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EFFECT OF LOCAL PROBIOTIC-ENRICHED COMMERCIAL FEED ON GROWTH PERFORMANCE AND SURVIVAL RATE OF SIAMESE PANGASIUS (*Pangasianodon hypophthalmus*) FRY

Pengaruh Pakan Komersial yang Diperkaya Probiotik Lokal Terhadap Pertumbuhan dan Kelangsungan Hidup Benih Ikan Jambal Siam (*Pangasianodon hypophthalmus*)

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ABSTRACT

The application of local probiotics in commercial feed not only contributes to aquaculture efficiency but also opens up opportunities for utilizing inexpensive and easily accessible local materials as alternative environmentally friendly feed additives. Biologically, probiotics work by enhancing the balance of intestinal microflora, improving nutrient absorption, and strengthening the fish's immune system against environmental stress and pathogenic infections. Through this mechanism, the inclusion of local probiotics in feed can be an effective approach to naturally and sustainably enhance the physiological performance of fish fry. This study aimed to determine the effect of adding locally-sourced probiotics to commercial feed on the growth and survival of Siamese Pangasius (Pangasianodon hypophthalmus) fry. The probiotics were formulated using local ingredients such as banana fronds, turmeric, fine rice bran, yeast, molasses, and Yakult, and were applied to commercial feed at various concentrations. The research was conducted experimentally using a Completely Randomized Design (CRD) with four treatments and three replications: P0 (control, no probiotics), P1 (10 mL probiotics/kg feed), P2 (20 mL/kg feed), and P3 (30 mL/kg feed). Observed parameters included growth, feed conversion ratio (FCR), and survival rate (SR). The results showed that treatment P2 yielded the best outcomes, with the highest growth rate, lowest FCR, and significantly higher survival rate compared to the control. In conclusion, enrichment of commercial feed with local probiotics at a dosage of 20 mL/kg significantly improved the growth performance and survival of Siamese Pangasius fry ($p<0.05$).

Keywords: Commercial Feed, Growth, Local Probiotics, Siamese Pangasius, Survival

ABSTRAK

Penerapan probiotik lokal dalam pakan komersial tidak hanya berkontribusi terhadap efisiensi budidaya, tetapi juga membuka peluang pemanfaatan bahan-bahan lokal yang murah dan mudah didapat sebagai sumber alternatif aditif pakan ramah lingkungan. Secara biologis,

probiotik bekerja dengan meningkatkan keseimbangan mikroflora usus, memperbaiki penyerapan nutrisi, dan memperkuat sistem imun ikan terhadap stres lingkungan dan serangan patogen. Dengan mekanisme ini, pemberian probiotik lokal pada pakan dapat menjadi pendekatan yang efektif dalam meningkatkan performa fisiologis benih ikan secara alami dan berkelanjutan. Penelitian ini bertujuan untuk mengetahui pengaruh penambahan probiotik berbahan baku lokal pada pakan komersial terhadap pertumbuhan dan kelangsungan hidup benih ikan Jambal Siam (*Pangasianodon hypophthalmus*). Probiotik diformulasikan dari bahan lokal seperti pelepah pisang, kunyit, dedak halus, ragi, molase dan yakult, kemudian diaplikasikan pada pakan komersial dengan konsentrasi tertentu. Penelitian dilakukan secara eksperimental menggunakan Rancangan Acak Lengkap (RAL) dengan empat perlakuan dan tiga ulangan, yaitu: P0 (kontrol, tanpa probiotik), P1 (probiotik 10 mL/kg pakan), P2 (20 mL/kg pakan), dan P3 (30 mL/kg pakan). Parameter yang diamati meliputi pertumbuhan, rasio konversi pakan (FCR), dan kelulushidupan (SR). Hasil penelitian menunjukkan bahwa perlakuan P2 memberikan hasil terbaik dengan pertumbuhan tertinggi, FCR terendah, dan tingkat kelangsungan hidup signifikan lebih tinggi dibanding kontrol. Kesimpulannya, pengayaan pakan komersial dengan probiotik lokal pada dosis 10 mL/kg pakan mampu meningkatkan performa pertumbuhan dan survival benih ikan Jambal Siam secara signifikan ($p<0,05$).

