THE GROWTH & SURVIVAL OF TILAPIA FRY (*Oreochronisniloticus*) WITH THE ADDITION OF FERMENTED COCONUT PULP TO FEED

ABSTRACT

Feed is one of the components that support the aquaculture business, hence the available feed must be sufficient and meet the needs of the fish.The use of coconut pulp as a feed ingredient is limited by its low protein content and high crude fiber content, which reduces the feed's digestibility level.Fermentation is a technology used to increase protein content and reduce crude fiber content, and increase protein digestibility.A. adding fermented coconut pulp 65%, commercial feed 35%, B. adding fermented coconut pulp 45%, commercial feed 55%, C. adding fermented coconut pulp 25%, 75% commercial feed, D. Control(100% commercial feed). This study aimed to analyze the effect of adding fermented coconut pulp to the commercial feed on the growth and survival of tilapia fry (*Orechromis*niloticus).The research is an experimental study using a Completely Randomized Design (CRD) with 4 treatments and 3 replications for12 experimental units. The results showed that the addition of fermented coconut pulp to tilapia feed had no significant effect on absolute weight and absolute length growth, but had a significant effect on the survival rate of tilapia fry. The best dose of adding fermented coconut pulp to the feed was found in the 25% treatment. The addition of fermented coconut pulp up to 45% did not make a significant difference with the use of commercial feed (control). This indicates the addition of fermented coconut pulp up to 45% can still be given to fish, hence it can be recommended that the addition of fermented coconut pulp to the feed should not exceed 45%

Keywords: Tilapia, feed, fermented coconut pulp, addition of coconut pulp, absolute weight, absolute length growth

INTRODUCTION

Tilapia (*Oreochromis niloticus*) is a widely cultivated freshwater fish species in Indonesia and one of the most important export commodities. Tran et al. (2017) ranked tilapia as the world's third most economically viable aquaculture commodity after shrimp and salmon. In addition, Arie (2002) explained that “tilapia has good commercial prospects because the wider community more easily accepts it. However, the fish has several advantages such as fast growth, high environmental tolerance, large body size, good taste, high survival rate, and easy cultivation. However, to meet the nutritional needs of humans as consumers, the nutritional value of fish must also be considered”.

“Feed is essential for the proper and efficient growth of aquaculture species. Quality feed ingredients can help increase the production of fish products. Unfortunately, cost constraints remain a common obstacle. Feed is the most expensive component of aquaculture production. Nutrition can reach 60-70%” (Hadadi et al., 2009). By fulfilling the need for high-quality feed in sufficient quantity, the aim is to increase fish production (Suhana, 2010). Coconut pulp has been widely used as a plant source of animal feed ingredients, hence its use as a fish feed mixture should be tested (Azwan et al. 2011). The use of coconut pulp as one of the plant components in fish feed is expected to increase the nutritional value of the feed.

The use of coconut pulp as a plant component in fish feed increases the nutritional value of the feed in addition to its easy availability. According to Derrick (2005), coconut pulp has a crude protein content of 23% and its easily digestible fiber content makes coconut pulp suitable for use as a feed ingredient. However, “coconut pulp has limiting factors, including high fiber content and poor protein quality, thus it needs to be processed to make it more useful for fish feed. Lower protein quality and higher crude fiber certainly affect feed absorption to support growth, reducing the availability of energy and other food substances, and affecting the speed of food flow in the digestive tract”(Mairizal, 2013). One way to increase the usability of protein and reduce the fiber content of coconut pulp is with a biotechnological approach through fermentation. Fermentation produces more digestible proteins, because of their hydrolyzation and degradation into shorter peptides and amino acids thus it can improve the nutritional quality of fish products used as a protein source in feed (Marti-Quijal et al., 2020).

Based on the above-mentioned, a study should be conducted on the addition of coconut pulp as a feed source for tilapia. This study aimed to analyze the effect of adding coconut pulp to tilapia feed and to determine the correct dose added to the feed on the growth and survival of tilapia (*O. niloticus*) fry.

MATERIALS AND METHODS

This research was conducted for 1 month, from June to July 2021 at UPTD BPPBIAT (Hatcheries and Development of Freshwater Fish Cultivation Centre) Soppeng Regency, South Sulawesi, Indonesia. Materials and tools used are tilapia fry 2.5 cm, commercial feed (Prima Feed, PF 500), coconut pulp, effective microorganism 4(EM4), distilled water, white sugar, and fine bran. The tools used are 1-liter and 25-liter jars, digital scales, DO meters, pH meters, filters, rulers, aerator stones, and thermometers.

