari pertama, dengan perlakuan C menunjukkan hasil yang lebih baik dibandingkan kontrol positif. Kadar hemoglobin dan hematokrit juga mengalami pemulihan yang lebih baik pada perlakuan C, dengan kadar hemoglobin 6 g/dL dan hematokrit 19% pada hari ke-14. Kelulushidupan ikan tertinggi tercatat pada perlakuan C (78,33% ± 8,38), sedangkan kontrol positif hanya mencapai 28,33% ± 6,38. Kualitas air selama penelitian menunjukkan kondisi yang mendukung kelangsungan hidup ikan. Kesimpulan dari penelitian ini secara keseluruhan, ekstrak daun jamblang dengan dosis 18,5 mL/1½ L terbukti efektif dalam meningkatkan kelulushidupan dan memperbaiki gambaran darah ikan yang terinfeksi bakteri.

Kata Kunci: *Aeromonas hydrophila*, ekstrak daun jamblang, hematokrit, ikan nila, kelulushidupan, kualitas air, *Syzygium cumini.*

INTRODUCTION

Tilapia is very popular among the public as a source of animal protein due to its low cholesterol content, with a nutritional value of 17.7% protein and 1.3% fat. This fish is a choice of animal protein source that is still affordable for various groups of people, resulting in increasing demand for tilapia. This has led to continued market demand for this fish (Saputra *et al.,* 2024). According to a report from the Ministry of Aquaculture (2024), tilapia production from 2020 to 2024 showed a significant increase, with an average increase of 1.19%. However, when viewed from the trend of production achievement against the annual target, tilapia production until 2024 still fell short of the set target. In 2024, only 56.05% of the expected target was achieved.

The main challenge in tilapia cultivation is disease, which can cause significant losses (Simorangkir *et al.,* 2020). Diseases caused by the bacteria Aeromonas hydrophila have been known in Indonesia since 1980. These bacteria cause outbreaks in fish, with high mortality rates occurring periodically, resulting in significant losses in fish farming. Aeromonas hydrophila produces various toxins, including exotoxins, cytotoxins, enterotoxins, and endotoxins.

One way to treat fish infected with these bacteria is with antibiotics. However, inappropriate antibiotic use can lead to bacterial residues and resistance. Therefore, solutions are needed to address the disease without causing other negative impacts (Mali *et al.,* 2023). One such approach is the use of herbal ingredients, such as jamblang leaves. Jamblang leaves are rich in acylated flavonol glycosides, triterpenoids, tannins, quercetin, myricetin, myricitin, esterase, and galloyl carboxylase (Kumawat *et al.,* 2018). Flavonoids and tannins have antimicrobial properties that can inhibit the growth of both positive and negative bacteria (Putri *et al.,* 2022). This study aims to examine the effect of using jamblang leaf extract in treating tilapia infected with Aeromonas hydrophila bacteria.

RESEARCH METHODS

Place and Time

This research was conducted in April-May 2024 at the Laboratory, Seeding and Breeding, Faculty of Marine Affairs and Fisheries, Syiah Kuala University, Banda Aceh.

Tools and Materials

This research was conducted in April-May 2024 at the Laboratory, Seeding and Breeding, Faculty of Marine Affairs and Fisheries, Syiah Kuala University, Banda Aceh.

Research Design

The study used an experimental method with a Completely Randomized Design (CRD) with 5 treatments and 4 replications, with doses referring to Renopi et al. (2021). The treatments in this study were as follows:

A. Negative control not infected with A. hydrophila.
B. Positive control infected with A. hydrophila
C. Jamblang leaf extract 18.5 mL/1.5 L infected with A. hydrophila.
D. Jamblang leaf extract 26.25 mL/1.5 L infected with A. hydrophila.
E. Jamblang leaf extract 33.75 mL/1.5 L infected with A. hydrophila

Procedure

The fish used were sourced from the Lambaro Fish Breeding Center in Aceh. Tilapia measuring 9-11 cm and weighing 5-6 grams were acclimatized for 15 minutes and kept for one week before treatment. A total of 300 fish were used at a stocking density of 15 fish per container (Maryani *et al.,* 2021).

