Asian Journal of Aquatic Sciences, August 2024. Vol 7, Issue (2) 292-298
e-issn: 2716-4608
p-issn: 2655-366X

THE EFFECT OF POWDERED NONI FRUIT (*Morinda citrifolia*) AS A FEED SUPPLEMENT ON THE GROWTH AND SURVIVAL RATE OF SILVER BARB (*Barbonymus gonionotus*)

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ABSTRACT

Silver barb is one of the fish that can be cultivated year-round due to their excellent ability to adapt to Indonesian climate. One of the problems that cultivators often face is feeding; long-term commercial feeding or pelleting will negatively impact the fish's body. Therefore, a natural admixture of feed can become an alternative solution. This study used powdered noni fruit as a feed supplement for silver barb (*Barbonymus gonionotus*) because of its content of antioxidant compounds that can reduce oxidative stress due to free radicals. This study aims to determine the best practice of feeding powdered noni fruit as a feed supplement and its influences on silver barb's growth and survival rate during the fingerling phase. The study was conducted in November – December 2022 using a complete randomized design experiment consisting of four treatments and four retries. Random sampling took five fish sized 2 – 3 cm as samples. The cultivation container used in this study has a volume of 30 L, with each container containing ten samples. This study uses one-way ANOVA and is continued with a DMRT test to find the best doses of powdered noni fruit. The result shows that the best addition of noni powder was 15% of the total feed. This addition of noni powder demonstrates an increase of growth yield by 1.62 cm, absolute weight of 2.11 g, 87.5% survival rate, and feed conversion ratio of 0.0535. Moreover, the percentage of fish weight increases by 1.1% for every 1% increase in height.

Keywords: Noni, FCR, Growth, Survival Rate

1. INTRODUCTION

Silver barb (*Barbonymus gonionotus*) is a type of freshwater fish cultivated because it is widely consumed by fishing communities, especially in Java, such as Central Java. According to Cahyono[1], silver barbs are included in fish that can be cultivated throughout the year. After all, they can adapt to Indonesia's tropical climate. The production of silver barb in Central Java Province in 2016 recorded 18,498 tons and a 58.59% increase in 2017 of 29,335 tons[2].

Feed is the most crucial element in fishery culture due to the availability of complete nutrients in feed and daily feed amounts to meet fish's metabolic needs. These are supportive factors in cultivation to stimulate fish growth and survival[3]. Therefore, the availability of feed in silver barb cultivation must be sufficient to support the success of the cultivation process. This is because feed is a mixture of various kinds of organic matter given to livestock to meet their nutritional needs for growth, development, and reproduction. Thus, to maximize its growth and productivity, the amount and nutritional value of food needed for fish must be considered[4].

Commercial fish feed typically contains synthetic antioxidant compounds such as Butylated Hydroxyanisole (BHA)

Received: 21 June 2024
Accepted: 25 July 2024

and Butylated Hydroxytoluene (BHT), which, if used over a long period, can have adverse side effects on the body due to carcinogenicity[5]. Therefore, natural feed is needed as one alternative to feed components. Natural feed is much cheaper and safer because it contains natural antioxidants such as flavonoids, tannin, kumarin, curcuminoids, and others found in leaves, fruits, and seeds[6]. One of the plants that can be used as an additional medium for feed is the noni (*Morinda citrifolia*).

Noni is a medicinal herb and food commonly used. Noni, commonly called nonplant by the world, became famous after Polynesia migrated to Southeast Asia 2000 years ago because it was believed to contain the efficacy of traditional medicine[7]. Noni plants grow fast and produce dense fruit regardless of season[8]. This plant can be an abundant raw material because it can be harvested quickly[9]. According to the Central Java Statistics Agency[10], the productivity of the noni plant in Central Java in 2020 was 584,887 kg/m^2 with a land area of 85,548 m^2.

The use of noni's powder as an additional feed to the growth and synthesis of silver barb in the seed phase is because, in addition to being easy to obtain and inexpensive, the use of noni powder as an additional feed is still rarely used, usually as a treatment medium for diseases. So this study aims to determine the effect and best dose of noni powder addition in feed on silver barb's growth and survival rate.

