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JOURNAL OF ARTHA BIOLOGICAL ENGINEERING

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The Usage of Starfruit Extract (*Averrhoa bilimbi*) as a Supplement for Tilapia Seed

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Article Information

Article history :
Received: March 21, 2025
Accepted: April 17, 2025
Available online: May 31, 2025

Keywords: *Starfruit, Tilapia, Fish Growth, Supplement, Vitamin C*

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Abstract

Tilapia (*Oreochromis niloticus*) has great potential in aquaculture due to its fast growth and delicious meat. However, challenges in providing quality feed and low nutrient intake hamper production. Administration of starfruit extract, rich in vitamin C and antibacterial compounds, can improve feed quality and support fish growth. Research shows that the addition of this extract can increase the weight, length, and survival of tilapia. Thus, using starfruit as a feed supplement at UPR Sumber Rezeki, Palembang, is expected to increase tilapia aquaculture productivity. Tilapia maintenance was carried out for 30 days, using 2 nets in a tarpaulin pond. The first net (P0) is for tilapia maintenance without the addition of starfruit extract, while the second net is for tilapia maintenance with the addition of starfruit extract (P1). Tilapia maintenance with periodic fasting for 30 days resulted in absolute length growth of 3.60 cm, absolute weight growth of 14.30 g, and 100% survival. The results of tilapia maintenance are classified as good compared to maintenance without the addition of starfruit extract.

DOI : https://doi.org/10.62521/j7se8j86

Introduction

Tilapia (*Oreochromis niloticus*) is a freshwater fish that has good development prospects because it is widely favored by the wider community. According to Novianti *et al*., (2022), tilapia has advantages such as a high survival rate, relatively fast growth with a relatively large fish body size, and resistance to changes in environmental conditions. Another factor that plays an important role in tilapia is the distinctive taste of its meat, the color of its meat is pure white and boneless with a fairly high nutritional content, so it is often used as a source of cheap and easily obtained protein and has a selling price that is very affordable for the community (Aliyas *et al*., 2016). According to the Ministry of Maritime Affairs and Fisheries (KKP), tilapia production data in 2021 reached 59,157.11 tons.

The success of fish farming is the availability of adequate fish supplies, both in quantity and quality. However, the supply of tilapia is still constrained by the low nutrient intake and the high price of feed which has an impact on the cost of seed production

(Novianti *et al*., 2022). Quality and quantity of feeding must also be considered to ensure that the fish receive the nutrition they need.The feed must contain complete nutritional information, easily digestible by fish, and remain free of harmful substances (Yunaidi *et al*., 2019). Therefore, the feed given must be effective and efficient so that it can be utilized by fish for growth. One effort that can be made to make feeding more efficient and can be utilized by fish effectively is by adding nutrients to the feed. One of the nutrients that can be added is starfruit extract.

Starfruit is a tropical plant that has many natural chemical compounds that are known to have antibacterial effects, namely flavonoids and phenols (Juniasti & Kosman, 2015). Additionally, starfruit is rich in vitamin C which can increase fish immunity, as an antibacterial, and accelerate the wound healing process. The advantages of using starfruit are that there is no danger of resistance to the fish body, or the environment around the cultivation media when compared to the use of antibiotics. Furthermore, starfruit is relatively easy to obtain (Buda *et al.,* 2023) and is easily applied by the community in the form of extracts (Zakaria *et al*., 2007). According to Aslianti & Priyono (2009), providing feed enriched with vitamin C also proves that vitamin C can accelerate the growth rate of fish. The addition of starfruit extract to commercial feed will be able to increase fish growth and increase fish appetite because the vitamin C contained in starfruit has a positive effect on fish growth. According to Agustina *et al*. (2017), vitamin C is useful for preventing the negative effects of environmental disturbances or stress, accelerating wound healing, and increasing natural defenses against bacterial infections. Based on research by Sefrianto *et al*. (2023), giving 75 ml kg-1 starfruit extract pellets gave good results for weight growth of 16.6 g, length growth of 15.13 cm, and survival of 93% in tilapia.

Materials and methods

Time and Place of Research

This research activity was conducted at UPR Sumber Rezeki Sukasari Village, Palembang from July to August 2024.