To prepare jamblang leaf extract, 1 kg of fresh leaves is required. The jamblang leaves are first cleaned and washed. Then, the leaves are air-dried in an open area protected from sunlight. The dried jamblang leaves are then blended into a powder. Maceration is then performed by soaking the jamblang leaves in 70% ethanol, with 250 grams of powdered jamblang leaves soaked in 2 liters of ethanol. This maceration process lasts for 24 hours. After soaking for 24 hours, the maceration results were filtered to separate the filtrate from the dregs. Finally, the filtrate was evaporated using a rotary evaporator at 70°C to produce a crude extract (Patricia *et al.,* 2021).

Bacterial infection was carried out by immersing the fish in a medium containing Aeromonas hydrophila bacteria at a density of 108 CFU/ml and then observing their clinical symptoms.

The immersion in jamblang leaf extract was carried out after the fish infected with Aeromonas hydrophila showed symptoms of Motile Aeromonas Septicemia (MAS). The test fish were immersed for 15 minutes according to the procedure described by Yasani *et al.,* (2024). After immersion, the water in the rearing medium was completely replaced with clean water. The fish were then reared for 14 days.

Tilapia blood sampling was carried out 4 times, the first time when the fish had not been infected with bacteria, the second time on day 1 after the fish were infected with bacteria, the third time on day 7, and the last time on day 14. The blood parameters observed included white blood cells (leukocytes), hemoglobin levels, and hematocrit levels. Blood sampling was carried out on the caudal artery with a 1 ml syringe that had been limited to EDTA, the blood taken was then stored in a microtube for further blood image viewing (Maulina & Herlina, 2022).

Research Parameters

The parameters observed in this study included clinical symptoms, fish blood parameters, survival, and water quality.

After the fish were infected with the bacteria, clinical symptoms were observed daily throughout the treatment period. The development and changes in clinical symptoms that emerged during the treatment period were recorded and analyzed descriptively, with the aim of describing patterns or trends that occurred over time. This observation process followed the

approach used by Pattipeiluhu *et al.,* (2022) in observing the dynamics of clinical symptoms in infected fish.

Blood samples from tilapia were taken at several time points to assess changes in blood counts following Aeromonas hydrophila infection and immersion in jamblang leaf extract. Blood samples were first taken on day 0, before bacterial infection, then on day 1 after infection, and on days 7 and 14 after immersion in jamblang leaf extract. The effect of jamblang leaf extract on fish blood counts was assessed based on several parameters, namely white blood cell (leukocyte) count, hemoglobin (Hb) levels, and hematocrit levels. Following the procedure described by Rousdy & Linda (2018), blood samples were taken from the caudal artery of the fish using a 1 mL syringe moistened with EDTA.

Fish survival was assessed after the tilapia were infected with Aeromonas hydrophila bacteria by counting the number of dead fish up to day 14 after the challenge test. The survival rate was calculated by comparing the number of surviving fish to the initial number of fish, and the results were expressed as a percentage. The survival rate was calculated using the formula proposed by Effendi (1997), which specifically measures the ratio between the number of surviving fish and the initial number of fish. The complete chart can be seen below:

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

Information:
SR : Survival rate (%)
Nt : Number of fish alive at the end of the observation (tail)
No : Initial number of fish surviving the challenge test (tail)

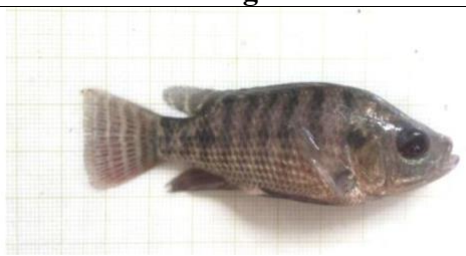
The water quality parameters observed in this study were pH, temperature, and DO. Temperature, pH, and DO measurements were conducted daily, in the morning and evening.