This research was designed using a completely randomized design (CRD), consisting of four treatments as follows:

A: Adding fermented coconut pulp 65%, commercial feed 35%

B: Addingfermented coconut pulp 45%, commercial feed 55%

C: Addingfermented coconut pulp 25%, 75% commercial feed

Ctr: 100% commercial feed

Preparation of containers and rearing media

The containers used in this study are plastic containers with a volume of 25-L and up to 12 containers. Before filling with water, the container is first washed with detergent, after scrubbing, the entire surface is washed and dried. Rearing media that has been treated by precipitation and by physical or chemical filtration. Aeration is installed in the tank to ensure the availability of dissolved oxygen.

Preparation of experimental Feed

The addition of coconut pulp to tilapia feed wasperformed by first preparing coconut pulp obtained from coconut squeezers and home preparations, then aerating until completely dry, after that, the coconut pulp was pureed using a blender and placed in a jar. 1 kg of coconut pulp is given 3% EM-4 (3/100 x 1000) = 30 ml, 235 ml distilled water, 1% white sugar (1/100 x 1000) = 10 g and 5% bran (5/100 x 1000) = 50 g (Haidla et al., 2016) moisture content reaches around 30%. After all the ingredients were evenly mixed, the jar was tightly closed and placed at room temperature in fermentation for 3-5 days. Fermented coconut pulp was mixed with commercial feed according to the specified dose and ground into pellets that fit the mouth opening of the experimental tilapia, after grinding then drying in the sun. Drying was performed tomaintain the feed last longer because the water content was reduced. Next, the proximate test was carried out. The content of coconut pulp before fermentation was 5.45% protein, 35.08% fat, 11.14% water; 1.02% ash; and 47.31% carbohydrates. After fermentation, the content of coconut pulp was 5.70% protein; 18.28% fat; 5.70% water; 2.96% ash; and 67.18% carbohydrate. After the test feed was prepared, the nutritional content was: treatment A protein 25.44%; fat 13.77; treatment B protein 28.99%, fat 7.76%; treatment C protein 32%, fat 6.14%.

Preparation of experimental tilapia

The tilapia used were the fry with a size of 2.5 cm length. Before they were stocked, the experimental tilapia were first acclimatized for 1 week before being given treatment. At the time of acclimatization, the experimental tilapia were given the experimental feed. The experimental tilapia were weighed and their body length was measured. The stocking density of the tilapia fry was 1 ind./2-L of water. Fry stocking was performed gently to avoid stress, stocking was done using a sieve as a conveyer.

Feeding Management

The feeds given to tilapia fry were commercial feed (Ctr) and experimental feed (A, B, and C). Feeding was 5% of body weight per day, the frequency of feeding was 3 times at 08:00, 12:00, and 17:00.

Observed Parameters

Absolute Weight Growth

Absolute weight growth was calculated using the formula of Effendie (1997):

$$Wm = Wt - Wo$$

Where Wm = Absolute growth (kg), Wt = Final biomass (kg), Wo = Initial biomass (kg)

Absolute Length Growth

Absolute length gain was calculated using the Effendi (1997) formula as follows**:**

$$Pm = Lt - Lo$$

Where Pm = Absolute length gain (cm), Lt = Final average length (cm), and Lo =initial average length (cm)

Feed Utilization Efficiency

According to Tacon (1987) in Arifin et al**.** (2018), the feed utilization efficiency (EPP) value was calculated by the following formula**:**

$$EPP = \frac{Wt - Wo}{F} x\ 100\%$$

Where EPP = Feed utilization efficiency (%), Wt = Total weight of fish at the end of the study (g), Wo = Total weight of fish at the beginning of the study (g), and F = The amount of feed consumed during the study (g)

Survival Rate

The survivalrate of the experimental tilapia can be calculated using the formula (e Costa et al. 2000).

$$SR = N_t / No \times 100\%$$

Where SR = Survival Rate, Nt = Number of live test animals at the end, No = number of initial live test animals.

Water Quality Management

The observed water quality parameters include temperature, dissolved oxygen (DO), and pH. To keep the water quality stable and following the quality standards of tilapia seed rearing water quality, temperature measurements, and dissolved oxygen were carried out once a week during maintenance, and removal of fish feces and uneaten feed was carried out once every 2 days.

