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THE EFFECT OF PERIODIC FATIGUING ON SEED GROWTH AND SURVIVAL JURUNG FISH (*Tor soro*)

Pengaruh Pemuasaan Secara Periodik Terhadap Pertumbuhan dan Kelangsungan Hidup Pada Benih Ikan Jurung (*Tor soro*)

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ABSTRACT

Jurung fish is one of the endemic freshwater fish in the Central Tapanuli river which is often called Batak fish (*Neolossochilus thienemanni*). Periodic fasting can increase the growth rate of fish to the same level or even higher when compared to fish that are not fasted. This research aims to determine the repetition of the feeding cycle followed by constant feeding on feed consumption and feed performance, as well as determine the level of feed requirements for Jurung (*Tor soro*) fry after a period of 2-3 days. The information obtained includes absolute weight, absolute length and viability (SR) as well as water quality. This research was carried out at the Production Laboratory of the Matauli College of Fisheries and Maritime Affairs in July-September 2024. The method used was an experimental method with an experimental design using a Completely Randomized Design (CRD) with 4 treatments and 3 replications. The fish tested were Jurung fish fry measuring 3-5 cm. with an average duration of 1.60 ± 0.00 cm and an average weight of 2.16 ± 0.23 g. Feeding is given at 08.00-08.10, 12.00-12.10, and 16.00-16.10. The fish are kept at a stocking density of 15 fish. The results showed that the feeding approach had a large influence ($P<0.05$) on absolute length and absolute weight, but had no significant effect ($P>0.05$) on survival. Treatment P1 gave absolute weight results of 2.16 ± 0.23c, absolute length of 1.60 ± 0.00c and survival of up to 93.33% which was the highest of the treatments carried out.

Key words: Absolute Weight, Shark Fish, Lifetime, Absolute Length

ABSTRAK

Ikan jurung merupakan salah satu ikan endemik air tawar di sungai Tapanuli Tengah yang sering disebut dengan ikan batak (*Neolossochilus thienemanni*). Pemuasaan secara periodik dapat meningkatkan kecepatan pertumbuhan ikan yang setara bahkan lebih tinggi jika dibandingkan dengan ikan yang tidak dipuasakan. Penelitian ini bertujuan untuk mengetahui pengulangan siklus pemberian pakan yang diikuti dengan pemberian pakan tetap terhadap

konsumsi pakan dan performa pakan, serta mengetahui tingkat kebutuhan pakan benih ikan jurung (*Tor soro*) setelah periode 2-3 hari. Informasi yang diperoleh meliputi bobot mutlak, panjang mutlak dan kelangsungan hidup (SR) serta kualitas air. Penelitian ini dilaksanakan di Laboratorium Produksi Sekolah Tinggi Perikanan dan Kelautan Matauli pada bulan Juli-September 2024. Metode yang digunakan yaitu metode eksperimental dengan rancangan percobaan menggunakan Rancangan Acak Lengkap (RAL) dengan 4 perlakuan dan 3 ulangan. Ikan yang diuji adalah benih ikan jurung berukuran 3-5 cm. dengan durasi rata-rata 1,60±0,00 cm dan rata-rata berat 2,16±0,23g. Pemberian pakan diberikan pada pukul 08.00-08.10, 12.00-12.10, dan pukul 16.00-16.10. Ikan tersebut dipelihara dengan padat tebar 15 ekor. Hasil penelitian menunjukkan bahwa pendekatan pemberian pakan memberikan pengaruh yang besar (P<0,05) terhadap panjang mutlak, bobot mutlak, namun tidak berpengaruh nyata (P>0,05) terhadap kelangsungan hidup. Perlakuan P1 memberikan hasil bobot mutlak sebesar 2.16 ± 0.23c, panjang mutlak 1.60 ± 0.00c dan kelangsungan hidup hingga 93.33 % yang merupakan perlakuan tertinggi dari perlakuan yang dilakukan

Kata Kunci: Bobot Mutlak, Ikan Jurung, Kelulushidupan, Panjang Mutlak

INTRODUCTION

Jurung fish, also known as batak fish (*Neolossochilus thienemanni*), is an endemic freshwater fish from the river in Central Tapanuli. This fish is classified as rare and is included in the category of Red List Status (List, 2004). With a high economic value, which is around Rp400,000 to Rp500,000 per kilogram (Rumondang et al., 2023; Subagja et al., 2017), jurung fish has great potential to be cultivated.

