Jurnal Agroqua
Volume 21 No. 1 Tahun 2023

DOI: https://doi.org/10.32663/ja.v%vi%i.3638

GROWTH PERFORMANCE OF TILAPIA (*Oreochromis niloticus*) SEEDS THROUGH THE ADDITION OF PAPAIN ENZYME

(Performa Pertumbuhan Benih Ikan Nila (Oreochromis niloticus) Melalui Penambahan Enzim Papain)

Veronitta Hodifa, Retno Cahya Mukti*
Aquaculture Study Program, Agriculture Faculty, Universitas Sriwijaya
Palembang-Prabumulih Street, KM 32, Indralaya, Ogan Ilir, South Sumatra, Indonesia
*Corresponding author, Email: retnocahyamukti@unsri.ac.id

ABSTRACT

As a maritime country, Indonesia relies heavily on the aquaculture sector, including freshwater aquaculture. Freshwater aquaculture has been widely practised in the aquaculture of nila tilapia fish (*Oreochromis niloticus*). The obstacle that often arises in nila tilapia fish culture is the low growth of fish. Factors that cause low fish growth are the low ability of fish to digest the feed given. The papain enzyme can be used as a protein catalyst in feed, increasing growth rates and reducing production costs. This study was conducted from November to December 2022 at the Seberang Ulu 1 District, Palembang, South Sumatra. This study used an experimental method with treatment P0 being the control (without adding the papain enzyme) and P1 being the treatment with adding the papain enzyme at a dose of 2.25%. The P1 treatment produced the highest results: the absolute length growth of 3.49 cm, the absolute weight of tilapia of 9.8 g, feed efficiency of 98.30% and survival of 88.80%.

Keywords: feed, nila tilapia fish, papain enzyme

ABSTRAK

Sebagai negara maritim, Indonesia sangat bergantung pada sektor budidaya, termasuk budidaya air tawar. Budidaya ikan air tawar telah banyak dilakukan khususnya pada budidaya ikan nila (*Oreochromis niloticus*). Kendala yang sering muncul dalam budidaya ikan nila adalah rendahnya pertumbuhan ikan. Faktor penyebab rendahnya pertumbuhan ikan adalah rendahnya kemampuan ikan dalam mencerna pakan yang diberikan. Enzim papain dapat digunakan sebagai katalis protein dalam pakan, meningkatkan laju pertumbuhan dan mengurangi biaya produksi. Penelitian ini dilakukan pada bulan November hingga Desember 2022 di Kecamatan Seberang Ulu 1, Palembang, Sumatera Selatan. Penelitian ini menggunakan metode eksperimen dengan perlakuan P0 sebagai kontrol (tanpa penambahan enzim papain) dan perlakuan P1 dengan penambahan enzim papain dengan dosis 2,25%. Perlakuan dengan penambahan enzim papain memberikan hasil yang lebih tinggi dibandingkan tanpa penambahan enzim papain yaitu pertumbuhan panjang mutlak 3,49 cm, berat mutlak ikan nila 9,8 g, efisiensi pakan 98,30% dan kelangsungan hidup 88,80 %.

Kata kunci: enzim papain, ikan nila, pakan

INTRODUCTION

As a maritime country, Indonesia relies heavily on the aquaculture sector, including freshwater aquaculture. The freshwater aquaculture sector is one of the focuses of the Indonesian government in supporting national food availability, which has the potential to play an important role as a source of domestic animal protein. From data from the Ministry of Maritime Affairs

DOI: https://doi.org/10.32663/ja.v%vi%i.3638

and Fisheries of the Republic of Indonesia, it is known that aquaculture production ranks first in the consumption of fish stocks in Indonesia. Aquaculture production in 2018 totalled 17.24 million tons, and capture fisheries 7.25 million tons (Ministry of Maritime Affairs and Fisheries of the Republic of Indonesia, 2019). One of the freshwater aquacultures widely practised is the aquaculture of nila tilapia fish (*Oreochromis niloticus*). However, the obstacle that often arises in nila tilapia fish culture is the low growth of fish. One of the factors causing the low growth of fish is caused by the low ability of fish to digest the feed given. Riyanti *et al*. (2014) state that the feed contains complex nutrients.

One effort to increase the digestibility of the feed is by adding additive enzymes to the feed. Adding enzymes to feed can help speed up the digestive process so that sufficient nutrients can be available for the growth and survival of fish (Widaryati, 2019). One of the enzymes that can be used is the enzyme papain. Papain enzymes are exogenous enzymes found in papaya fruit, leaves, and sap that break down protein in feed to increase protein absorption and digestibility by fish (Hutabarat *et al*., 2015). The papain enzyme can break down proteins in food into simpler ones so they are easily digested (Anggraini & Yunianta, 2015).