Preparation of maintenance container

The maintenance container used in this study for tilapia maintenance is a tarpaulin maintenance pond lined with netting. The tarpaulin pond used measures 3×3 m^2. Before use, the pond must be cleaned by brushing the inside. After that, fill the pond again with clean water until it reaches a height of 50 cm. Then, install two nettings

measuring 0.5×0.5×0.8 m^3. Each netting is equipped with an aeration system to maintain the concentration of dissolved oxygen in the water.

Mixing starfruit extract

The best way to mix starfruit extract in tilapia seed feed (*Oreochromis niloticus*) is to place feed in one container with one layer of arrangement, the starfruit juice is sprayed on the pellet feed and then sifted slowly so the feed is turned over to even out the spray of starfruit juice, and left for approximately 30 minutes so the starfruit extract can be absorbed into the feed after being left for a few minutes. Then the feed is given a layer/coating using chicken egg yolk white of approximately 2% for the treatment feed to increase the resistance of the vitamin C content contained in starfruit (Hutajulu *et al*., 2009).

The starfruit used in this study was harvested from residents' yards in ripe, fresh, and still-hard conditions. The process of making the extract began by washing, weighing, and cutting the starfruit into small pieces, then blending it finely for 1 minute. This mixture was filtered and the extract was stored in a clean plastic bottle, then placed in a cool place and protected from sunlight. Afterward, the feed was sprayed with 75 ml kg^{-1} of starfruit extract, left for 30 minutes, and then coated with chicken egg white to the extent of 2%. Store the feed in a tightly closed jar.

Maintenance Process of Tilapia

The tilapia used were 5-7 cm in size with a stocking volume of 13 fish m-2, which were acclimatized for 7 days (Purnamasari *et al*., 2015). Tilapia seed maintenance was carried out for 30 days. During maintenance, tilapia were given commercial feed with a protein content of 32% mixed with starfruit extract with a frequency of 3 times a day at 07:00, 12:00, and 17:00 WIB at satiation. Fish sampling was carried out at the beginning and end of maintenance. Water siphoning was carried out conditionally, if there was turbidity in the water, 50% of the total water volume would be siphoned. Dead fish were weighed and their weight and length were measured. Harvesting was carried out after the tilapia (*Oreochromis niloticus*) had been maintained for 30 days. Gift tilapia can be harvested in the morning by draining some of the water and scooping out the fish with a small scoop. After the fish are placed into a holding tank, their total weight is calculated to determine their final weight, length, and survival rate.

Measurement of water quality maintenance

The water quality parameters observed

include temperature and pH. Temperature and pH observations are carried out once a day at 08.00 a.m., water temperature measurements using a thermometer and water pH measurements using a pH meter.

Results and Discussion

Absolute Growth of Tilapia

The absolute growth of tilapia seeds maintained for 30 days is presented in Table 1.

Table 1 shows the absolute growth of tilapia during the study with the best results achieved in the P1 treatment with 3.6 cm higher than in the P0 treatment with 3.4 cm higher. Likewise, the absolute weight growth in the P1 treatment was obtained in the P1 treatment, namely 14.3 g and the P0 treatment was 10.2 g. The results of the feed treatment given the addition of starfruit extract showed higher results compared to without the addition of starfruit extract. Based on research by Sefrianto *et al*. (2023), the absolute growth results of tilapia given starfruit extract were 15.13 cm and 16.6 g.

Treatment P1 obtained higher absolute growth results compared to P0, allegedly due to the vitamin C content in the starfruit extract which makes the fish have an appetite. Tilapia grow faster if their appetite increases, as opposed to when they don't receive starfruit extract. This is reinforced by research by Sumitro & Afandi (2021) which states that the growth of tilapia seeds with the addition of vitamin C of 600 mg kg^{-1} feed gives higher results because vitamin C stimulates growth well with the increase in body weight of tilapia seeds, the amount of feed given during the maintenance period is utilized well by the fish's body as a source of energy, growth and metabolism.

Fish growth is influenced by the energy obtained for growth, fish can grow optimally if they get enough nutritional intake to be absorbed by the fish's body (Agustina *et al*., 2017). According to Amelia *et al*. (2020), starfruit which contains a lot of natural vitamin C can increase the immune system which greatly affects the growth of

Table 1. Absolute growth of tilapia seeds during rearing

Parameter	Absolute length (cm)	Absolute weight (g)
P0 (control)	3,4	10,2
P1 (treatment)	3,6	14,3

Table 2. Survival of tilapia seeds

Parameter	Survival rate (%)
P0 (control)	92%
P1 (treatment)	100%

tilapia length. Thus, giving starfruit juice which contains a lot of natural vitamin C in tilapia feed is very much needed to accelerate the growth rate of tilapia length.