In North Sumatra, especially in Central Tapanuli, jurung fish has a sacred value in the culture of the Batak people. This fish is often served in various traditional events, such as the birth of children and weddings (Rumondang et al., 2023). In addition, jurung fish is rich in protein but low in fat. The albumin content is equivalent to snakehead fish, with a Fish Serum Albumin (FSA) value of 102.67 ± 2.99 mg/g, compared to snakehead fish which has an FSA of 107.28 mg/g (Susilowati, 2015). This nutrient content makes jurung fish meat beneficial for body health. However, the high fishing activity of batak fish (*Neolissochilus thienemanni*) in nature has resulted in difficulty in finding jurung fish broodstock with optimal gonad maturity and good egg quality.

Feed is one of the most important factors in determining fish growth. Fish growth will increase if the nutritional needs are appropriate (Sanjayasari & Kasprijo, 2010). Quality feed is related to the nutrient content and digestibility level of the feed. One of the nutrients in feed is found in animal and vegetable feed, feed sourced from animals in the form of black soldier fly carcass flour which also has a fairly good digestibility value if given to fish (Huda et al., 2020). Digestibility is food substances from feed consumption that are not excreted into feces, but food substances that can be used by the fish's body. The high or low digestibility of feed ingredients means how much food ingredients contain food substances in a form that can be digested into the digestive tract. For this reason, it is necessary to feed periodically to increase appetite.

Periodic mastering can increase the growth rate of fish to the same or even higher than fish that are fed continuously (Rachmawati et al., 2010). This occurs because of the compensatory growth mechanism, which is faster growth than usual after the fish pass the feed restriction period and are fed again as needed. During this process, fasted fish experience an increase in temporary feed consumption (hyperphagia) when they are fed again. According to Chatakondi & Yant, (2001), one to three days of mastering followed by re-feeding causes the fish to experience hyperphagia for two to three days, before the appetite returns to normal. This

increase in feed consumption is accompanied by an increase in the absolute growth rate, so that the efficiency of feed use becomes more optimal.

Studies on feed efficiency improvement that have been carried out generally focus on the exploration of feed nutrition content and fish feeding rate (Copeland et al., 2002; Mihelakakis et al., 2002). It has also been reported by Gaylord & Gatlin, (2000); Chatakondi & Yant, (2001); Wu et al., (2001) that the efficiency of feed use increased in fish that experienced compensatory growth, namely rapid body weight gain when the fish were fed again after fasting. This study explained the consumption and feed efficiency in jurung fish (*T. soro*) which were fasted for 2 and 3 days followed by feeding for a certain period. Studies on feed consumption and efficiency are important for their application in feed management in fish farming systems.

METHODS

Place and Time

This research was carried out at the Production Laboratory in July-September 2024, Central Tapanuli Regency, North Sumatra Province.

Research Methods

Research on this mastery is in accordance with references by Chatakondi & Yant, (2001); Wu et al., (2001) that the efficiency of feed use increased in fish that experienced compensatory growth, namely rapid body weight gain when the fish were fed again after fasting. This study uses a complete random design (RAL). In its implementation, 4 Treatments and 3 Tests are as follows:

Po : Fish never fasted (control).
P1 : The fish are fed 1 day, then the fish are fasted for 2 days.
P2 : The fish are fed 1 day, then the fish are fasted for 3 days.
P3 : The fish are fed 1 day, then the fish are fasted for 2 and 3 days (alternately)

Tools and Materials

The tools and materials used can be seen in table 1 and table 2.