According to Sangita *et al*. (2017), adding papaya fruit powder containing the papain enzyme to feed at a dose of 3.40 g/kg increased the rate of feed utilization by the eel body. It optimized the protein digestion process in the feed for growth. In the research by Amalia *et al*. (2013) for African catfish, the best treatment was the addition of papain enzyme at a dose of 2.25%. The same thing was also reported by Hasan (2000), who stated that adding the papain enzyme in commercial feed with a concentration of 1.3-1.7% resulted in the highest daily growth rate, feed efficiency, and protein retention for the growth of gurami fish. Therefore it is necessary to use the addition of papain enzymes derived from papaya fruit to increase the growth of nila tilapia fish.

MATERIALS AND METHODS

These studies were conducted at the Seberang Ulu 1 District, Palembang, South Sumatra, from November to December 2022. The materials used in this study were nila tilapia fish size 4-6 cm, feed commercial, and papain enzyme. The tools used in this study were ponds measuring 2×3 m^2, a net measuring 1×1 m^2, aluminium foil, trays, blenders, sprayers, buckets, basins, pH meters, thermometers, rulers, scales, and jars. This study used an experimental method with treatment:

P0 being the control (without the addition of the papain enzyme)

P1 is the treatment by adding the papain enzyme at a dose of 2.25%.

The containers used in the rearing of nila tilapia fish were nets measuring 1×1 m^2. The net was placed in a pond measuring 2×3 m^2. Water was filled in the pond with a height of 30 cm. The source of water used comes from well water. Before use, the water was settled for almost one week until it was ready for sowing the seeds.

The papain enzyme was extracted from ripe papaya fruit, and then the fruit was peeled. The seeds were removed, washed under running water until clean and cut into thin slices. Thinly sliced papaya fruit was placed on a tray covered with aluminium foil. Papaya fruit was dried in the sun for one week until the water content reached 0%. Then, the crude papain enzyme extraction

DOI: https://doi.org/10.32663/ja.v%vi%i.3638

was carried out by crushing the cells in the papaya fruit using a blender to make it into flour. The extraction results were dried and made into powder (Simanjuntak *et al.,* 2018).

Papain enzyme powder can be applied to feed by dissolving 2.25 % in sufficient water and then spraying it evenly throughout the feed (Simanjuntak *et al*., 2018). After the feed and extract were mixed evenly using the spray method using a spray bottle. The feed was air-dried for about 15 minutes and then given to the fish. Enzyme spraying on the feed was carried out every feeding (2 times a day).

Many nila tilapia fish were 100, measuring 4-6 cm with a stocking density of 45 m-2. Sowing the seeds was done when the weather was calm, for example, in the morning or evening, to prevent the seeds from experiencing stress. The fish were acclimatized before stocking, and then for seven days after stocking, they were released. After that, initial weight and length weighing (initial sampling) were carried out the day before treatment. Feeding the fish was carried out two times a day as much as 5% of the total body weight of the fish, namely at 08.00 a.m and 04.00 p.m. The fish-rearing process was carried out for 30 days. Sampling was done every ten days. Water quality measurements were conducted during rearing in temperature and pH every 10.00 a.m.

Parameter

Growth

Absolute Weight Growth

Absolute weight growth (W) is calculated based on the formula according to Effendie (2002):

$$W(g) = Average\ of\ final\ weight\ (g) - Average\ of\ initial\ weight\ (g)$$

Absolute Length Growth

Absolute length growth (L) is calculated using the formula according to Effendi (2002):

$$L(cm) = Average\ of\ final\ length\ (cm) - Average\ of\ initial\ length\ (cm)$$

Feed Efficiency

Feed efficiency (FE) is calculated using the formula according to the National Research Council (2011) :

$$FE(\%) = \frac{(Final\ biomass + Dead\ biomass) - Initial\ biomass}{Feed\ consumption}$$

Survival Rate

Survival rate (SR) is calculated using the formula according to Effendie (2002):

$$SR(\%) = \frac{Final\ fish\ number}{Initial\ fish\ number}\ x\ 100$$

DOI: https://doi.org/10.32663/ja.v%vi%i.3638

Water Quality

Parameters of water quality for parrot fish included temperature and pH. Temperature and pH measurements were carried out every day.

RESULTS AND DISCUSSION

The data on the growth in length and absolute weight of nila tilapia fish are presented in Figures 1 and 2.

