

EFFECTIVENESS OF MALEIZATION OF TILAPIA (*Oreochromis niloticus*) SEEDS BY SOAKING IN COCONUT WATER

Efektivitas Jantanisasi Benih Ikan Nila (*Oreochromis niloticus*) dengan Perendaman Air Kelapa

Fathin Maulana Putra Wardana, Azam Bachur Zaidy, Suratman, Nayu Nurmalia*, M. Harja Supena

Fisheries Extension Study Program, Fisheries Business Expert Polytechnic

*Corresponding author: nayunurmalia.emma@gmail.com

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ABSTRACT

Market demand, especially the export market, requires tilapia with an average weight of more than 500 g. To achieve a size of 500 g, farmers experience obstacles requiring a long time, especially because the growth of female tilapia is slower than male tilapia. The purpose of this study was to produce a higher ratio of male tilapia seeds. The research design was a completely randomized design with 2 treatments and three replications. The treatment tested was soaking tilapia seeds with 40% coconut water compared to the control. Parameters measured included male sex ratio, survival, biomass and feed conversion. The results showed that coconut water soaking significantly increased the male sex ratio to 71.8% compared to the control of 56.7%. The average weight of fish soaked in coconut water was higher with a significant difference of 7.17 g compared to 3.17 and biomass of 1,100 g compared to 571 g. The feed conversion of treated fish was lower and a significant difference of 1.5 compared to the control of 2.9. The research results can be used by fish breeders to produce high-quality fry with good production performance and efficiency in artificial use.

Keywords: aquaculture, freshwater, masculinization, ponds

ABSTRAK

Permintaan pasar khususnya pasar ekspor membutuhkan ikan nila ukuran dengan berat-rata lebih dari 500 g. Untuk mencapai ukuran 500 g, pembudidaya mengalami kendala membutuhkan waktu yang lama khususnya karena pertumbuhan ikan nila betina lebih lambat dibandingkan ikan nila Jantan. Tujuan penelitian adalah untuk menghasilkan rasio benih nila jantan yang lebih banyak. Desain penelitian rancangan acak lengkap dengan 2 perlakuan dan tiga ulangan. Perlakuan yang diujicobakan adalah perendaman benih nila dengan 40% air kelapa dibandingkan dengan kontrol. Parameter yang diukur meliputi rasio kelamin jantan, kelangsungan hidup, biomas dan konversi pakan. Hasil penelitian menunjukkan bahwa perendaman air kelapa meningkatkan rasio kelamin jantan secara signifikan menjadi 71,8% dibandingkan kontrol 56,7%. Berat rata-rata ikan yang direndam air kelapa lebih tinggi beda nyata 7,17 g dibanding 3,17 dan biomas 1.100 g dibanding 571 g. Konversi pakan ikan yang

diberi perlakuan lebih rendah dan beda nyata yaitu 1,5 dibanding kontrol 2,9. Hasil penelitian dapat dimanfaatkan oleh pembudidaya ikan untuk menghasilkan benih bermutu dengan performa pertumbuhan yang baik dan efisien dalam pemanfaatan pakan.

Kata kunci: air tawar, budidaya ikan, jantanisasi, kolam

INTRODUCTION

Tilapia (*Oreochromis niloticus*) is a freshwater fish species with the second-highest national production after catfish. Tilapia's advantages lie in its rapid growth, tolerance to various environmental conditions, and growing demand in both the domestic and export markets. In 2024, the Directorate General of Aquaculture planned to develop saline tilapia on the North Coast, including Bekasi, Karawang, Subang, and Indramayu, with a target harvest weight of 1 kg, primarily to meet the export market. This program requires not only a sufficient number of seeds but also high-quality seeds with a fast growth rate to achieve an average weight of 1 kg. One approach is to provide monosex male seeds, which grow faster than females.

Industrial-scale tilapia cultivation is intended to meet export market demand, generally in the form of fillets. Fillets require fish weighing between 800 and 1,000 grams. Male tilapia grow faster than female tilapia; therefore, to obtain relatively fast-growing tilapia, high-quality, monosex male seeds are required. (Sayouh *et al.* 2024) Male fish grow larger and heavier than females. Sex reversal in tilapia is performed on 7-day-old larvae (Noor and Handayani 2023). Tilapia is one of the fish species frequently studied for sex reversal (Baroiller and d'Cotta 2018) and (Silva *et al.* 2023). (Wibowo, Danakusumah, and Rahmatia 2019) demonstrate the process of masculinizing betta fish by soaking larvae in a mixture of coconut water and honey.