Table 1. Tools used

No	Tool Name	Information	Specifications
1	Aquarium	As a research forum	100 x 50 x 50 cm
2	Aerators	As an oxygen supplier	5 mm
3	Filter	As a water filter	30 x 40 cm^2
4	Plastic hose	As a phone	6 cm^2
5	Ruler and Millimeter Paper	As an observation of the growth of the length of the test fish	-
6	Digital scales	As a tool for weighing fish feed and weight	10,5 x 57 x 2 cm^3
7	Thermometer	As a tool to measure air temperature	-
8	DO Meter	To measure oxygen	-
9	pH Meter	To measure pH	-
10	Camera	For activity documentation	-
11	Stationery	To record research data	-

Table 2. Materials used

No	Material name	Information
1	Jurong fish fry	As an object of research
2	PF 1000 Pellet	As fish feed
3	Fresh water	As a medium of life for fish

Procedure

Container Preparation and Seed Maintenance

The container used in this study is an aquarium measuring 100 x 50 x 50 cm with a total of 12 units. Before use, the test container is cleaned first by removing dirt in the form of moss in the aquarium using a sponge, then the aquarium is watered with water until it is clean. After that, the water in the aquarium is expelled until the feces are wasted, then the aquarium is filled with clean water with a height of 40 cm. Furthermore, the installation of aerators, checking temperature, pH, DO and giving treatment codes in the research container.

Selection and Seeding

The jurung fish fry used measured 3-5 cm with a weight of 2.16 grams as many as 180 fish with a dense stocking of 15 fish/aquarium or 1 fish/4L (Lubis et al., 2019). Fish fry came from the P2MKP/UPR Amphibi Padang Lancat Sisoma Center, South Tapanuli Regency, North Sumatra. Seed selection is carried out in the afternoon, the seeds selected are seeds that are free from disease and not deformed. Before being put into the aquarium, acclimatization is carried out for 15 minutes to adjust the temperature in the environment so that the fish do not experience stress.

Feed Preparation

The feed used in this study is PF 1000, which is obtained from a feed factory with a nutritional composition in the form of protein 39–41%, fat 5%, fiber 6%, ash 16%, and moisture content 10%. The feed is weighed using a digital scale as much as 5% of the fish's body weight. Furthermore, feed is given to each aquarium at three times of the day, namely in the morning at 08.00–08.10 WIB, during the day at 12.00–12.10 WIB, and in the afternoon at 17.00–17.10 WIB.

Fish conservation

Feeding the test fish was carried out three times a day, namely at 08.00 WIB, 12.00 WIB, and 17.00 WIB, with a total feed of 5% of the fish's body weight, based on biomass calculations. The amount of feed is adjusted weekly by weighing 15 sample fish from each experimental unit, so that the weight of the feed given can be accurately determined. The rest of the uneaten feed is cleaned from the aquarium using a plastic hose to keep the aquatic environment clean.

Water Quality

Water is a very important medium of life for the jurung fish, playing a major role in supporting its survival. The water quality parameters measured in this study include DO (dissolved oxygen), pH, and temperature. DO is measured using a DO-meter, pH using a pH-meter, and temperature using a thermometer. Measurements are taken once a week before feeding. Water quality is determined through certain tests on these parameters (Asdak, 2010).

Test Parameters

Growth in Absolute Weight

Using the formula given by Effendi (1979), the absolute weight gain is determined as follows:

$$W = Wt - Wo$$

Information:
W = Absolute length growth (cm)
Wt = Average length of the end (cm)
Wo = Average length of the start (cm)

Absolute Length Growth

The growth of the absolute length of fish is determined by using the following method, according to Effendi, (1979):

$$Pm = Lt – Lo$$

Information:
Pm = Absolute length growth (cm)
Lt = Average length of the end (cm)
Lo = Average length of the start (cm)

Survival Rate

Effendi, (1979) defines survival as a comparison of test fish that survive at the end of the study with fish given at the beginning of the study with the following formula:

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

Information:
SR = Survival rate (SR)
Nt = Number of fish at the end of the study (tail)
No = Number of fish at the beginning of the study (tail)

Water Quality

The quality measured in this study was Temperature, Do and pH value with measurement 1 time a week before feeding.

Data Analysis

Using statistical analysis, the data is examined. Calculations with a 95% confidence level will be used to continue additional Duncan testing if the impact looks different.

RESULT

The results obtained are the effect of mastery on jurung fish on absolute weight growth, absolute length growth, and survival of early to late fish are presented in (Table 3).