2. RESEARCH METHOD

Time and Place

This study was conducted from November to December 2022 in Potrobangsan Village, North Magelang District, Magelang City, Central Java. A sample of the silver barb was obtained from the Sawangan Fish Seed Hall (BBI) cultivation pool, Kabupaten Magelang.

Method

The method used is an experimental method or direct observation of the research object with a CRD, 4 levels of treatment, and 4 tests[11]. The treatment used is:

K : Control (without noni powder)
A : Addition of noni powder to feed at a dose of 5%
B : dose of 10%
C : dose of 15%

Procedures

Silver barbs are kept in jars of 30 L with a water volume of 20 L. Each research container contains 10 silver barbs (2-3 cm). Fish were fed noni powder-enriched feed on an ad-libitum basis and kept for 30 days.

Absolute Weight Growth

Individual weight growth is the difference in weight or weight in fish weighed using analytical scales during maintenance, namely at the end and beginning of the study. Weighing is done using analytic scales of g or kg by sampling several fish at a time, each tail to weigh, then calculating the average weight per fish weekly, which can be calculated using the formula[12], as follows:

$$W = Wt - Wo$$

Information:
W : Absolute Weight Growth (g)
Wt : Average weight of silver barb at the end of rearing (g)
Wo : The average weight of silver barb at the beginning of rearing (g)

Absolute Length Growth

Individual length growth is the difference in fish length between the tip of the tail head during the maintenance period, the length at the end of the study and the length at the beginning of the study by sampling some fish, and the length of the fish. Then, one fish at a time will be measured in length using a ruler with a precision of 1 mm, then measured horizontally from head to tail, which can be calculated using the formula[12], as follows:

$$L = Lt - Lo$$

Information:
L : Absolute Length Growth (cm)

Lt : The average length of silver barb at the end of rearing (cm)
Lo : The average length of silver barb at the beginning of rearing (cm)

Survival Rate

The survival rate is the life expectancy of an individual at a given time. In this study, the summary was used to compare the number of fish living from the beginning to end of the research and in the maintenance period by calculating the number of fish populations, which would then be divided by the average weight per fish in the aquarium. The survival rate can be calculated using Tarigan[12], as follows:

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

Information:
SR : Survival Rate (%)
Nt : Number of silver barbs at the end of the study (fish)
No : Number of silver barbs at the beginning of the study (fish)

Feed Conversion Ratio (FCR)

FCR can be calculated using Suwannasang et al.[13], as follows:

$$FCR = \frac{F}{(Wt+D)-Wo}$$

Information:
FCR : Feed conversion ratio
F : The amount of test feed consumed during the study (g)
Wt : Total weight of test fish at the end of maintenance (g)
D : Total weight of dead test fish (g)
Wo : Total weight of test fish at the beginning of maintenance (g)

Water Quality Parameters

The water quality used in this study includes temperature, pH, dissolved oxygen (DO), and ammonia. Water quality measurements are carried out in each maintenance container using measuring instruments that match its usefulness so that they can obtain accurate results. Water quality sampling was conducted in the morning at 08.00 WIB in each maintenance pool.

Data Analysis

After the study, the growth and survival rate data were statistically analyzed using a one-way Anova Test or One Way Anova with an alpha value of 0.05 (real difference) or P 0 0.05 and differently very real with an alpha value of 0.01 or P 0.05. The DMRT test was then continued to find the best doses of powdered noni Fruit. It was found that there is a difference in the dose of noni powder from the growth of silver barb fish biomass[11].

3. RESULT AND DISCUSSION

Absolute Length Growth of Silver Barb

The study's results showed data on the average growth of the absolute length of common carp during the study, as shown in Figure 1. The results were highest in treatment C (noni's powder 15%) with an average of 1.62 cm, followed by treatment B (noni's powder 10%) with an average of 1.29 cm, treatment K (pellet 100%) with an average of 0.64 cm, and lowest in treatment in treatment A (noni's powder 5%) with an average of 0.41 cm. This corresponds to Utami et al.[14], who found that the best relatively long growth of silver barb in treatment A was 0.02–1.48 cm.