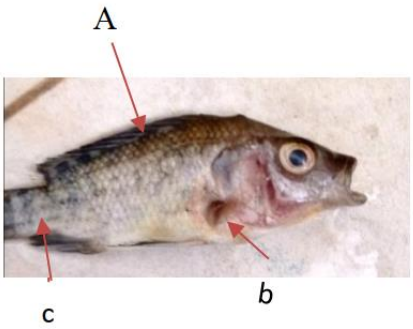
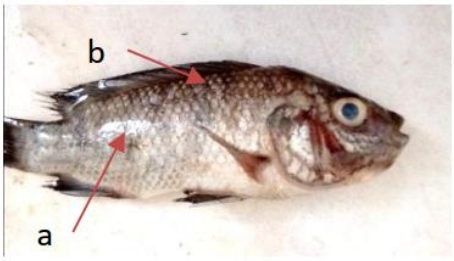
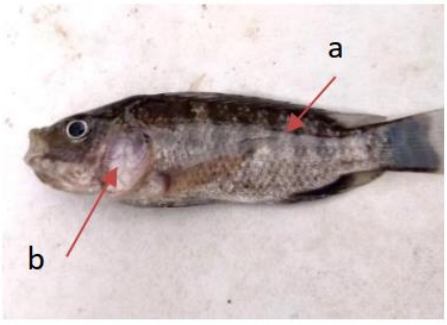
RESULT

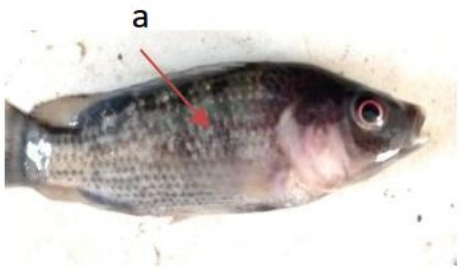
Clinical Symptoms

Clinical symptoms of tilapia observed before infection indicated normal behavior and condition. However, after infection with Aeromonas hydrophila bacteria, observations revealed changes in clinical symptoms in each infected treatment. Fish began to exhibit bottom-dwelling behavior and lesions appeared on their body surfaces. Furthermore, excess mucus was observed on the tilapia's body, indicating infection and the fish's immune response to the bacteria.

Table 1. Clinical Symptoms of Tilapia

No.	Treatment	Symptom	Figure
1	Fish before being infected with Aeromonas hydrophila bacteria	Responsive to feed, brightly colored and stable swimming.	

2.	Fish after being infected with Aeromonas hydrophila bacteria	a. Red spots on his back. b. Damage to the lower fins, bleeding in the gills. c. Peeling scales.	
3.	Fish after being given jamblang leaf extract.		
	a. Treatment A (Negative Control)	Responds to the feed given, bright colors and stable swimming.	
	b. Treatment B (Positive Control)	experiencing red spots around the gills, back and stomach.	
	c. Treatment C	a. Decreased mucus b. red spots fade	
	d. Treatment D	a. Decreased mucus b. the wound on the gills is getting better.	

e. Treatment E	a. Decreased mucus		

Hematology Testing

White Blood Cells (Leukocytes) of Tilapia Fish

Based on observations of tilapia leukocytes during the study, it can be seen that the treatments given affected the number of fish leukocytes. On day 0, before bacterial infection, leukocyte levels in all treatments were within the normal range (Table 2). The normal range for fish leukocytes is between 20,000 and 150,000 cells/mm³ (Pattipeiluhu *et al.,* 2022). In the negative control treatment (A), the number was recorded at 30.6 x 10^3 cells/mm³, while in the positive control treatment (B), it was 35.1 x 10^3 cells/mm³. Likewise, the treatments with jamblang leaf extract (C, D, and E) showed quite diverse variations but remained within the normal range of healthy fish, with values of 38.7 x 10^3 cells/mm³ in treatment C, 33.5 x 10^3 cells/mm³ in treatment D, and 29.0 x 10^3 cells/mm³ in treatment E.

After bacterial infection on day 1, there was a significant spike in all treatments, especially in the positive control (B), which increased sharply to 230.4 x 10^3 cells/mm³. Other treatments also showed an increase although not as high as treatment B, namely 219.4 x 10^3 cells/mm³ for treatment C, 204.5 x 10^3 cells/mm³ for treatment D, and 174 x 10^3 cells/mm³ for treatment E. On the 7th day, there was a further increase in the positive control treatment (B) to 347 x 10^3 cells/mm³, while the treatment with jamblang leaf extract showed greater variation, with treatment D recording the highest figure of 672 x 10^3 cells/mm³, and the lowest in treatment C, namely 292 x 10^3 cells/mm³. On the 14th day, although the number of leukocytes decreased again, treatment B still showed the highest number with a value of 352 x 10^3 cells/mm³, followed by treatment D which was 430 x 10^3 cells/mm³, treatment E was 410 x 10^3 cells/mm³, treatment C was 246 x 10^3 cells/mm³, and treatment A which remained stable at 36.1 x 10^3 cells/mm³. These results indicate that the administration of jamblang leaf extract is able to relieve Aeromonas hydrophila infection in tilapia which is indicated by a decrease in total leukocytes over time.