Table 3. Values with different superscripts in the column indicate the presence of real difference (P<0.05)

P	Wt (g)	PM (cm)	SR (%)
P0	0.50±0.00a	0.33±0.05a	84.44±3.85a
P1	1.33±0.11b	0.93±0.11b	91.11±3.84bc
P2	2.16±0.23c	1.60±0.00c	93.33±0.00c
P3	0.73±0.40a	0.63±0.15d	86.67±0.00ab

Growth in Absolute Weight

Based on figure 1. It can be seen that from the 4 mastering treatments, the highest absolute weight growth results were obtained, namely in the P2 treatment (fish are fed for 1 day, then the fish are fasted for 3 days) with a value of 2.16±0.23C. Meanwhile, the lowest absolute weight growth value was in Po treatment (without mastery) with a value of 0.5±0.00a.

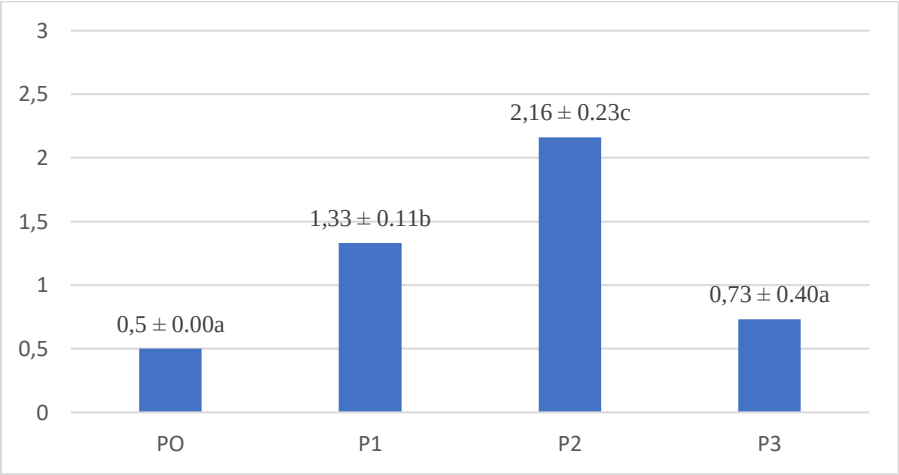

Fig 1. Absolute Weight Average Value Chart

Absolute Length Growth

The results of absolute length growth presented in Figure 2 can be seen if the highest value is found in the P2 treatment (fish are fed for 1 day, then fish are fasted for 3 days) of 1.60±0.00 cm. The P2 treatment that was not significantly different from P1 was (the fish were fed for 1 day, then the fish were fasted for 2 days) by 0.93±0.11 cm. Furthermore, it was followed by the P3 treatment, namely (fish fed 1 day, then fish fasted for 2 and 3 days) of 0.63±0.15 cm and the lowest result in Po treatment, namely test fish without treatment (control) of 0.33±0.05 cm. Based on these results, it can be seen that the P2 treatment (fish are fed 1 day, then the fish are fasted for 3 days) shows a significant difference to the P1 treatment.

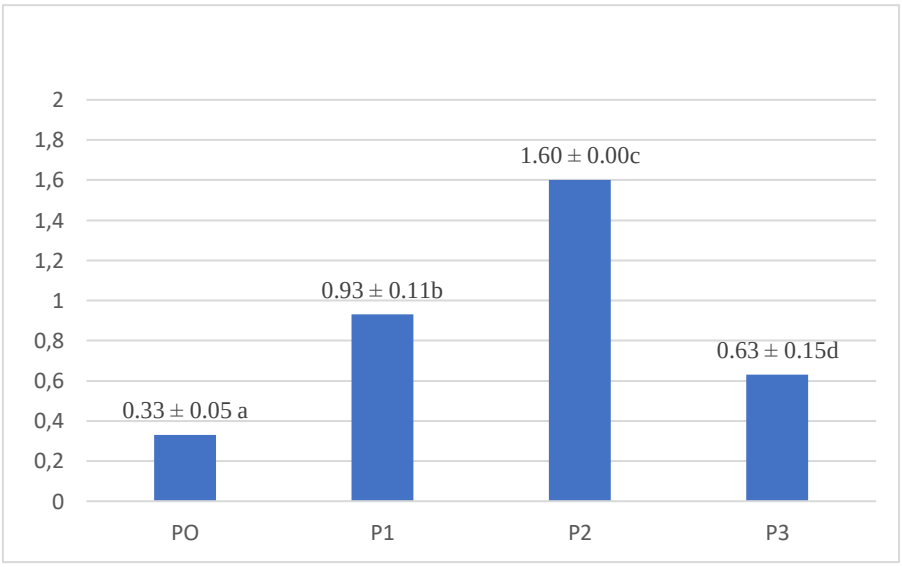

Fig 2. Absolute Length Average Value Chart

Survival Rate (SR)