Kata Kunci: Jambal Siam, Probiotik Lokal, Pakan Komersial, Pertumbuhan, Kelangsungan Hidup

INTRODUCTION

Jambal Siamese fish (*Pangasianodon hypophthalmus*) is one of the freshwater fish commodities that has high economic value and increasing demand in both domestic and international markets (Anjar, 2022). The advantages of this fish lie in its rapid growth rate, tolerance to a relatively wide environment, and efficiency in feed conversion (Pramudiyas, 2014). However, in intensive cultivation practices, the seed maintenance phase is a major challenge because it is susceptible to environmental stress, disease infection, and intestinal microflora imbalance which has an impact on decreasing growth performance and survival.

Commercial feed plays an important role as the main source of nutrition in the cultivation system, but its effectiveness in supporting the physiological performance of fish can be increased by adding functional additives, one of which is probiotics (Telaumbanua et al., 2023). Probiotics are live microorganisms that, when given in sufficient quantities, can provide health benefits to the host, including farmed fish (Setiaji et al., 2014). Several studies have shown that probiotics can increase the efficiency of nutrient absorption, improve the balance of intestinal microbiota, and strengthen the fish's immune system against pathogens and less than optimal environmental conditions.

Innovation in local probiotic formulations from ingredients such as banana stems, turmeric, fine bran, yeast, molasses, and fermented drinks (yakult) is a strategic approach to producing natural feed supplements that are environmentally friendly, inexpensive, and easy to apply by small-scale farmers (Jayadi, 2024). In addition to providing added value from an economic perspective, the use of local resources in making probiotics also supports the development of a sustainable cultivation system based on regional potential. However, the effectiveness of these local probiotics still requires scientific validation through experimental research.

This study aims to evaluate the effect of providing commercial feed enriched with local probiotics on the growth rate and survival rate of Jambal Siam fish seeds. Through this approach, it is hoped that scientific information can be obtained that can be used as a basis for the formulation of functional feed based on local probiotics, while strengthening the strategy

for efficient, healthy, and environmentally friendly freshwater fish cultivation.

In addition, the approach of using local probiotics in feed is also part of the strategy of diversifying aquaculture technology that is adaptive to climate change and environmental pressures. Amid the increasing issues of antibiotic resistance and degradation of the quality of the aquatic environment, local probiotics offer an alternative solution that is preventive and sustainable. By utilizing microorganisms that have naturally adapted to the local environment, the chances of successful colonization in the digestive tract of fish will be greater, so that the positive effects on fish physiology can be more optimal. Therefore, the integration of local probiotics into the cultivation system is expected to increase the resilience of the national aquaculture system in the long term.

METHODS

Time and Place

This research was conducted for 40 days, starting from January to March 2025. The entire series of research activities were carried out at the Fish Reproduction Laboratory, Matauli Fisheries and Marine College (STPK), located in Central Tapanuli Regency, North Sumatra Province.

Tools and Materials

This research used various tools to support maintenance and observation activities, including 12 units of 60×40×40 cm glass aquariums, aerators along with hoses and aeration stones for oxygen supply, digital scales for weighing fish feed and biomass, water thermometers for measuring temperature, DO meters for measuring dissolved oxygen levels, and digital pH meters. In addition, buckets, dippers, siphon hoses, and scoops were also used for daily operational needs during maintenance.

The materials used in this study included Jambal Siamese fish (*Pangasianodon hypophthalmus*) seeds with an average length and initial weight of 6-7 cm and 2-3 grams per fish, commercial floating pellet feed with a protein content of ±30%, and fresh water from PAM wells that had been sedimented for 24 hours. The local probiotics used were formulated from natural ingredients such as banana stems, fine bran, bread yeast, molasses, turmeric, and fermented drinks (yakult). The probiotics were fermented for 7 days before being applied to the feed with different treatment doses according to the research design.