Long-term growth during the study occurred because silver barbs could absorb nutrients contained in the feed and the fish's interest in the feed to eat it through the aroma and flavor of the feed. This is because freshwater fish have a working nervous system and are controlled by chemoreceptors. Chemoreceptors recognize the taste and smell of liquids, air, and feed, as feed contains a chemical compound[15]. So, the fish can easily detect the presence of feed.

Absolute weight growth of silver barb

The study, conducted for 30 days, showed an average growth in silver barbs weight, as shown in Figure 2.

The highest yield in treatment C (15% noni powder) with an average value of 2.11 g, followed by treatment B (10% noni powder) with an average of 1.61 g, treatment K (100% pellet) with an average of 0.70 g, and lowest in treatment A with an average value of 0.42 g. This is due to the highly significant growth of protein availability in feed, a primary energy source for fish in the growth process. Following Widyati[16]; Novita & Nurlita[17], the fish can use nutrients from feed for energy and storage in the body. According to Sulawesty et al.[18], the proper combination of feed will sustain growth, prevent infection, and improve survival or synthesis. Appropriate foods such as proteins, carbohydrates, fats, vitamins, and minerals will be utilized well in the growth process based on the needs of the fish[19].

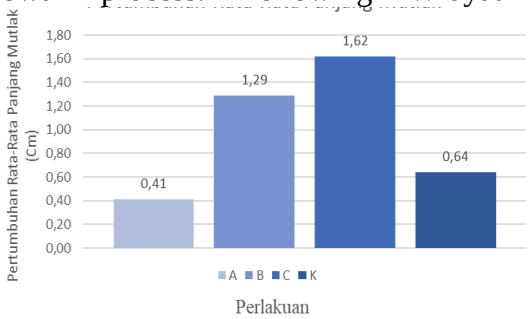

Figure 1. Silver barb length growth

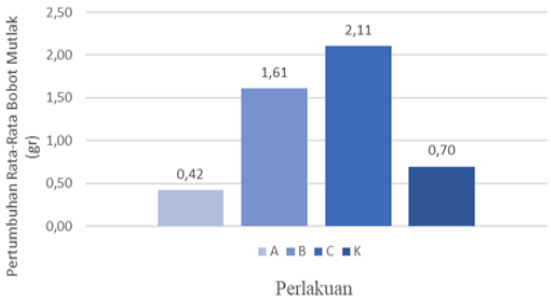

Figure 2. Silver barb weight growth

Survival Rate

The survival rate (Figure 3) with the highest concentration of silver barbs is in the C treatment (15% noni powder) at 87.5%, followed by the A and B treatments at 85%, and the lowest value in the K treatment at 80%. The survival rate of the silver barb, with a maintenance period of 30 days, is reasonable because it is at least 50%. It was supported by Utami et al.[14], and the survival rate was 83–93%. The survival rate is divided into three: if the survival rate is not less than 50%, it is good to say, but if the life graduation rate is 30-50%, it is moderate, and for a survival rate less than 30%, it is not good[20].

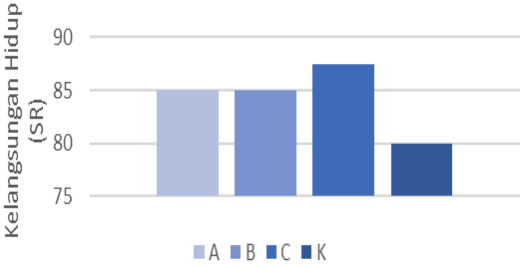

Figure 3. Survival rate of silver barb

The survival factor in silver barb juvenile is that the presence of a compound content in noni powder provides additional benefits to the feed so that it can supplement nutrients that are neither contained in commercial feed nor pellets. Among the compounds that improve fish health are active antioxidant compounds such as flavonoids, ascorbic acid, and amino acids. It acts as a leukocyte stimulant in non-specific defenses to function as an immunostimulant[21].

Feed Conversion Ratio (FCR)

Protein conversion to feed determines how much protein fish can absorb to become the body's resulting biomass. Feed conversion is closely related to the protein content of the feed because the higher the protein value, the lower the feed conversion, which means that to produce 1 kg of fish, less feed is needed; the result of FCR as figured in Table 1.