The results of the average survival value of jurung fish (*T. soro*) in P2 treatment was 93.00±0.00, P1 treatment was 91.11±3.84, P3 treatment was 86.67±0.00 and Po treatment was 84.44±3.85. In general, the results of the survival of jurung fish during the study showed good results. All treatments had a survival rate above 85%. It is suspected that the mastery of jurung fish during the study did not have a negative effect on jurung fish (T. soro). The recirculation system also supports the survival of freshwater pomfret fish because it provides water quality that is in accordance with the needs of jurung fish (*T. soro*). A good survival rate is influenced by optimal environmental conditions and sufficient feed. The environmental conditions of the maintenance in this study are within a decent range that allows the fish to grow well.

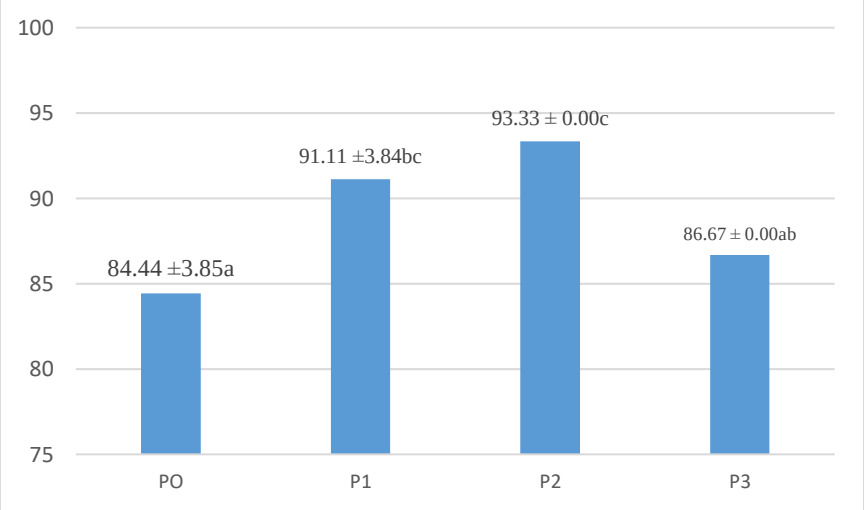

Fig 3. Survival rate chart

DISCUSSION

Growth in Absolute Weight

The results of the Fingerprint Analysis of the data of the absolute length growth of jurung seeds (*T. soro*) that were periodically fasted showed a very significant effect (P<0.05). According to Kordi, (2009) excess protein and fat in feed can cause fat accumulation in the fish's body, resulting in a decrease in appetite. In general, the nutritional value of feed is determined by the composition of the nutrients contained in it. Important nutritional components that must be present in feed include proteins, fats, carbohydrates, and vitamins.

Absolute Length Growth

The higher relative growth rate and greater absolute length growth in the P2 treatment compared to the P1 treatment are thought to be due to the higher feed consumption in the test fish. Feed is the main source of nutrients for growth. The principle of starving states that fish raised in a certain period or at a certain level of satiety, will experience rapid growth after the starving period. According to Ekasanti, (2007) the increase in growth in fasted fish is suspected to be related to the hyperphagia response during the refeeding period. Hyperphagia is a period in which the fish's appetite increases, which usually lasts for two to three days. Based on DUNCAN test, The results showed that the P2 treatment (fish fed for 1 day, then fasted for 3 days) did not show a significant difference from the P1 treatment (fish fed for 1 day, then fasted for 3 days). However, the P2 treatment tended to give a higher yield than P1.