Conventional tilapia hatchery production produces a balance of males and females. One way to obtain male fry is by administering the hormone methyltestosterone. However, synthetic hormones are currently prohibited for use in fish farming. Therefore, alternative natural ingredients are needed to replace synthetic hormones, one of which is coconut water. Coconut water contains potassium, which plays a role in the masculinization process. The use of coconut water as a masculinizing agent is considered safer and more environmentally friendly than synthetic hormones. Research on the virility of tilapia using coconut water has been conducted by (Puspitha, Prasetya, and Wulandari 2023). Research on the virility of tilapia using coconut water has been conducted by (Puspitha *et al.* 2023) and (Asis and Cahyono 2025). However, the appropriate dosage and timing of administration still need further study to ensure its effectiveness. The study aims to determine the effectiveness of using coconut water in the virility process of tilapia fry. The results of the study are expected to be utilized by tilapia breeders to produce male fish fry using natural and environmentally friendly materials.

RESEARCH METHODS

Time and Place

The research was conducted in 2025 at the Pasir Gaok Fish Farm Community Hatchery Unit in Rancabungur District, Bogor Regency, West Java. Three-day-old tilapia larvae sourced from Mina Agribisnis in South Bogor, Bogor City, were used for the study.

The study used a completely randomized design with two treatments and three replications. The first treatment included coconut water at 40% of the total water volume. The second treatment (control) did not use coconut water.

The larvae were immersed in plastic bags for 8 hours and provided with oxygen. The treated tilapia larvae were reared in 1x1x0.5 m tanks, each containing 200 larvae, and

maintained for 90 days. During the rearing period, the fish were fed artificial feed twice daily..

Research Parameters

Parameters measured included sex, survival, average weight, biomass, and feed conversion. At the end of the experiment, sex was identified by observing the fish's genitalia. Water quality, including temperature, pH, and dissolved oxygen, was also measured.

Data Analysis

The percentage of male gender is obtained using the formula:

$$J\% = \frac{A}{T} + 100$$

Information:

J = Percentage of Males (%)

A = Number of Male Fish (tails)

T = Number of Fish Observed (tails)

$$\text{KH (\%)} = (\text{Nt/No}) \times 100$$

KH = survival rate (%)

Nt = Number of fish at the end of the
experiment (fish)

No = Number of fish released (fish)

$$\text{Average weight (g)} = \text{Biomass (g)} / \text{number of fish}$$

$$\text{KP} = \text{JP} / \text{Bt}$$

KP = Feed Conversion

JP = Amount of feed given (kg)

Bt = Increase in fish biomass (kg)

Statistical Analysis

The collected data were analyzed using ANOVA at a 95% confidence level, using SPSS Version 23 software to determine the differences between treatments (Steel, Torrie, and Sumantri 1993)

RESULTS

The results of water quality measurements during the experiment, including temperature, pH and dissolved oxygen, are shown in Table 1.

Table 1 Water quality during the experiment

Parameters	Units	Mark
pH	-	7 – 8
Temperature	°C	26 – 30
Oxygen	mg/L	5 – 6

Fish Gender Ratio

The results of the maleization study on tilapia seeds are as shown in Figure 1. Tilapia seeds soaked in coconut water as much as 40% of the total water volume for 8 hours produced 71.73% male sex and were significantly different compared to seeds that were not soaked in coconut water which produced fewer male seeds, namely 32,76% ($P < 0,05$).

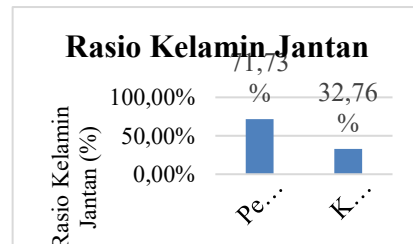


Figure 1. Sex ratio of male fish

Life Sustainability

At the end of the experiment, the survival rate of tilapia seeds is shown in Figure 2. The survival rate of tilapia seeds in the control was higher at 90% and was significantly different compared to tilapia seeds soaked in coconut water at 76,70% ($P < 0,05$).