Vitamin C plays a role in the hydroxylation reaction of proline to lysine, which is an important compound in the formation of collagen and the development of young bones (cartilage) (Gunawan, 2014). The development of fish characteristics is not only influenced by genetic factors, but also by environmental factors (Akmal *et al*., 2019). Based on research from Aslianti & Priyono (2009), regarding the provision of feed enriched with vitamin C, vitamin C can accelerate the growth rate of fish. The right nutritional composition for fish consumption will have a positive impact on the growth and development of fish (Rachmi, 2020). According to Sartika, (2011), several feed energy that is used in excess for body maintenance is used for growth.

Survival rate during maintenance

The survival of tilapia seeds maintained for 30 days is presented in Table 2.

Table 2 shows that the highest survival value was obtained in treatment P1 (addition of starfruit extract) which was 100%, while in treatment P0 (without the addition of starfruit extract) the results were 92%. This shows that the treatment given in P1 has a significant effect on fish survival compared to the control treatment. These results are the same as the research of Sefrianto *et al*. (2023) which produced a survival value of tilapia with the addition of starfruit extract of 100%. Several factors indicate that fish survival such as water quality, feed, and the cultivation environment are in optimal conditions to support fish life in treatments P1 and P0.

The increase in survival from the P1 treatment showed that the treatment with the provision of vitamin C in the feed given was effective in increasing the resistance of fish to environmental conditions or diseases compared to the treatment without the provision of starfruit extract in the P0 feed. The vitamin C content in starfruit acts as an antibacterial and able to increase normal body

Table 3. Water quality of the tilapia during maintenance

Parameter	P0 (control)	P1 (treatment)
Temperature (℃)	26,3-28,6	26,3-28,8
pH	7,30-7,79	7,40-7,84

resistance and protection of the body's immune system against disease attacks (Agustina *et al*., 2017). According to Sumitro & Afandi (2021), vitamin C plays a role in increasing and normalizing body resistance to prevent stress in fish seeds. Therefore, the addition of vitamin C affects the survival of tilapia as shown in P1. Fish survival is influenced by various factors including water quality, feed, fish age, environment, and fish health conditions (Adewolu *et al*., 2008). According to Harun (2007), the adequacy of the amount and type of feed that is sufficient to support the basic needs of fish can support the life of fish.

Water quality during maintenance

The water quality of the tilapia seed maintenance media for 30 days is presented in Table 3.

Table 3. During the maintenance of tilapia in the study, it was found that the water quality values of temperature and pH of the water in this study were still considered suitable for tilapia maintenance. The water quality parameters produced were for temperatures ranging from 26.0 to 28.8°C for treatment P1 with the addition of starfruit extract to the feed and treatment P0 without the addition of starfruit extract to the feed. This follows the research of Effendi *et al*. (2015), which stated that the optimum temperature for fish growth is 25-32ºC. Water quality is an important factor in fish farming because it is needed as a living medium. The water used for maintaining tilapia seeds needs to be maintained in quality. According to Niode *et al*. (2017), the optimal temperature range for tilapia life is 28-32°C. Meanwhile, for the pH value in this study, the results obtained in treatment P1 were 7.40-7.84 and in treatment, P0 were 7.30-7.79. Tilapia can grow and develop well in aquatic environments with neutral acidity (pH) or low alkalinity. According to Arikunto & Suharsimi (2019), the pH of water that can be tolerated by tilapia ranges from 5-11. The pH value in this study for tilapia cultivation is still within the normal range.

Conclusion

The best treatment was obtained in P1 with the addition of starfruit extract as much as 75 ml/kg of feed, which resulted in an

absolute length growth of 3.6 cm, an absolute weight of 14.3 g, and a survival rate of 100%. Water quality during maintenance supported optimal growth, with temperatures ranging from 26.3-28.8°C and pH 7.40-7.84. This shows that the addition of starfruit extract is effective in increasing the growth of tilapia seeds.

Acknowledgements

We would like to thank the Unit Pembenihan Rakyat Sumber Rezeki for providing facilities and infrastructure for our research.

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