Data Analysis

Research data on growth, size gain, and survival rate (SR) were analyzed statistically using one-way analysis of variance with SPSS (Version 25.0) at a confidence level of 95% ($P<0.05$). If the results are significantly different then a further test is carried out with Tukey HSD, while water quality data were analyzed descriptively.

RESULTS AND DISCUSSION

Based on the results of research on the growth of absolute weight of tilapia fish fry reared for 30 days, the average absolute weight is presented in Figure 1.

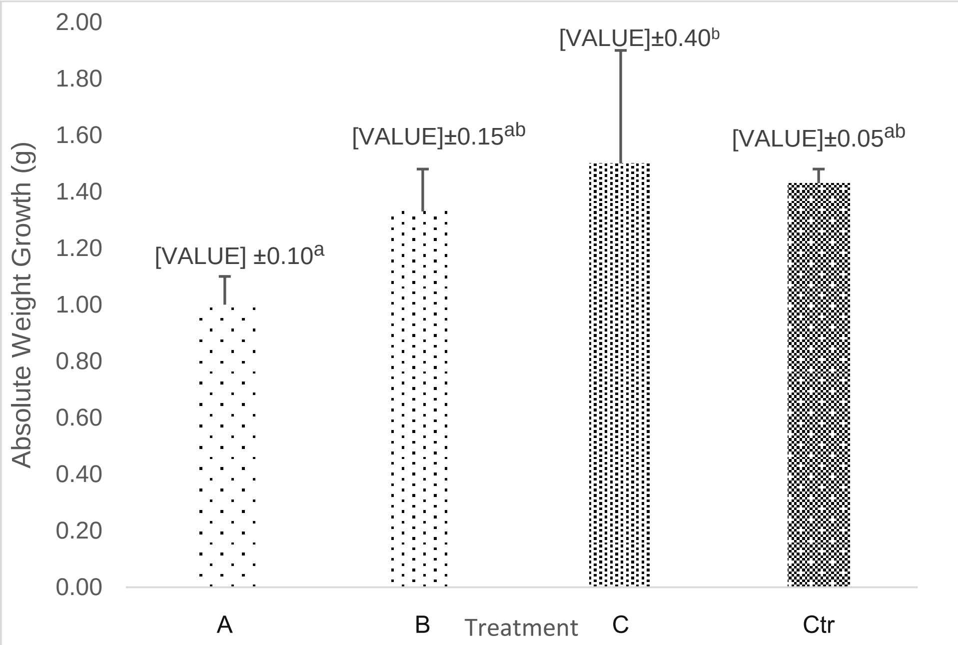

Figure 1. Absolute Weight Growth of Tilapia (*O. niloticus*) Fry. Different letters a, b, c, and d indicate significant differences between treatments. A. Fermented coconut pulp 65%, commercial feed 35%, B. Fermented Fermented coconut pulp 45%, commercial feed 55%, C. Fermented coconut pulp 25%, commercial feed 75%, Ctr. 100% commercial feed.

Statistically, the highest absolute weight growth was found in treatment C, namely the addition of 25% fermented coconut pulp. The lowest growth was obtained in treatment A; the addition of 65% fermented coconut pulp. However, the addition of 45% fermented coconut pulp is still feasible to use because it does not show significant differences from the control. This indicates that the addition of excessive fermented coconut pulp to the feed up to 65% (A) causes the growth of the sample fish to slow down, particularly seen in the absolute growth of the experimental tilapia. The weight difference of the experimental tilapia shows a proportional relationship between the amount of protein and the weight gain of the tilapia. The more protein there is in the feed, the more effectively it increases the weight of tilapia fry.Elangovan et al. (2017) stated that growth is influenced by nutrients (feed), such as proteins, fats, carbohydrates, vitamins, minerals, water, and oxygen. In addition to factors and hormones. Protein is the most important nutrient for fish weight gain.

This result is in line with the statement of Francis et al. (2001) that using too high a percentage of coconut pulp fermentation results in decreasing growth of the absolute body weight. Insufficient energy requirements for growth make it difficult for tilapia to adjust to the environment. (Cruz-Suarez et al., 1994 in Reo, 2016) state that at a certain level, carbohydrates can substitute energy derived from feed protein (feed protein sparing), and therefore the efficiency of feed protein utilization for growth can be increased.