Table 2. Leukocyte Levels of Tilapia Fish

Treatment	Leukosit (10^3 Sel/mm³)			
	Before Infection	After Infection	After H+7	Treatment H+14
A	30,6	36,6	39,8	36,1
B	35,1	230,4	347	352
C	38,7	219,4	292	246
D	33,5	204,5	672	430
E	29,0	174	504,8	410

Hemoglobin

Observations of the hemoglobin levels of tilapia during the study showed that treatment with jamblang leaf extract affected the hemoglobin levels of fish infected with Aeromonas hydrophila. On day 0, before bacterial infection, hemoglobin levels in all treatments were

within the normal range (Table 3). According to Sahfitri *et al.,* (2021), normal hemoglobin levels in tilapia range from 5.05 to 8.33 g/dL. However, after bacterial infection on day 1, hemoglobin levels in all treatments showed a significant decrease, especially in the positive control treatment (B), which dropped drastically to 3.8 g/dL. Treatment with jamblang leaf extract also experienced a decrease, but hemoglobin levels remained higher than the positive control, with treatments C, D, and E showing levels of 2.6 g/dL, 2.6 g/dL, and 2.8 g/dL, respectively. On day 7, hemoglobin levels in the negative control treatment (A) remained relatively stable (6.2 g/dL), while in the other treatments, hemoglobin levels remained low, although treatment C (4 g/dL) showed a slight increase. On day 14, hemoglobin levels in treatment C increased again to 6 g/dL, while treatments D and E showed values of 4.2 g/dL and 4 g/dL, respectively. The positive control (B) remained low at 2.4 g/dL. These results indicate that jamblang leaf extract can help increase hemoglobin levels in infected tilapia, although higher doses do not always produce better results, as seen in treatments D and E.

Table 3. Hemoglobin Levels in Tilapia

Treatment	Hemoglobin (g/dL)			
	Before Infection	After Infection	After H+7	Treatment H+14
A	6,2	6,6	6,2	6
B	6,6	3,8	2,4	2,4
C	7,8	2,6	4	6
D	7,2	2,6	2,8	4,2
E	6,6	2,8	2,8	4

Hematocrit

The results of observations of hematocrit levels in tilapia during the study showed that Aeromonas hydrophila infection affected hematocrit levels in fish. On day 1 post-infection, all treatments showed a significant decrease in hematocrit levels (Table 4), especially in the positive control treatment (B), which dropped drastically to 19%. Treatments with jamblang leaf extract (C, D, and E) also showed a decrease, but treatment C (18.5 ml/1½ L) showed a better response than the other treatments, with a hematocrit level of 8% on day 1. On day 7, the hematocrit level in treatment C increased to 12%, while treatments D and E remained low at 8%. On day 14, treatment C showed a significant recovery with a hematocrit level of 19%, while the positive control (B) remained low at 7%. This indicates that jamblang leaf extract, particularly in treatment C at a dose of 18.5 ml/1.5 L, can help improve hematocrit levels in tilapia infected with Aeromonas hydrophila, indicating that treatment C has the potential to be effective in supporting fish recovery from this bacterial infection.

Table 4. Hematocrit Levels in Tilapia

Treatment	Hematokrit (%)			
	Before Infection	After Infection	After H+7	Treatment H+14
A	29	34	31	30
B	33	19	7	7
C	27	8	12	19
D	28	16	8	8
E	31	8	8	8

Survival Rate

Observations on the survival of tilapia during this study showed that treatment with jamblang leaf extract had a significant effect on the survival of fish infected with Aeromonas hydrophila. The negative control treatment (A) showed the highest survival rate of 73.33% ± 9.42, indicating that healthy fish without bacterial infection could survive well. In contrast, the positive control treatment (B), which involved fish infected with bacteria, showed a very low survival rate (Table 5), namely 28.33% ± 6.38, indicating that Aeromonas hydrophila bacterial infection had a major impact on fish survival. Treatments with jamblang leaf extract (C, D, and E) showed varying results, with treatment C (18.5 ml/1.5 L) showing the highest survival rate among the other jamblang leaf extract treatments, at 78.33% ± 8.38, which was better than treatments D (20.00% ± 5.44) and E (56.67% ± 8.60). These results indicate that jamblang leaf extract can improve the survival rate of fish infected with bacteria, with a dose of 18.5 ml/1.5 L proving to provide the best results in supporting fish survival compared to higher doses.