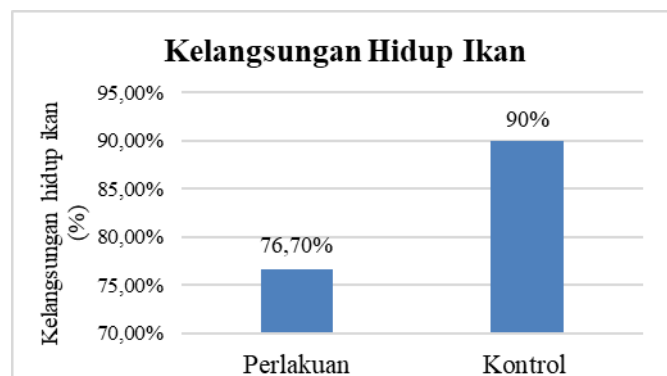


Figure 2. Fish Survival

Fish Weight

The average weight of fish at the end of the experiment is shown in Figure 3. The average weight of fish soaked in coconut water was 7.17 g higher and significantly different from the control of 3.17 g ($P < 0,05$).

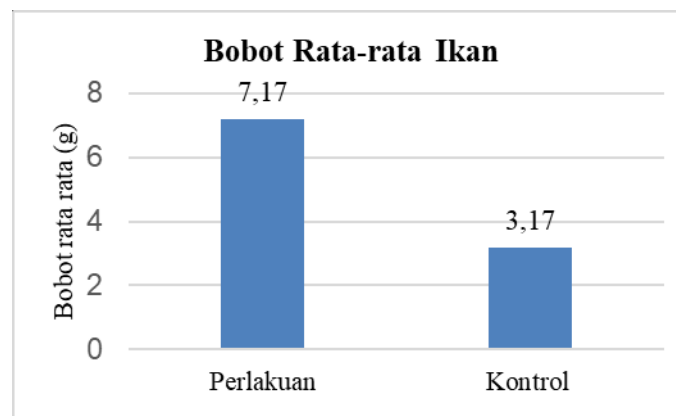


Figure 3. Average weight of fish

Biomass The fish biomass at the end of the experiment is shown in Figure 4. The biomass of fish soaked in coconut water was 1,100 g higher and significantly different from the control of 570 g ($P < 0.05$).

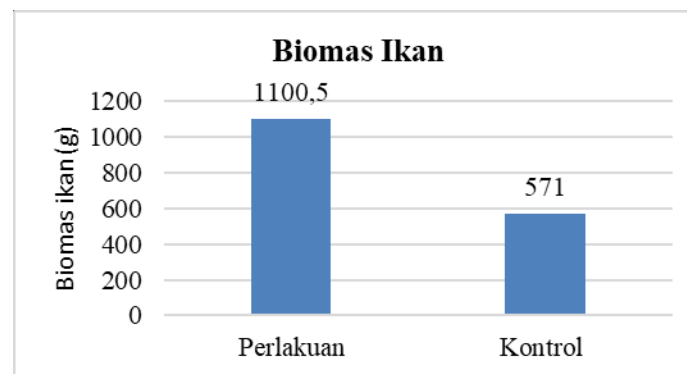


Figure 4. Fish biomass

Feed Conversion

Konversi The feed conversion at the end of the experiment is shown in Figure 5. The feed conversion (FCR) of fish soaked in coconut water was 1.5 lower and significantly different compared to the control 2.9 ($P < 0.05$).