Absolute Length Growth

The results of the calculation of the absolute length growth of tilapia fry reared for 30 days, obtained the average absolute length presented in Figure2**.**

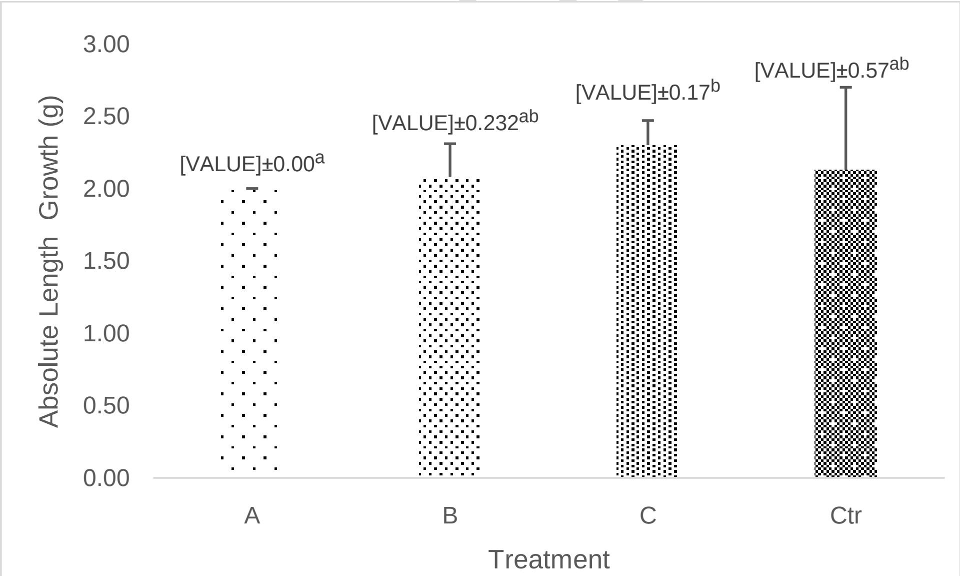

Figure 2 Absolute Length Growthof Tilapia (O. niloticus) Fry. Different letters a, b, c, and d indicate significant differences between treatments. A. Fermented coconut pulp 65%, commercial feed 35%, B. Fermented coconut pulp 45%, commercial feed 55%, C. Fermented coconut pulp 25%, commercial feed 75%, Ctr. 100% commercial feed.

Statistically, treatment C of 25% fermented coconut pulp addition shows that it is effective enough to affect the absolute length growth of tilapia. Meanwhile, the lowest growth was found in treatment A of 65% fermented coconut pulp addition. Adding coconut pulp up to 45% (B) is still good enough to be used because it is not significantly different from the control. Treatment B, containing 45% fermented coconut pulp, and the control treatment, containing 100% commercial feed are not significantly different, indicating that the use of commercial feed alone can be replaced by feed containing up to 45% fermented coconut pulp.A 25% fermented coconut pulp in addition to commercial feeds as one of the raw materials. That is due to the nutritional content of the feed being sufficient to support fish growth.

The addition of fermented coconut pulp to commercial feed contains protein, fat, and carbohydrates that can be absorbed by the fish body to grow and develop with nutrient content such as protein 32.36% and fat 6.14%. With this nutrient content, coconut pulp can also be used as an alternative feed to reduce fish consumption costs. With the addition of protein and fat, the long growth of tilapia can be faster. The slow growth of fish is thought to be due to the energy/protein feed that is not optimal needed by tilapia for growth. According to Putranti et al. (2015), the occurrence of growth indicates that the energy/protein (GE/P) of the feed given has exceeded the needs of fish for maintenance. Ruvalcaba-Márquez et al. (2021) stated that an adequate balance (Protein, lipid, and carbohydrate ratio) between all macronutrients in the feed is essential to improving growth.

Feed Utilization Efficiency

Feed efficiency is obtained from the comparison between fish body weight gain and the amount of feed consumed by fish for 30 days.