Research Methods

This study used an experimental method with a Completely Randomized Design (CRD) consisting of four treatments and three replications, to evaluate the effect of administering local probiotics to commercial feed on the growth and survival of Jambal Siamese fish (*Pangasianodon hypophthalmus*) seeds. The treatments consisted of P0 (control, without probiotics), P1 (probiotics 10 mL/kg feed), P2 (probiotics 20 mL/kg feed), and P3 (probiotics 30 mL/kg feed) (Riswan et al., 2014). Each experimental unit used an aquarium containing 10 fish seeds with uniform initial sizes (length 6–7 cm and weight 2–3 grams/fish). Maintenance was carried out for 40 days with an adaptation feeding system, namely until the fish showed signs of being full, and was carried out three times a day (at 08.00, 13.00, and 18.00 WIB). This approach aims to increase the efficiency of feed utilization and reduce organic waste in the maintenance media. The local probiotics used were formulated from a mixture of natural ingredients such as banana stems, turmeric, fine bran, bread yeast, molasses, and yakult, which were fermented for seven days in a closed container. The application of probiotics to the feed was carried out using an even spraying technique, then aired for ±30 minutes until the feed was dry before being given to the fish.

The parameters observed included absolute weight growth, absolute length growth, Feed Conversion Ratio (FCR), and survival (SR). Growth data were obtained by measuring the weight and length of the fish every seven days, while the FCR was calculated based on the comparison between the amount of feed given and the total weight gain of the fish during maintenance. Survival was calculated based on the percentage of the number of fish that survived until the end of the study. All data were analyzed statistically using analysis of variance (ANOVA) at a significance level of 5% ($\alpha = 0.05$), and if there was a significant difference between treatments, it was continued with the Duncan's Multiple Range Test (DMRT) to identify the best treatment in improving fish farming performance.

Research Stages

This research was conducted through several systematic stages, starting from material preparation to data analysis. The first stage is the preparation and procurement of materials, where Jambal Siamese fish (*Pangasianodon hypophthalmus*) seeds with a uniform size of 6-7 cm and 2-3 grams per fish, commercial floating pellet feed with a protein content of ±30%, and materials for making local probiotics such as banana stems, turmeric, fine bran, bread yeast, molasses, and yakult were obtained from local sources. After the materials were available, the formulation and production stage of local probiotics was carried out, where the materials were mixed and fermented for 7 days to produce probiotics that were ready to use. The fermentation process was carried out in a place with controlled temperature and humidity to ensure the success of beneficial microorganisms.

After the probiotics were finished being produced, the next stage was fish maintenance, which was carried out in an aquarium measuring 60×40×40 cm with 10 fish per aquarium. Feed enriched with local probiotics was given to the fish according to the dosage determined for each treatment (P0, P1, P2, P3). Feeding was done three times a day in an adaptation manner, that is, feed was given gradually until the fish showed signs of being full. Maintenance lasted for 40 days with water changes every seven days and regular monitoring of water quality. Observations were made every 7 days to measure fish growth parameters, such as fish weight and length, and to calculate the feed conversion ratio (FCR) and survival rate (SR) of the fish.

In the final stage, data analysis was carried out from the observations. Growth data, FCR, and SR were analyzed statistically using the analysis of variance (ANOVA) test to test for differences between treatments. If there was a significant difference, it was continued with the Duncan test to determine the treatment that gave the best results. The results of this analysis will be used to determine the effect of local probiotics on the growth and survival of Jambal Siam fish seeds which were the object of the study.

Research Parameters

In this study, several main parameters observed include:

1. Growth

a. Absolute length

Absolute length growth can be calculated using the formula (Rumondang et al., 2024) as follows:

$$Lm = Lt - Lo$$

Where:

Lm : Absolute length growth (cm)
Lt : Final length (cm)
Lo : Initial length (cm)

b. Absolute weight

Absolute weight growth can be calculated using the formula (Rumondang et al., 2024).

$$Wm = Wt - Wo$$

Where:
Wm : Absolute Weight Growth (gr)
Wt : Final Weight (gr)
Wo : Initial Weight (gr)

2. Feed Conversion Ratio (FCR)

Feed conversion ratio (FCR) is an indicator of feed utilization efficiency in fish farming activities, which is expressed as a comparison between the total weight of feed given and the total fish biomass produced during a certain maintenance period. The FCR value is calculated using the formula (Harefa et al., 2024):

$$FCR = \frac{\text{Total feed consumed (g)}}{\text{Fish biomass obtained (g)}}$$

The lower the FCR value, the more efficient the use of feed, which means that less feed is needed to produce an increase in fish biomass weight.