The best protein conversion results during maintenance are in the C treatment (noni powder 15%), which has a ratio of 1:3.33. C-treatment of the silver barb requires 3.33 g of protein to form 1 gram of meat. Feed conversion values in treatments B and C are lower than those of A and K, indicating that silver barb can efficiently use feed. This corresponds to Liu et al.[22], which states that the feed conversion value decreases as the feed protein increases. Each

diet's different amino acid content has various levels of digestion and methionine. Methionine acts as detoxification and metabolism in the body and can also help the body absorb mineral Zn from food. With mineral Zn content added to the noni powder to the feed, the mineral Zn is more available to increase the activity of the enzymes involved in protein synthesis and digestion.

The mineral Zn acts as an activator of the Pancreatic carboxypeptidase A and B enzymes that digest peptides into amino acids. Then, the enzyme dipeptidase will break down the dipeptide into other forms of free amino acids and protease enzymes that will break down proteins in digestion to be adsorbed[23]. In addition, vitamin C content can increase enzyme production in triglyceride degradation, which causes serum triglycerides to decrease and strengthen the cell wall caused by increased collagen synthesis and mucopolysaccharides within the cell wall[24].

Table 1. FCR of silver barb

Treatment	Protein Content (g)	Feed Conversion (g)
K	1.18	0.0737
A	1.69	0.0679
B	2.85	0.0495
C	3.33	0.0535
Total	9.05	0.2445

Table 2. The amount of feed protein and feed cost for fish weight increase by 1 g

Treatment	Feed Conversion		Feed cost for 1 g of fish biomass (IDR)
	Feed (g)	Protein (g)	
K	2,95	0,144	74
A	2,70	0,275	85
B	4,22	0,090	133
C	4,6	0,086	145

Based on the results of the protein conversion analysis obtained, analysis of the feed price is continued. The feed price used during the study was pellet (IDR 25,000/kg) and noni powder (IDR 38,000/kg). Comparisons of the biomasses formed through ingested proteins include control (1:1.18), A (1:1.69), B (1:2.85), and C (1:3.33).

The best protein absorption is found in C treatment with a value of 0.086, while for the lowest cost, it is obtained with a value of IDR 74 (control) for the growth of 1 g of silver barb fish biomass (Table 2). This suggests that adding cedar powder as an additional feed for the growth and survival of silver barbs is relatively easy to absorb but costs more than controls that use pellets alone.

Water Quality Parameters

The study, conducted for 30 days, showed average water quality parameters with silver barbs, as shown in Table 3.

Table 3. The amount of water quality parameters of silver barbs during an experiment

Parameter	Treatment			
	K	A	B	C
Temperature (°C)	26,0	26,1	26,1	25,6
pH	7,75	7,8	7,76	7,75
DO (ppm)	6,68	6,84	6,69	6,88
Ammonia (mg/L)	0,15-0,25	0,15-0,25	0,15-0,25	0,15-0,25

The measurement results of the water quality parameters obtained in Table 16 show that the water temperature at each treatment during the study was 25.6- 26.1℃. This aligns with Kordi[25] that this temperature range includes a reasonable range for maintaining silver barb, 25 - 31℃. The pH range obtained during the study ranged from 7.75 to 7.8. The range is in line with Kordi[25], including the pH value good enough for the life of silver barb in water, which is around 7.5-8.5. The DO value in this study is 6.68–6.88 ppm, which is constantly aerated to keep dissolved oxygen stable. This value corresponds to Susanto[26], which states that the dissolved oxygen in water ideal for the fish growth process is 3 3 ppm, so the DO value during the study period is within the optimal range. The maintenance container's ammonia content is derived from fish and feedstocks. The measurements show ammonia values in the 0.15–0.25 mg/L range. Values with a range of 0.15–0.25 mg/L belong to the stable for fish, following Siegers et al.[27], that ammonia levels in water are suitable for 11 mg/L.

4. CONCLUSION

The feeding of noni powder as an additional feed affects long and heavy growth but does not affect the life-cycle of silver barbs juvenile. Treatment of C by adding 15% of noni powder as an additional feed for growth and survival in the silver barbs' fingerling is essential for increasing the absolute length growth of 1.62 cm and the absolute weight growth of 2.11 g. It has a survival rate of 87.5% and a feed conversion ratio of 0.0535.

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