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Utilization of Durian Durio Zibethinus Seed Flour and Kelakai Stenochlaena Palustris Leaf Flour Formulation as Feed for Nile Tilapia Oreochromis Niloticus

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Abstract---*Small-scale fish farmers have financial limitations to buy expensive commercial pellets to meet fish feed needs. Therefore, it is necessary to find alternative feeds that are cheap and able to support fish growth. Durian seeds (Durio Zibethinus) and Kelakai leaves (Stenochlaena palustris) are potential plant materials for additional fish feed which are abundant in Central Kalimantan Province. This study aims to determine whether additional feed formulations made from durian seed meal andelakai leaf meal can provide significant growth in tilapia (Oreochromis niloticus) rearing. The study used an experimental approach with a completely randomized design (CRD) with 3 treatments and 3 replications. The feed formulation is a mixture of pellets with 95% durian seed meal and 5% melakai leaf meal. Additional feeding is based on the following treatment: Treatment A, given commercial feed made by the factory brand MS prima Feed 1000 as much as 5% of the total weight of the fish kept, Treatment B: given formulated feed (90% pellets + 10% durian seed flour and kelakai leaf flour) as much as 5% of the total weight per day, Treatment C: given formulated feed (95% pellets + 5% mixture of durian seed flour and kelakai leaf flour) as much as 5% of the total fish weight per day. The results showed that the feeding of pellet formulations with durian seed flour and kelakai leaf flour as much as 10 % of body weight per day resulted in the highest growth in length and weight of fish. Thus durian seed flour and Kelakai leaf flour can be used as additional feed for Nile tilapia to help increase fish growth and reduce fish feed costs.*
Keywords---*durian seed, growth fish, Kelakai leaf, Nile tilapia*

Introduction

Nile tilapia (*Oreochromis niloticus*) is an important freshwater fish in aquaculture production in many countries. Tilapia is widely cultivated in Indonesia because it tastes good, doesn't have many bones, and has a high survival rate (Nuryanto et al., 2022). Nile tilapia has good adaptation to variations in water salinity (Jaspe & Caipang, 2011; Hasbullah et al., 2018), therefore in Indonesia, Nile tilapia has been cultivated in fresh and brackish water ponds. Nile tilapia is a highly nutritious food ingredient containing carbohydrates 2.51%, protein 18.46%, fat 1.98%, ash 1.60%, water 75.44%, and fiber <0.01%, (Nuryanto et al., 2022).

Commercial pellets used for feed in the Tilapia aquaculture industry in Indonesia contain 20-25% protein. Commercial pellets provide all the nutrients needed for fish growth and health. However, small-scale fish farmers have financial limitations to buy these expensive commercial pellets. Therefore, it is necessary to look for alternative feeds that are cheap and able to support fish growth. Nile tilapia is an omnivorous fish, so it can consume feed from plant materials. According to Manuel et al. (2020), feed for Nile tilapia can be composed using local vegetables with low economic values such as water lettuce (*Pistia stratiotes*) and water spinach (*Ipomoea aquatica*). Handajani et al. (2021), stated that using pumpkin seeds and sunflower seeds to substitute corn could support the growth of Nile

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tilapia. Plants and their by-products with low economic value can be used as fish feed ingredients. Most of these ingredients are nutritionally limited and sometimes have anti-nutritional factors. The combination of feed ingredients can increase the nutritional content of the fish feed. Plants or their by-products which are abundant in Central Kalimantan for additional fish feed are durian (*Durio Zibethinus Murr*) seeds and local vegetable Kelakai (*Stenochlaena palustris*) (Benli et al., 2008; Darmadi et al., 2017; Ermayanti et al., 2016).

Durian is an economically important tropical fruit that is widely cultivated in Southeast Asia, especially Indonesia, Malaysia, and Thailand. Central Kalimantan Regency is one of the durian production areas in Indonesia. Based on a statistical report for Central Kalimantan Province (2018), durian fruit production reaches 5,041 tons/per year. Nuraini & Mahata (2015), stated that durian fruit consists of 60% peel, 20% flesh, and 20% seeds. The peel and seeds are waste from durian fruit production which can potentially be used for livestock or fish feed. Durian Peel can be used in a limited way for livestock feed (Putri et al., 2020), and also for medicinal ingredients. Durian seeds can be used for poultry feed as much as 6% (Nuraini & Mahata, 2015; Mangisah et al., 2020). Durian seeds can be an alternative for additional feed ingredients that can reduce feed costs in fish farming. Purnama et al. (2022), stated that the nutritional content of durian seed flour from Donggala Regency was 41.76% of carbohydrates, 3.24% of lipids, 10.93% of protein, 7.1 mg/kg of Mn, and 1.22 mg/ kg of Zn. Durian fruit seeds have low-fat content compared to other fruit seeds and are dominated by palmitic acid.