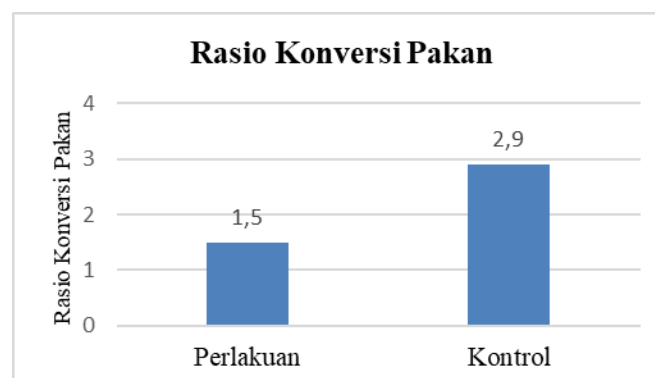


Figure 5. Feed Conversion Ratio

DISCUSSION

Table 1 shows water quality; water temperature, pH, and dissolved oxygen levels

during the study were within the optimal range for the life and growth of tilapia (Indriati and Hafiludin 2022).

Tilapia fry soaked in coconut water produced a higher male population, at 71.73%, while fry not treated with coconut water produced fewer male populations, at 32.76%. This is consistent with research results (Cahyani *et al.* 2021), which found that coconut water contains 312 mg/100 g of potassium, resulting in the highest male population of tilapia (86.87%) when soaked in 35% coconut water compared to those soaked in 25% and 45% coconut water. (Sulystyaningsih *et al.* 2022) For guppies soaked in 150% coconut water, the male to female ratio was 91.1%. Coconut water, as a natural ingredient, was chosen for the fish fertilization process. Besides being environmentally friendly, it also replaces the use of the synthetic hormone methyltestosterone, which is banned by the government. Several natural ingredients used for fish virility include honey (Gumelar *et al.* 2025), Amir and Setyono (2021), Deswira, Sudrajat, and Soelistyowati (2016), sea urchin gonad extract (Nababan *et al.* 2024), and (Abou El-Fotoh *et al.* 2014). Besides using natural ingredients, temperature can also be used. The sex ratio of male tilapia at 28°C was 52.33%, while at 36°C it was 81.00%. (Sarida *et al.* 2025) Tribulus extract at a concentration of 0.01 g/L was the best virility process. (Wibowo *et al.* 2019) found that soaking betta fish larvae in coconut water and honey increased the male-to-female ratio.

The survival rate of tilapia fry in the control group was 90% higher than that of fish soaked in coconut water, which was 76.70%. Treatment with young coconut water generally has a lower pH than the water used in the control. This is thought to cause mortality in tilapia larvae soaked in young coconut water. Several researchers found that the survival of fish soaked in coconut water was no different than that of fish not soaked in coconut water (Asis and Cahyono 2025), (Nababan *et al.* 2024), and (Sarida *et al.* 2025).

Fish soaked in coconut water were heavier than control fish. This was due to the higher number of males and the higher weight of males in treated fish compared to control fish. According to research results (Sayouh *et al.* 2024), male tilapia grew faster than female tilapia.

Feed conversion was lower in treated fish compared to control fish. This can be explained by the faster growth rate of treated fish, resulting in a lower ratio of feed given to weight gain, or in other words, more efficient feed utilization. Female fish grew slower because some of the feed energy was used for gonad formation, resulting in less energy used for growth (Bagenal and Gerking 1978).

CONCLUSION

Soaking tilapia larvae in coconut water at a concentration of 40% of the total water volume can increase the ratio of male fish to female fish, faster growth and more efficient feed utilization.

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REFERENCES

- Abou El-Fotoh, E. M., Ayyat, M. S., Abd El-Rahman, G. A., & Farag, M. E. (2014). Mono sex male production in Nile tilapia (*Oreochromis niloticus*) using different water temperatures. *Zagazig Journal of Agricultural Research*, 41, 1–8.
- Amir, S., & Setyono, B. D. H. (2021). Pengaruh lama waktu perendaman larva ikan cupang dalam madu terhadap persentase jenis kelamin. *Jurnal Perikanan Unram*, 11(1), 56–66.