3. Survival Rate

The survival rate (SR) is one of the important parameters in fish farming research which is used to measure the percentage of individual fish that survive during the maintenance period. This parameter reflects the level of success of fish adaptation to environmental conditions and treatments given, such as feed quality, nutrient content, and the presence of additives such as probiotics calculated using the formula (Rumondang et al., 2023).

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

Where:
SR : Percentage of fish survival (%)
Nt : Number of fish alive at the end of maintenance (fish)
No : Number of fish alive at the beginning of maintenance (fish)

4. Water Quality

The water quality parameters observed in this study include temperature, dissolved oxygen, and pH. Water quality measurements were carried out every 7 days. Fish growth was measured based on changes in fish weight and length which were carried out every 7 days. Fish weight measurements were carried out using a digital scale with a high level of precision, while length measurements were carried out using a digital ruler. In addition, to determine the efficiency of feeding, the feed conversion ratio (FCR) was calculated, which was obtained by comparing the amount of feed given with the total weight of the fish obtained during the study period. The FCR parameter is used to evaluate the efficiency of fish in converting feed into body biomass.

Fish survival (SR) was calculated by counting the number of fish that were still alive at the end of the study and compared to the number of fish placed in each aquarium at the beginning of the study. Survival was measured as a percentage, which reflects the level of health and resistance of fish to environmental conditions and the success of feeding enriched with probiotics. All of these parameters were used to evaluate the effect of local probiotics on the growth and survival performance of Jambal Siamese fish (*Pangasianodon hypophthalmus*) seeds, as well as to determine the optimal dose of probiotics in increasing fish farming efficiency.

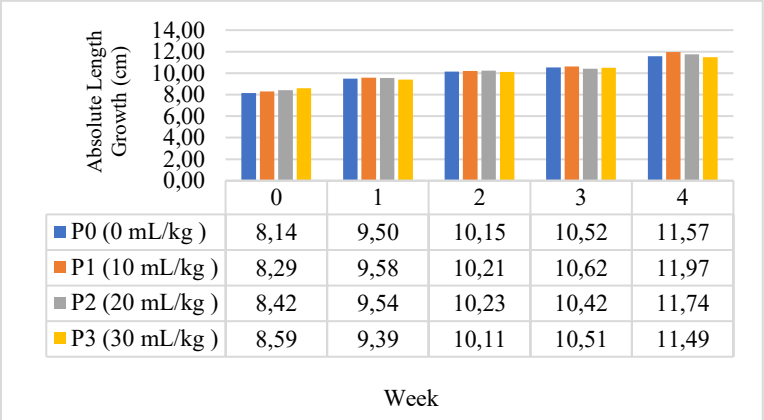
The water quality measured includes temperature, pH, and dissolved oxygen (DO) levels. Water temperature was measured using a digital thermometer, to ensure optimal conditions for fish growth. Water pH was measured using a pH meter to ensure the ideal pH range for cultivating Jambal Siam fish. Dissolved oxygen levels were measured using a DO meter to ensure that oxygen levels in the water were sufficient for fish respiration needs.

Data Analysis

The data obtained during the study were analyzed quantitatively using SPSS (Statistical Package for the Social Sciences) statistical software to evaluate the effect of local probiotics on growth performance, feed conversion ratio (FCR), and survival (SR) of Jambal Siam fish (*Pangasianodon hypophthalmus*) seeds. One-way analysis of variance (ANOVA) at a significance level of 5% ($\alpha = 0.05$) was used to test differences between treatments, and if significant differences were found, Duncan's test was continued to identify the best treatment. In addition, descriptive analysis was carried out to calculate the mean value and standard deviation of the growth parameters of fish weight and length, FCR, and SR. Water quality parameters such as temperature, pH, and dissolved oxygen levels were also analyzed to ensure that environmental conditions during the study were within the optimal range to support fish growth. This analytical approach aims to provide a strong scientific basis for assessing the effectiveness of using local probiotics in fish farming systems.