Kelakai is a pteridophyta plant that grows well on peatland and is found on the banks of rivers, former burnt areas, and open land (Chotimah et al., 2022). Local people harvest Kelakai from peatlands and use it as food and medicine (Pendiangan et al., 2022). According to Chotimah et al., 2022, the nutrition value of Kelakai was 17.44 % protein, 1.47% fat, 13.58 % ash, 18.67 % fiber, 0.06 % Ca, 1.84 % K, 0.01 % Mg, and 0.01 % Fe. Kelakai contains bioactive substances such as flavonoids, steroids, and alkaloids. Utilization of Kelalai for fish feed is still very limited. Kelakai in Snakehead fish feed can act as immunostimulants (Norhayati & Bijaksana, 2019). Furthermore, according to Siskawati (2022), the use of fermented kelakai leaf flour in feed can significantly increase the growth of the Climbing perch (*Anabas testudineus*). This study aims to determine whether the additional feed formulation of durian seed flour and kelakai leaf flour can provide significant growth in Nile tilapia rearing.

Material and Method

This research was carried out in the research earthen pond of the Faculty of Fisheries, Palangka Raya Christian University, from April to June 2022. Nile tilapia were reared in 9 hapa measuring 1 x 1 x 1 meter. Hapa is placed randomly with a water depth of 80 cm from the surface of the pond. 100 fish were stocked for each hapa. Fishes were stocked had an average length of 2.64 cm and an average weight of 3.32 grams. The study used an experimental approach with a completely randomized design (CRD) with 3 treatments and 3 replications. The treatment in this study was the provision of formulations of pelet with durian seed flour and Kelakai leaf flour. The main fish feed in this study was commercial pellets with a protein content of 39-40% which was provision as much as 5% of the total fish weight per day. Additional feed was provision based on the following treatment: Treatment A: given commercial feed made by the factory brand MS prima Feed 1000 as much as 5% of the total weight per day. Treatment B: fed formulated feed (90% pellets + 10% durian seed flour and kelakai leaf flour) as much as 5% of the total weight er day. Treatment C: given formulated feed (95% pellets + 5% durian seed flour and kelakai leaf flour) as much as 5% of the total weight per day.

Feed formulations in this study were made as follows: fresh durian seeds were sorted, peeled, thinly sliced, and then sun-dried. After drying, it was ground into flour. Fresh Kelakai leaves were sun-dried and then ground into flour. feed formulations were made by mixing 95% durian seed flour and 5% Kelakai leaf flour. This mixture is added with a little water, manually pelleted, and sun-dried. The proximate content of additional feed formulations was measured using the AOAC (2020) procedure. The research parameters observed were relative growth, mortality, and water quality. Parameters were observed every 15 days for 75 days of the fish-rearing period. The relative growth (length and weight) of fish was estimated by taking a random sample of 10% of the fish population per hapa. The water quality parameters measured were temperature, pH, dissolved oxygen, and ammonia. Fish growth data were analyzed using one-way ANOVA. If the data are significantly different between treatments, then continued with the Least Significant Different (LSD) test analysis (Ho & Bhat, 2015; Amin et al., 2007; Thongkum et al., 2018).

Result and Discussion

The result of proximate analysis of the feed formulation made from durian seed flour and Kelakai leaf flour was moisture 8.24%; protein 4.74%; fat 2.52%; ash 10.83%; crude fiber 1.90%; and carbohydrate 73.94%. The result of measuring the pond water quality during the study was pH ranging from 5.6 to 7.2. The pond water tended acidic because the pond bottom was peat soil. The lowest pH was recorded in the morning. The water temperature in the morning was 27.5oC and 30.5oC in the afternoon. Dissolved oxygen in the morning at 06.00 am was 4.9 mgL-1 and in the afternoon until 17.00 pm ranged from 5.7 to 6.8 mgL-1. The ammonia level measured on day 15 was 0.032 mg/L and on day 60 it increased to 0.048 mg/L (Chai et al., 2015; Bhujel, 2000; Köprücü & Özdemir, 2005).

During the research, fish mortality occurred up to day 15 reaching 8%, and on day 30 the average mortality was 2% for each experimental unit. Fish mortality occurred in the morning after heavy rain so the pond water level rose and the pH increased to 7.2. Meanwhile, on the 30th to 75th day of observation, there was no mortality, because the fish have been able to adapt to the environmental conditions of the pond. The results of measuring the absolute length growth of fish during the study are presented in Figure 1. At the end of rearing (day 75) the length growth of fish from treatment A was obtained: 6.85 cm; B: 7.24cm; and C: 6.88 cm. The results of the analysis of variance (ANOVA) on the length growth data showed that treatments A; B; and C differed significantly (F = 847.8). Furthermore, based on LSD test, it was found that treatment A was very significantly different from treatments B and C, and treatment B was very significantly different from treatment C. The absolute weight growth of fish for 75 days of rearing is presented in Figure 2. The highest weight growth of fish was obtained by provision of additional feed formulation of treatment B = 55.18 grams, then followed by treatment C = 54.25 grams and treatment A = 53.27 grams. Based on the analysis of variance (ANOVA) showed that the weight growth of fish differed significantly between treatments (F = 18.79). Furthermore, the results of LSD test showed that treatment B was very significantly different from treatments C and A.