- Asis, I., & Cahyono, I. (2025). Synergistic effects of honey and coconut water on masculinization, hatchability, and survival rate of Nile tilapia (*Oreochromis niloticus*) larvae. *Agrikan: Jurnal Agribisnis Perikanan*, 18(2), 61–66.
- Bagenal, T. B., & Gerking, S. D. (1978). *Ecology of freshwater fish production*. Blackwell Scientific Publications.
- Baroiller, J.-F., & d’Cotta, H. (2018). Sex control in tilapias. In H. Piferrer & M. Donaldson (Eds.), *Sex control in aquaculture* (pp. 189–234). Wiley-Blackwell.
- Cahyani, R., Serdiati, N., Tis’in, M., & Putra, A. E. (2021). Maskulinisasi ikan nila (*Oreochromis niloticus*) melalui perendaman air kelapa dengan konsentrasi berbeda. *Jurnal Agrisains*, 22(2), 89–97.
- Deswira, U., Sudrajat, A. O., & Soelistyowati, D. T. (2016). Sex reversal mechanism in Nile tilapia *Oreochromis niloticus* (Linnaeus, 1758) by manipulation of aromatase gene expression.
- Gumelar, T., Rina, R., Farkan, M., & Zaidy, A. B. (2025). The effect of different pure natural honey on betta fish seed production (*Betta splendens*) male. *Aceh Journal of Animal Science*, 10(1).
- Indriati, P. A., & Hafiludin, H. (2022). Manajemen kualitas air pada pembenihan ikan nila (*Oreochromis niloticus*) di Balai Benih Ikan Teja Timur Pamekasan. *Juvenil: Jurnal Ilmiah Kelautan dan Perikanan*, 3(2), 27–31.
- Nababan, Y., Susanto, G. N., Widiastuti, E. L., & Tugiyono, T. (2024). Sex reversal ikan nila (*Oreochromis niloticus*) dengan perendaman dalam ekstrak metanol gonad bulu babi (*Diadema setosum*) dosis 8 mg/L. *Jurnal Perikanan Unram*, 14(3), 1151–1160.
- Noor, N. M., & Handayani, M. (2023). Senyawa aktif dari ekstrak keong mas sebagai pengganti 17α -metil testosteron untuk pembenihan ikan nila (*Oreochromis niloticus*) monosex. *Jurnal Marshela (Marine and Fisheries Tropical Applied Journal)*, 1(2), 106–112.
- Puspitha, S. M. M. T., Prasetya, I. N. D., & Wulandari, D. (2023). Uji efektivitas perendaman air kelapa dengan konsentrasi berbeda terhadap maskulinisasi ikan guppy (*Poecilia reticulata*). *Juvenil: Jurnal Ilmiah Kelautan dan Perikanan*, 4(3), 167–174.
- Sarida, M., Putri, A. Y., Elisdiana, Y., & Adiputra, Y. T. (2025). Early gonadal differentiation, sex ratio, and growth performance of Nile tilapia (*Oreochromis niloticus*) with *Tribulus terrestris* extract supplementation. *Journal of Aquaculture & Fish Health*, 14(1).
- Sayouh, M., Ali, M., Li, Y., Tao, Y.-F., Lu, S.-Q., & Qiang, J. (2024). Differences in growth performance and meat quality between male and female juvenile Nile tilapia (*Oreochromis niloticus*) during separate rearing. *Animals*, 14(20), Article 2954.
- Silva, R. C., Britto, D. M. C., Santos, C. A., Giordani, S. C. O., & Pedreira, M. M. (2023). Sexual differentiation and sex reversal in tilapia (*Oreochromis niloticus*) by hormone 17α -methyltestosterone similar to that used in cultivation systems. *Aquaculture*, 574, 739624. <https://doi.org/10.1016/j.aquaculture.2023.739624>
- Steel, R. G. D., Torrie, J. H., & Sumantri, B. (1993). *Prinsip dan prosedur statistika: Suatu pendekatan biometrik*. Gramedia Pustaka Utama.
- Sulystyaningsih, N. D., Turmuzi, T., Tilar, L. A. T. W. S. K., Muahiddah, N., & Sumahiradewi, L. G. (2022). The effectiveness of coconut (*Cocos nucifera*) soaking on the masculinity of guppy fish (*Poecilia reticulata*). *Jurnal Agroqua: Media Informasi Agronomi dan Budidaya Perairan*, 20(2), 320–328.
- Wibowo, C. Y. S., Danakusumah, E., & Rahmatia, F. (2019). Jantanisasi ikan cupang (*Betta sp.*) dengan 17α -metil testosteron melalui perendaman larva. *Jurnal Ilmiah Satya Minabahari*, 4(2), 80–93.