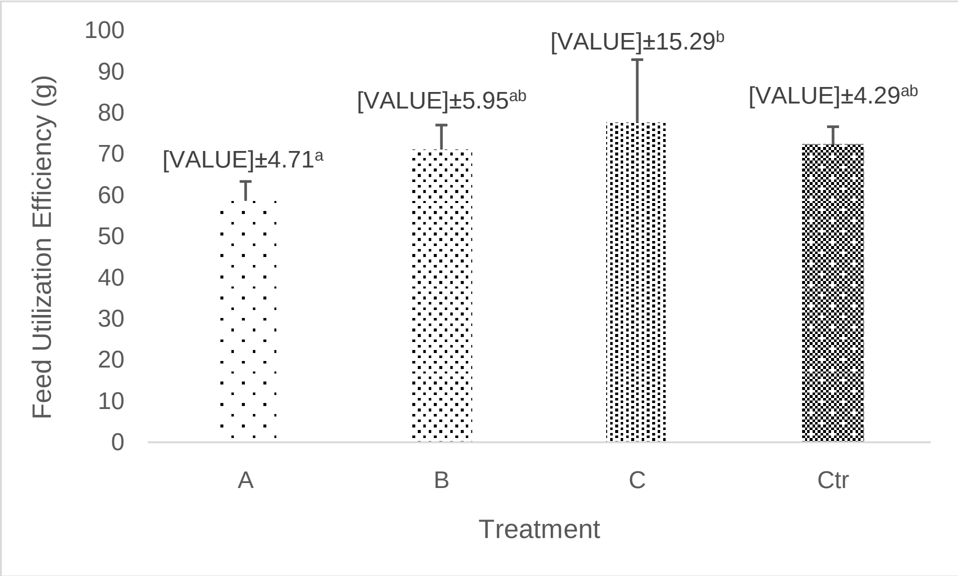

Figure 3 Feed Utilization Efficiency of Tilapia (*O. niloticus*) Fry. Different letters a, b, c, and d indicate significant differences between treatments. A. Fermented coconut pulp 65%, commercial feed 35%, B. Fermented coconut pulp 45%, commercial feed 55%, C. Fermented coconut pulp 25%, commercial feed 75%, Ctr. 100% commercial feed.

Figure 3 indicates the concentration of fermented coconut pulps added to the commercial feed of up to 25% increases the palatability of experimental feed, but compared to the commercial feed used, 45% fermented coconut pulps provide the same palatability to commercialfeed. The palatability of fish feed plays an important role in determining the efficient use of nutrients and reducing the operating costs of aquaculture. Farizaldi et al. (2017) reported that the fermentation process may increase nutrition quality such as the protein content, fats, andflavors that usually can stimulate palatability. Inara (2011) further explained that states that palatability may be influenced by the feed shape, size, color, flavor,and aroma. Furthermore, Hamidoghli et al. (2020), increasing feed intake and maximizing digestive enzyme activity in cultured tilapia can be done by providing raw fermented feed ingredients. In this context, a new method is used to improve tilapia feed quality, feed efficiency, and growth rate.

The value of feed efficiency is related to growth, the greater the increase in fish body weight, the higher the value of feed efficiency, the higher the efficiency of feed utilization, and the better the growth of tilapia. Direct observations made during the study showed the fish whose feed was given fermented coconut pulp were faster in removing feces. Based on the statement of Gilangsari (2000) in Cahyoko et al., 2011), the suitability of the type of feed greatly affects an organism to survive, grow, and reproduce.

Survival Rate

The results of the calculation of the survival rate of tilapia fry are presented in Figure 4 below:

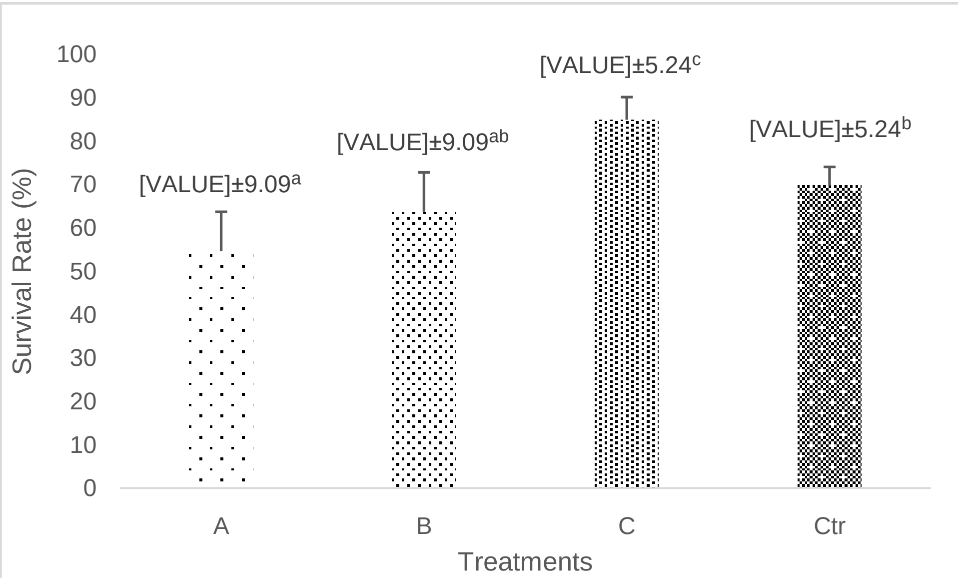

Figure 4 Survival rate of Tilapia (*O. niloticus*) Fry. Different letters a, b, c, and d indicate significant differences between treatments. A. Fermented coconut pulp 65%, commercial feed 35%, B. Fermented coconut pulp 45%, commercial feed 55%, C. Fermented coconut pulp 25%, commercial feed 75%, Ctr. 100% commercial feed.

Statistically, treatment C, which is the addition of 25% fermented coconut pulp affects the survival rate of tilapia. One of the factors that affect survival rates is biotic and abiotic factors such as water quality.The survival rate of fish is also determined by environmental conditions such as the adequacy of water for growth and development. Putranti et al. (2015) reported that the survival rate can be influenced by biotic and abiotic factors. Biotic factors consist of age and the ability of fish to adapt to the environment, while abiotic factors include food availability and water quality of rearing media. This can also mean that the amount and the nutrient content of the feed given meet the needs of fish for activity, growth, and survival. Kordi (2010) argues that the level of survival rate of a cultivation biota is influenced by several factors, one of which is feed nutrients.It has been argued that fats can affect the taste and texture of feed, but the excessive fat content in feed will affect the quality, which is susceptible to oxidation and contributes to rancid odor.

Water Quality

Table 1. Water Quality Parameters in Rearing Containers

No	Parameter	Treatment	Range Values	Optimal Values
1	Temperature (^0C)	Ctr	25,1-27,6	25 – 32^oC (SNI 7550:2009)
		A	25,2-27,8	
		B	25-27,6	
		C	25-27,8	
2	Dissolved Oxygen (mg/L)	Ctr	5,25-6,7	>3 (SNI 7550:2009)
		A	6,61-7,06	
		B	5,04-6,91	

		C	5,24-6,82	
3	pH -log[H^+]	Ctr	7,33-8,39	6,5 – 8,5
		A	7,46-8,31	(SNI 7550:2009)
		B	7,46-8,34	
		C	7,63-8,29	

The temperature during the study was in the range of 25 - 27.8^{O}C, which is following the SNI 7550:2009 standard of 25-32^{O}C. The temperature range can support the growth and survival of fish. The temperature of the rearing water affects the life of fish, if the water temperature ranges from 10-11^{O}C can be deadly within a few days, temperatures below 16 - 17ºC will reduce fish appetite, and temperatures below 21^{O}C will facilitate the occurrence of disease attacks.

Dissolved oxygen during the study ranged from 5.04 to 7.06 ppm. Based on SNI 7550: 2009, good dissolved oxygen levels are more than 3 mg/liter. Observations during the research were carried out, and the condition of dissolved oxygen was still in a state that was suitable for maintenance. Fish need dissolved oxygen for breathing and food combustion which produces energy for swimming, growth, reproduction, and others.

The degree of acidity (pH) during the study was in the range of 7.33-8.34. Meanwhile, according to SNI 7550:2009, the appropriate pH is 6.5-8.5. Based on observations during the study, the pH condition is still in a state that is suitable for maintenance. The pH value can be used as an illustration of the ability of a body of water to produce mineral salts, which, if the pH is not following the needs of the organism being maintained, will inhibit fish growth.

CONCLUSION

The addition of fermented coconut pulp does not have a significant effect on absolute weight growth, and absolute length growth, but on the survival rate of tilapia fry has a significant effect. The best dose of combined feed addition was found in the 25% treatment. The addition of coconut pulp up to 45% in the feed did not provide a significant difference. This shows that the addition of 45% fermented coconut pulp 45% is still feasible to be given to fish.Based on the results of the research that has been carried out, it can be suggested that the use of combined feed ingredients of coconut pulp does not exceed 45%.

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