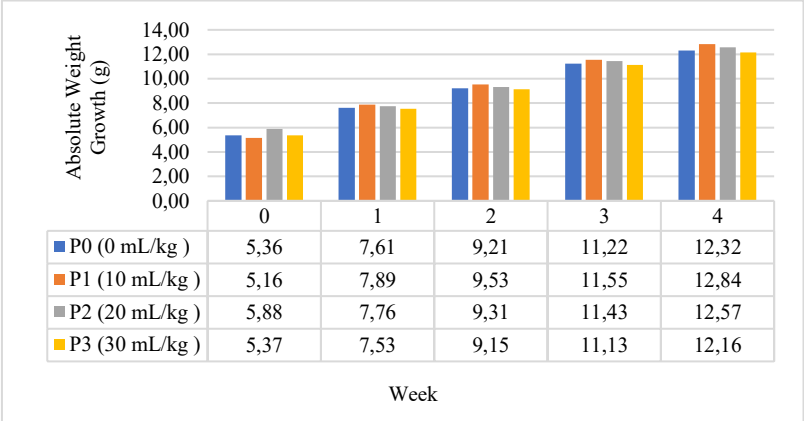
RESULTS

From the results of the research conducted, the absolute growth in length and weight of Jambal Siamese fish (*Pangasianodon hypophthalmus*) seeds was obtained as follows:



	0	1	2	3	4
P0 (0 mL/kg)	8,14	9,50	10,15	10,52	11,57
P1 (10 mL/kg)	8,29	9,58	10,21	10,62	11,97
P2 (20 mL/kg)	8,42	9,54	10,23	10,42	11,74
P3 (30 mL/kg)	8,59	9,39	10,11	10,51	11,49

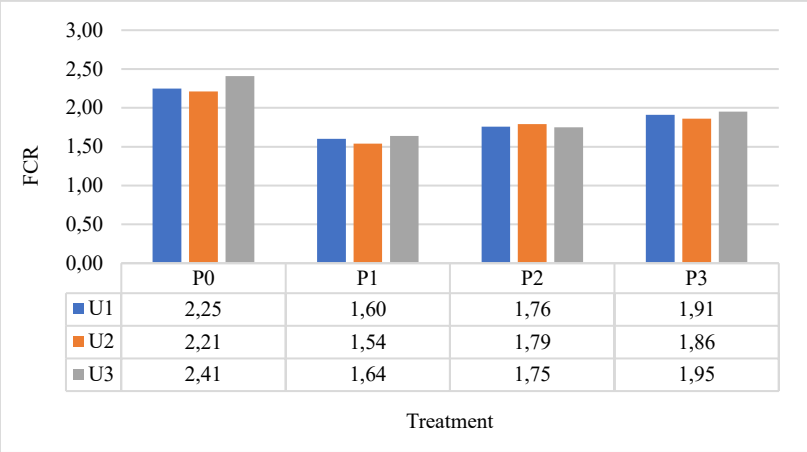
Figure 1. Absolute Length Growth of Jambal Siamese Fish Seeds



	0	1	2	3	4
P0 (0 mL/kg)	5,36	7,61	9,21	11,22	12,32
P1 (10 mL/kg)	5,16	7,89	9,53	11,55	12,84
P2 (20 mL/kg)	5,88	7,76	9,31	11,43	12,57
P3 (30 mL/kg)	5,37	7,53	9,15	11,13	12,16

Figure 2. Absolute Weight Growth of Jambal Siamese Fish Seeds

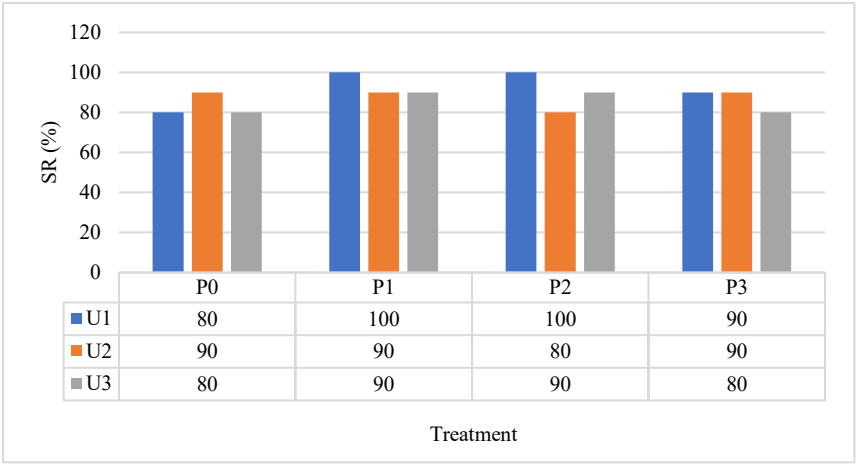
From the results of the research conducted, the feed conversion ratio (FCR) of Jambal Siamese fish (*Pangasianodon hypophthalmus*) seeds was obtained as follows:



	P0	P1	P2	P3
U1	2,25	1,60	1,76	1,91
U2	2,21	1,54	1,79	1,86
U3	2,41	1,64	1,75	1,95

Figure 3. Feed Conversion Ratio of Jambal Siamese Fish Seeds

From the results of the research conducted, the survival rate (SR) of Jambal Siamese fish (*Pangasianodon hypophthalmus*) seeds was obtained as follows:



	P0	P1	P2	P3
U1	80	100	100	90
U2	90	90	80	90
U3	80	90	90	80

Figure 4. Survival Rate (SR) of Jambal Siamese Fish Seeds

From the results of the research conducted, the results of the water quality of Jambal Siamese fish (*Pangasianodon hypophthalmus*) seed maintenance were obtained as follows:

Table 1. Results of Water Quality Measurements for Jambal Fish Seed Maintenance

Treatment	Water Quality Parameters		
	Temperature (˚C)	pH	DO (mg/l)
P0	29.5 – 30.4	6.5 – 7.0	5.9 – 6.3
P1	28.3 – 30.5	6.7 – 7.0	6.2 – 6.8
P2	27.8 – 30.5	6.5 – 7.0	5.7 – 6.3
P3	26.7 – 29.4	6.4 – 6.6	5.3 – 6.6

DISCUSSION

Absolute Length and Weight Growth

Absolute length and weight growth are the main indicators in assessing fish growth performance during the cultivation period. The results of the study showed that treatment with

the addition of local probiotics had a positive effect on increasing the absolute length and weight of Jambal Siamese fish (*Pangasianodon hypophthalmus*) fry. This is due to the ability of probiotics to improve digestive tract function by increasing the population of beneficial microorganisms, so that nutrient absorption becomes more efficient. With the availability of sufficient and easily digestible nutrients, the growth process of fish body tissue can take place optimally (Prihanto et al., 2021).

A probiotic dose of 10 mL/kg feed (P1) showed the best results in increasing the absolute length and weight of Jambal Siamese fish (*Pangasianodon hypophthalmus*) fry, with values that were significantly higher than the control treatment and other treatments. This dose is considered optimal because it is able to create a balance of intestinal microbiota that supports the digestion process without triggering excessive competition between microorganisms. In addition, probiotics are known to play a role in producing important digestive enzymes such as protease, amylase, and lipase which function in breaking down feed components into forms that are more easily absorbed by the body. This mechanism allows for more efficient utilization of nutrients to support maximum fish growth, as also reported by Setiawati et al., (2013).

The increase in growth in the treatment group can also be associated with increased appetite and metabolic activity of the fish due to stimulation by probiotics. In addition, a healthier internal environment of the fish as a result of the balance of intestinal microflora contributes to physiological efficiency in absorbing and using energy from feed. Therefore, the provision of local probiotics in commercial feed can be considered an effective and sustainable strategy in improving the growth performance of farmed fish, especially Jambal Siam, both in terms of length and body weight.

Feed Conversion Ratio (FCR)

The Feed Conversion Ratio (FCR) is one of the main indicators in assessing the efficiency of feed utilization in fish farming activities. A low FCR value indicates the ability of fish to convert feed into body biomass efficiently. The results of this study indicate that treatment with the addition of local probiotics resulted in a lower FCR value compared to the control treatment, especially at a dose of 10 mL/kg feed (P1), which reflects the highest feed utilization efficiency. This finding indicates that local probiotics play an important role in increasing digestive efficiency by increasing digestive microbial activity and more optimal nutrient absorption, as supported by the results of the study by Simamora et al., (2021).