The condition of the pond water quality used in the study is influenced by the environment. The pH of pond water during the study ranged from 5.6 – 7.0. Each species of fish tolerates different pH levels, but in general, most species will do better in ponds with a pH closer to 7.0. According to Ghufran (2009), the growth of Nile tilapia fry will be optimal at a pH range of 7-8. Furthermore, according to Dauhan & Efendi (2014), the pH of the water is influenced by dissolved oxygen where the lower the dissolved oxygen, the pH tends to increase, conversely if the dissolved oxygen is high, the pH will be acidic. Pond water temperature during the study ranged from 27.5ºC - 30.5ºC. Tropical fish will grow well in the temperature range of 25º - 32º C throughout the year in lowland areas (Boyd, 1982). The surface temperature of pond water is more affected by air temperature than deeper water. Thus, the surface of the pond will be slightly warmer in the dry season and cooler in the rainy season than the deeper parts of the pond. According to Kawuri (2012), Nile tilapia can live well in the temperature range of 23º-30ºC, and Effendi et al. (2015), stated that the optimal temperature for fish growth is 25º-32ºC. Nile tilapia reared at 28°C had a growth rate of 0.41 grams per day (Hien et al., 2022). The dissolved oxygen content of pond water during the study ranged from 4.9 – 6.8 mgL^{-1}. The amount of oxygen dissolved in water is very important for fish and other biota life. The maximum oxygen that can be dissolved in water is affected by temperature. Warmer water can hold less dissolved oxygen than cooler water. Lack of dissolved oxygen is the most common cause of fish death. Waters for fish farming should contain dissolved oxygen at a minimum of 5 mgL^{-1}, if less than 2 mgL^{-1} it can result in fish death. According to Swistock at al. (2006), reduced dissolved oxygen in ponds is caused by the biological decomposition of organic matter in ponds. In general, most pool waters contain about 10 to 12 mgL^{-1} of dissolved oxygen. The ammonia level measured on day 15 was 0.032 mg/L and on day 60 it increased to 0.048 mg/L. The limit of ammonia in water should not be more than 0.05 mg/L for tropical fish. According to Duborrow et al. (1997), toxic ammonia levels that can kill fish within a few days start from 0.06 mg/L.

After a 75-day study, it was shown that the provision of durian seed flour and Kelakai leaf flour had a very significant effect on the growth in length and weight of Nile tilapia reared. Treatment B, providing feed formulation of peeled with durian seed flour and Kelakai leaf flour as much as 5% of body weight per day resulted in the highest growth in length and weight of fish (Amid & Mirhosseini, 2012; Liu et al., 1998; Sifa et al., 2002). Thus the treatment of provision feed formulations of peeled durian seed flour and Kelakai leaf flour made a positive contribution to the growth of the length and weight of Nile tilapia. In addition to providing commercial feed with a protein content of 39% in rearing Nile tilapia, the use of this additional feed formulation will increase protein intake by 4.74%. Protein requirements in fish depend on several factors such as species, size and age, water temperature, water salinity, stocking density, and feed protein/energy ratio (Radhakrishnan et al., 2020). Protein content in feed for tilapia farming generally ranges from 35 to 40 percent. Fish-fed diets with 50% protein content produced significantly higher weight growth than fish-fed diets with 35% and 40% protein content. Providing additional feed

of this formulation contributes to the growth of fish 0.74 grams per day during rearing. While the weight growth of Nile tilapia seeds with the biofilter treatment was 0.33 grams per day (Christin et al., 2022).

Conclusion

The provision of durian seed flour and Kelakai leaf flour had a very significant effect on the growth in length and weight of Nile tilapia reared. Treatment B, providing feed formulation as much as 5% of body weight per day resulted in the highest growth of fish in length (7.24 cm) and weight (55.18 grams). Thus durian seed flour and Kelakai leaf flour can be used as additional feed for Nile tilapia to help increase fish growth and reduce fish feed costs.

The formulation of pellets with durian seed flour and kelakai leaf flour had a very significant effect on the growth in length and weight of nile tilapia reared. Treatment B, providing feed formulation as much as 5% of body weight per day resulted in the highest growth of fish in length (7.24 cm) and weight (55.18 grams). Thus durian seed flour and Kelakai leaf flour can be used as feed formulations for Nile tilapia to help increase fish growth and reduce fish feed costs.

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