Table 5. Tilapia Survival Rate

Treatment	Survival Rate (%)
A	73.33 ± 9.42^{c}
B	28.33 ± 6.38^{a}
C	78.33 ± 8.38^{c}
D	20.00 ± 5.44^{a}
E	56.67 ± 8.60^{b}

Water Quality

The water quality parameters measured in this study included temperature, pH, and dissolved oxygen (DO).

Table 6. Water Quality Parameter Data

Treatment	Temperature °C	pH	DO (mg/L)
A (Negative Control)	24-29	6,5-7	6,5-7,5
B (Positive Control)	25-30	6,7-8	7,5-8
C (18,5 ml/1½L)	28-30	7,6-8	7,3-7,8
D (26,2 mL/1½L)	26-29	8,7-8	8,0-8,3
E (33,7 mL/1½L)	27-28	7,6-9,6	7,8-8

DISCUSSION

Clinical Symptoms of Tilapia

Test results on tilapia before infection with Aeromonas hydrophila bacteria showed normal symptoms. However, after infection, tilapia showed striking behavioral changes, such as stress, swimming at the water surface, and gathering around the aeration. In addition, there was damage to the fish's fins, bleeding in the gills, and red spots were found, as well as decreased body balance. This is in line with the findings of Pattipeiluhu et al. (2022), who stated that tilapia infected with Aeromonas hydrophila showed clinical symptoms such as stress, swimming in groups around the aeration, and swimming in a tilted position due to impaired body balance.

Observation of Tilapia Leukocytes

The higher increase in the number of leukocytes in the positive control treatment indicates that Aeromonas hydrophila infection does trigger a significant immune response in

tilapia, in accordance with previous findings showing that an increase in the number of leukocytes indicates that fish are fighting bacterial infections through the phagocytosis process carried out by leukocyte cells (Mariana *et al.,* 2025). Leukocytes function in the fish's body defense system which will react if there is an external disturbance including pathogen infection (Rahmatia *et al.,* 2023). In this study, jamblang leaf extract showed potential as an immunomodulatory agent, which can help reduce the intensity of Aeromonas hydrophila infection. According to Nugraha et al. (2017), the active compounds contained in the plant extract function as antibacterial agents by permanently damaging the bacterial cell wall, which ultimately inhibits growth and causes bacterial death. The stable decrease in the number of leukocytes at the end of the study indicates that jamblang leaf extract can function as a useful additional therapy in the treatment of Aeromonas hydrophila infection in tilapia. The results of the study showed that the administration of jamblang leaf extract plays a role in modulating the immune response of tilapia infected with Aeromonas hydrophila. Treatment with jamblang leaf extract in treatment C (18.5 ml/1.5 L) showed the most optimal results, even though it used a lower dose than the other treatments, showing higher effectiveness in alleviating bacterial infections and reducing the number of leukocytes. The consistent decrease in the number of leukocytes until the end of the study indicates that this dose has a better effect in stabilizing the fish's immune response without causing excessive side effects, as seen in treatment D with a higher dose which showed a greater increase in total leukocytes on the 7th and 14th days. This indicates that a lower dose of jamblang leaf extract can be more effective in regulating the fish's immune system. In line with these findings, Awaludin et al. (2019), revealed that administering too high a dose can cause stress in fish, even leading to death.

Observation of Tilapia Hemoglobin

The results of this study indicate that administration of jamblang leaf extract can suppress Aeromonas hydrophila infection in tilapia, as indicated by increased hemoglobin levels after administration. On the 7th day after infection, hemoglobin levels in all treatments decreased significantly, especially in the positive control (B), which dropped drastically to 2.4 g/dL. Seuk *et al.* (2021) explained that the decrease in hemoglobin levels in fish infected with the bacteria is related to a decrease in the number of red blood cells, caused by red blood cell lysis. This lysis is thought to occur due to the rupture of red blood cells due to bacterial toxins in the blood, known as hemolysis. These toxins damage and destroy hemoglobin.