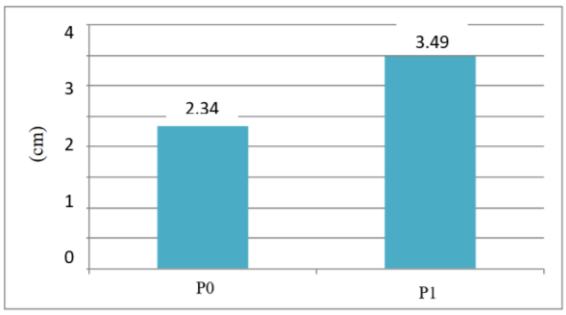

Figure 1. The diagram on the absolute length growth of nila tilapia fish

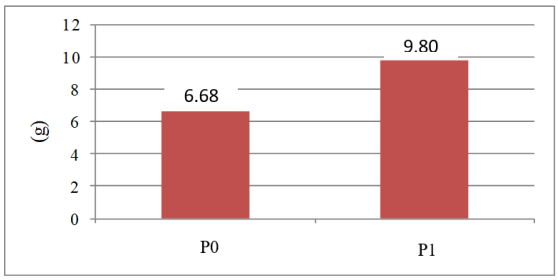

Figure 2. The diagram on the absolute weight growth of nila tilapia fish

Data on the feed efficiency of nila tilapia fish is presented in Figure 3.

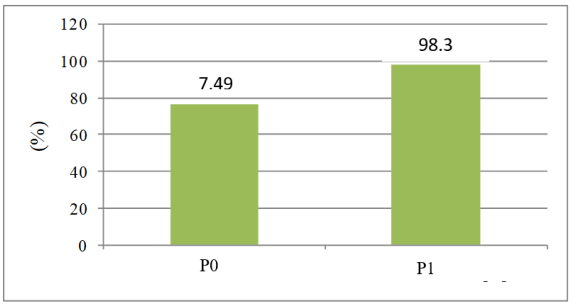

Figure 3. The diagram on feed efficiency of nila tilapia fish

Data on the survival rate of nila tilapia fish during rearing are presented in Figure 4.

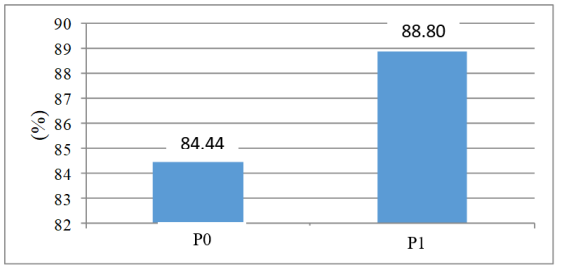

Figure 4. The diagram on the survival rate of nila tilapia fish

The water quality data during rearing is presented in Table 1.

Table 1. Water quality

Treatment	Temperature (^{0}C)	pH
Control (without the addition of the papain enzyme)	26.4-30.4	6.8-8.4
Adding the papain enzyme at a dose of 2.25%	26.3-30.2	6.9-8.1

Based on the results of the study obtained show an increase in the growth of nila tilapia fish. The highest growth value was in P1 treated, showing a length growth of 3.49 cm and an absolute weight of 9.8 g. While the value of P0 that was not added papain enzyme was 2.34 cm and for absolute weight was 6.68 g. The protein contained in the feed greatly affects growth. Feeding with optimal protein content can produce

DOI: https://doi.org/10.32663/ja.v%vi%i.3638

maximum growth. Fish treated with protein utilization are suspected to be very efficient with adding papain (Amalia *et al*., 2013).

According to Widowati *et al.* (2002), endogenous enzymes carry out protein hydrolysis and are assisted by exogenous enzymes. Adding the papain enzyme as much as 2.25% to commercial feed is the right dose to hydrolyze the protein contained in the feed into more amino acids to be absorbed and used for growth (Khodijah *et al*., 2015).

Feed efficiency can be affected by several factors, such as feed quality. Good quality feed will result in fish growth, and high feed efficiency indicates efficient use of feed so that only a few nutrients are broken down to meet energy needs and the rest is used for growth. The feed efficiency value in this study shows that the feed efficiency value to P1 is better, namely, 98.30%, compared to P0, which equals 76.49%. High levels of digestibility can increase the rate of absorption of amino acids into the body of fish for growth. This can be estimated based on the value of feed utilization efficiency, protein efficiency ratio, relative growth rate, and survival (Amalia *et al*., 2013). According to Wiyanto & Hartono (2003), feed utilization efficiency is the ratio between body weight gain and the amount of feed given during rearing. The higher the dose of papain enzyme added, the higher the body's metabolic rate, so the higher the rate of feed consumption.

Based on the results of Table 2, the survival rate P0 was 84.44%, while for P1, the results were higher, namely 88.88%. Survival during rearing is affected by changes that occur due to adding papain in feed (moisture, feed texture, odour). According to Watanabe (1998), survival can be influenced by biotic and abiotic factors. Biotic factors consist of the age and ability of the lobsters to adapt to the environment. In contrast, abiotic factors include food availability, stocking density, and the quality of the living media (Hutabarat *et al*., 2015). Providing feed containing young papaya fruit powder extract has sufficient quality and quantity to support the survival of tilapia (Widaryati, 2019).