This phenomenon shows that the fasted fish have adapted to the treatment, so that their metabolic rate decreases and the use of energy becomes more efficient. Mulyani et al., (2014)

argue that the relatively small growth difference between fasted and non-fasted fish may be caused by periodic mastering that affects energy utilization during the time the fish are not fed. Fasted fish adapt to the condition of "hunger," which is reflected in a decrease in activity and a decrease in the rate of basal metabolism, until the fish regain feed (Blyth, 1989 in Rosniar, 2013). Radona et al., (2016) also stated that mastery in fish can affect their metabolic rate.

The decrease in metabolic rate in fasted fish causes the use of energy to be more efficient. The energy obtained from feed proteins is used to support growth, motor activity, reproduction, physiological function, and repair of damaged body cells (Khotimah in Radona et al., 2013). The increase in metabolic rate that occurs is likely related to an increase in the hormone thyroxine. This is reinforced by Pahlawan et al., in Alwi et al., (2014), who stated that the hormone thyroxine has an important role in the metabolism, development, and growth of body tissues. According to Djojosoebagio in Mulyani et al., (2014), the hormone thyroxine can increase oxygen consumption and stimulate an increase in the rate of cell oxidation of foodstuffs, which in turn increases fish metabolism. This hormone also plays a role in increasing the absorption of amino acids by the intestines. This increase in activity is suspected to be related to the fish's efforts to maximize the use of nutrients to meet nutritional needs after the mastering period.

Survival Rate (SR)

Survival is a comparison value between the number of initial organisms at the time of stocking expressed in percent where the larger the percentage value indicates the more organisms live during maintenance. Survival is a parameter for the success of a cultivation activity from the time the fish are stocked until the fish are harvested, the number of fish that are still alive in a cultivation process is called survival (Alfie, 2009).

The results of the variety analysis showed that the treatment of feed control did not have a real effect ($P>0.05$) on the survival of jurung fish (*T. soro*) during the study. It is suspected that feed mastery treatment has an effect on growth, but does not have a real effect on the survival rate of graduation. The death of jurung fish (*T. soro*) is possible because the fasted fish are aggressive and have a high potential for cannibalism between individuals to trigger a high potential for fish fry death. Fish fry mortality occurs due to aggressive fish behavior that causes other fish to suffer injuries that eventually lead to death. The hyperphagia response usually associated with compensatory growth can cause fish to behave aggressively in consuming the feed necessary to satisfy the appetite hyperphagia leading to greater risk-taking and competitive behavior, which will increase fish mortality (Hitchcock, 2012).

Water Quality

Jurong fish (*T. soro*) is able to survive at temperatures up to 27.8oC, based on the results obtained during the study, ranging from 25.2-27.8oC. Because water heaters were built inside the aquarium to maintain a consistent temperature in the circulation system, the temperature in this study was relatively stable. Heaters operate based on the standard principle of thermodynamics, which is to use heat to raise the temperature of a cold area (Samsugi, 2015).

The ideal temperature for tropical fish life is between 26°C-32°C, according to SNI (2009) suggests that air temperature has an impact on physiological processes including respiration rate and feed conversion. Dissolved oxygen levels during the study varied between 5.97-7.65 mg/L. Based on SNI-7550 (2009), it was established that the dissolved oxygen level in the air suitable for fish farming should not be less than 3 mg/L because it can cause the death of living organisms in the water. Since the aquatic organisms in the recirculation system are constantly circulating, their use is very helpful in regulating dissolved oxygen levels. The recirculation system functions to meet the physiological needs of fish, especially oxygen, according to Murray et al., (2014). The research vessel has a pH range of 6.5-7.3. A measure

of water quality known as pH is a measure of how acidic water is. The pH value of water can encourage the development of growth for biota in it, and can even cause death (Centyana et al., 2014). The optimal pH value for fish growth ranges from 6.5 -8.5 SNI (2009).

CONCLUSION

From the results that have been obtained, it can be concluded that fish kept for 45 days in an aquarium with the title of periodic mastering have a real effect ($P<0.05$) on the growth of absolute weight, absolute length, but no real effect on fish survival ($P>0.05$). The water quality parameters during the study were pH 6.5-7.3, temperature was 25.2ºC - 27.8ºC and dissolved oxygen (DO) during the study was 5.5-7.4.

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