Probiotics work by producing digestive enzymes such as amylase, protease, and lipase which help break down feed molecules into simpler forms that are easily absorbed by the fish's body (Umami, 2017). In addition, probiotics also improve the balance of healthy intestinal microbiota, so that the metabolism and nutrient absorption processes take place more optimally. This efficiency reduces the amount of feed needed to produce weight gain, thus having a direct impact on reducing the FCR value.

A low FCR value not only indicates the success of the treatment in supporting fish growth, but also has an impact on the economic efficiency and sustainability of the cultivation system. Providing local probiotics can be an effective strategy in reducing feed costs, which are the largest cost component in cultivation. Thus, enrichment of commercial feeds using locally sourced probiotics can significantly increase productivity while supporting environmentally friendly aquaculture practices.

Survival Rate (SR)

Survival Rate (SR) is a crucial parameter in assessing the success of fish farming, because it reflects the ability of fish to survive in various environmental conditions and treatments given. The results of this study indicate that the addition of local probiotics to commercial feed significantly increased the SR of Jambal Siamese fish (*Pangasianodon hypophthalmus*) seeds,

especially at a dose of 10 mL/kg feed (P1). This finding indicates that probiotics have a positive effect on fish survival during the maintenance period, which is in line with the findings expressed by Sihombing et al., (2024).

The increase in SR is thought to be closely related to the role of probiotics in strengthening the fish's immune system by improving the balance of digestive tract microflora and the production of natural antibacterial compounds (Agustini et al., 2018). Probiotic microorganisms also play a role in reducing oxidative stress and improving internal physiological conditions, which makes fish more resistant to environmental fluctuations and pathogen attacks (Suryaningtyas, 2022). With a stable internal environment and a stronger immune system, fish have a higher chance of survival throughout the maintenance period.

Furthermore, the use of local probiotics as feed additives supports the concept of sustainable cultivation because it can increase fish resistance without relying on synthetic antibiotics. This approach is not only safe for fish health and the environment, but also economical because it utilizes easily available local raw materials. Therefore, increasing SR through feed enrichment with local probiotics is a relevant innovation in the development of an environmentally friendly and efficient aquaculture system.

Water Quality

Water quality is one of the key factors that determines the success of fish farming activities, because it affects various physiological aspects, such as respiration, metabolism, growth, and the immune system of fish. Parameters such as temperature, pH, dissolved oxygen (DO), and ammonia levels must be maintained within the optimal range so as not to cause stress that can reduce fish performance (Ahmad et al., 2024). In this study, the measurement results showed that all water quality parameters during the maintenance period were still within the appropriate range for the growth and survival of Jambal Siamese fish (*Pangasianodon hypophthalmus*) seeds (Supriyan et al., 2020).

The provision of local probiotics through feed not only has an impact on fish physiology, but also indirectly affects the quality of the maintenance media. Microorganisms in probiotics play an active role in decomposing leftover feed and organic waste at the bottom of the pond, as well as suppressing the growth of pathogenic microorganisms. This activity helps maintain stable water quality, especially in reducing ammonia levels which are toxic and often cause stress and death in fish.

These results indicate that local probiotics not only function as feed additives to increase growth and survival, but also as biological agents that support the management of the cultivation environment. By maintaining stable water quality, the use of local probiotics has the potential to extend the maintenance cycle, reduce mortality, and support environmentally friendly and sustainable aquaculture practices. Therefore, feed enrichment with local probiotics can be considered as an integrated approach to increasing the productivity and efficiency of freshwater fish cultivation systems.

CONCLUSION

Based on the results of the study, it was concluded that the addition of local probiotics to commercial feed had a significant effect on the growth and survival of Jambal Siamese fish (*Pangasianodon hypophthalmus*) seeds. Treatment with a dose of 10 mL/kg feed (P1) showed the best results with the highest growth rate, the lowest feed conversion ratio (FCR), and the most optimal survival rate compared to other treatments. Local probiotics formulated from ingredients such as banana stems, turmeric, fine bran, yeast, molasses, and yakult have proven effective as natural feed additives that can increase feed efficiency and physiological performance of fish seeds sustainably. These findings recommend the use of local probiotics as a potential strategy in environmentally friendly and economical freshwater fish farming.

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