Water quality is one factor supporting fish growth and survival that must be considered in fish culture. The results of water quality measurements during rearing show that the water quality obtained is still decent. Generally, a very suitable pH for all types of fish ranges from 6.8 - 8.1. The optimum pH for tilapia growth is around 6-8, and the optimal temperature range for tilapia rearing is around 28-32^{o}C (Arifin, 2016).

CONCLUSION

The addition of papain enzyme in nila tilapia fish at a dose of 2.25% resulted in higher yields than without the enzyme, namely 3.49 cm of absolute length growth, 9.8 g of absolute weight growth, 98.30% feed efficiency, and 88.80% survival.

REFERENCE

Amalia, R. Subandiyono & Arini, E., (2013). The effect of papain on dietary protein utility and growth of african catfish (*Clarias gariepinus*). *Journal of Aquaculture Management and Technology*, 2 (1), 136-143.

Anggraini, A. & Yunianta, _2015). Effect of papain hydrolysis temperature and time on chemical, physical and organoleptic characteristic of edamame milk. *Jurnal Pangan & Agroindustri*, 3(3), 1015-1025.

Arifin, M.Y., (2016). Pertumbuhan & kelangsungan survival rate ikan nila

DOI: https://doi.org/10.32663/ja.v%vi%i.3638

(*Oreochromis niloticus*) strain merah & strain hitam yang dipelihara pada media bersalinitas. *Jurnal Ilmiah Universitas Batanghari Jambi*, 16(1), 1-8.

Effendie, M.I., (2002). *Biologi Perikanan*. Yogyakarta: Yayasan Pustaka Nusantama.

Hasan, O.D.S., (2012). *Evaluation Of Kapook Seed (Ceiba Petandra Gaertn) Based On Digestibility, Enzimatic, Blood Parameter, Histology And Growth Performance As Alternatif Of Feed Ingredient For Common carp, Cyprinus carpio L.* Dissertation. Graduate School. Agricultural Bogor University.

Hasan, O.D.S., (2000). *Pengaruh Pemberian Enzim Papain Dalam Pakan Buatan Terhadap Pemanfaatan Protein Dan Pertumbuhan Benih Ikan Gurame (Osphronemus gourami lac).* Undergraduate Theses. Agricultural Bogor University.

Hutabarat, G.M., Rachmawati, D. & Pinandoyo, (2015). perfothe growth performance of crayfish seeds (*Cherax quadricarinatus*) through addition of enzyme papain in artificial feed. *Journal of Aquaculture Management and Technology*, 4(1), 10-18.

Khodijah, D., Rachmawati, D. & Pinandoyo, (2015). The growth performance of the catfish seeds (*Clarias gariepinus*) by the addition of the papain enzyme in the artificial diet. *Journal of Aquaculture Management and Technology*. 4(2), 35-43.

Ministry of Maritime Affairs and Fisheries of the Republic of Indonesia. 2019. *Program Prioritas Struktur Ekonomi 2019*. Jakarta: Ke Ministry of Maritime Affairs and Fisheries of the Republic of Indonesia

National Research Council, (2011). *Nutrient Requirements of Fish and Shrimp*. Washington DC: National Academic of Science.

Riyanti, A., Susanto, A. & Sukarti, K., (2014). Penambahan tepung buah pepaya (*Carica papaya*) dalam pakan terhadap pertumbuhan & efesiensi pakan pada ikan nila GIFT (*Oreochromis* sp.) ukuran 3-5 cm. *Jurnal Ilmu Perikanan Tropis.* 30(1), 60-67.

Simanjuntak, R.F., Abdiani, I.M. & Verawati. (2018). Bioenrichment of papaya meal (*Carica papaya)* with different feed formulation on tilapia growth out performance (*Oreochromis niloticus*). *Jurnal Harpodon Borneo.* 11(2), 59-68.

Watanabe, T. (1998). *Fish Nutrition and Marine Culture*. Department of Aquatic Biosciences. Tokyo University of Fisheries. Jica, 223.

Widaryati, R., (2019). Effect of addition of young papaya fruit extracts (Carica papaya L) in feed to the growth and survival of tilapia seeds (*Oreochromis nilotius*). (*Oreochromis nilotius*). *Jurnal Ilmu Hewan Tropika*, 7(2), 62–65.

Widowati, T. P., Setyawardani, T., & Hastuti,D, (2002). Effect of the pinaple (*Ananas comosus*) slurry as bating agent on the tensile strength and shrinkage temperature of local vegetable tanned of rabbit skins. *Majalah Barang Kulit Karet dan Plastik, 18(1), 29-34.*