Decreased hematocrit levels in infected fish. The treatment with jamblang leaf extract, although showing a decrease, still showed higher hemoglobin levels than the positive control, with treatment C showing a greater increase on days 7 and 14, with levels of 4 and 6 g/dL. This indicates that jamblang leaf extract has a positive effect in relieving Aeromonas hydrophila infection, this is thought to be due to the content of active compounds such as flavonoids and tannins, which are known to have antibacterial and anti-inflammatory properties. These results indicate that jamblang leaf extract has a positive effect in relieving Aeromonas hydrophila infection. This effectiveness is thought to be related to the content of active compounds such as flavonoids and tannins, which are known to have antibacterial and anti-inflammatory properties. This is also in line with previous findings by Putri *et al.,* (2021), who stated that phytochemical test results showed that jamblang leaves contain various chemical compounds, including flavonoids, alkaloids, elgasic acid, essential oils, and tannins. Marselyna et al. (2022), stated that flavonoids have the potential as antioxidants and have antibacterial and anti-inflammatory activities. The lower decrease in hemoglobin levels in treatment C indicates that jamblang leaf extract can accelerate recovery by reducing the impact of Aeromonas hydrophila infection in fish.

Hematocrit Observation of Tilapia Fish

The decrease in hematocrit levels in fish infected with Aeromonas hydrophila is caused by red blood cell damage due to infection and the ongoing inflammatory process. Flavonoids and tannins contained in jamblang leaf extract are known to have anti-inflammatory and antibacterial effects that can help reduce inflammation and support the recovery of fish's hematological condition (Yuliani *et al.,* 2024). This is in line with research by Renopi *et al.,* (2021), which reported that jamblang leaf extract is effective in increasing fish's immunity to bacteria and helps accelerate recovery from infection by reducing red blood cell damage. Therefore, treatment C can be considered a promising solution in the treatment of Aeromonas hydrophila infection in tilapia, particularly in improving hematocrit status and improving their health.

Survival Rate

Jamblang leaf extract is known to contain bioactive compounds such as flavonoids and tannins, which have antibacterial and immunomodulatory activities that can help fish fight Aeromonas hydrophila bacterial infections. Several previous studies have shown that flavonoids have the ability to improve the fish's immune system and reduce the adverse effects of bacterial infections (Pasaribu *et al.,* (2015), while tannins have antimicrobial properties that can inhibit bacterial growth by damaging bacterial cells and shrinking cell walls, thereby disrupting their permeability, resulting in disruption of the bacterial protoplasm, then their growth will be inhibited or even die (Wahab *et al.,* 2020). The results of this study indicate that a lower dose of jamblang leaf extract (18.5 mL/1.5 L) is proven to be more effective in increasing fish survival compared to higher doses. According to Monica *et al.* (2020), excessive doses will have adverse effects on fish such as stress and even death. Thus, treatment C can be considered an effective choice in supporting the survival of fish infected with bacteria.

Water Quality

Observations of water quality during the study showed that the water quality conditions in all treatments were within a range that supported the survival of tilapia. Water temperature in all treatments was quite stable, with a temperature range between 24-30°C, which corresponds to the optimal temperature range for tilapia growth. Water pH showed greater variation, with treatments B (positive control) and D (26.25 mL/1.5 L jamblang leaf extract treatment) showing higher pH fluctuations (6.7-8 and 8.7-8, respectively), while treatments A (negative control) and E (33.75 mL/1.5 L jamblang leaf extract treatment) showed a more stable pH range. Similarly, dissolved oxygen (DO) levels were sufficient to support fish survival, with DO levels ranging between 6.5-8.3 mg/L in all treatments. Overall, water quality during the study showed conditions that supported fish health and there were no indications of significant changes that could disrupt fish growth or survival. Santikawati et al. (2023), stated that the water quality that can be tolerated by tilapia is a temperature between 25-32oC, water pH between 6-8, good DO levels in tilapia cultivation range from 6.1-14.5 mg/L.

CONCLUSION

The use of jamblang leaf extract (Syzygium cumini) is effective in treating tilapia (*Oreochromis niloticus*) infected with Aeromonas hydrophilla bacteria with an optimal dose in treatment C of 18.5 mL/1½L with a survival rate of 78%.

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