Addition of turmeric in feed on growth and survival rate of Nilasa red tilapia (*Oreochromis* sp.)

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Abstract. Nilasa red tilapia (*Oreochromis* sp.) is a Cangkringan tilapia produced from cross-breeding of 4-(four) parents, namely red tilapia from Thailand, NIFI-Thailand, Singapore, and the Philippines. The feed requirements for fish farming activities reaches around 60%, so one way to increase feed efficiency is to use feed additives. Curcumin in turmeric can stimulate fish appetite and increase absorption of food substances. The aimed of this study was to determine the addition of turmeric to the growth and survival of Nilasa red tilapia. The fish were reared in two different ponds (12 m²) with a density of 25 individuals/m² with turmeric and no turmeric added. The results showed that red tilapia with the addition of turmeric gave growth, growth rate, specific growth rate, FCR, feed efficiency was 48.34 g, 1.61 g/day, 5.48 g%/day, 0.81 and 122.81 % respectively and were higher than without the addition of turmeric. The survival rate of Nilasa red tilapia with the addition of turmeric and without the addition of turmeric was 85.67 and 87.33%, respectively. It can be concluded that the addition of turmeric through the feed can increase the growth of Nilasa red tilapia and survival rate above 80%.

1. Introduction

Nilasa red tilapia (*Oreochromis* sp.) is a Cangkringan tilapia produced from cross-breeding of 4-(four) parents, Citralada (Thailand) red tilapia, National Inland Fisheries Institute (NIFI) Thailand, Singapore, and the Philippines. Nilasa red tilapia is one of the fisheries commodities that are widely cultivated because it has high economic value. It has the strength that has a relatively fast growth rate, able to withstand in temperature of 38.66°C and salinity until 18 ppt [4].

The feed is the most important element in the cultivation process that can support fish's growth and survival because about 60% of production costs come from a feed [10]. One way to increase feed efficiency is by adding feed additives to the feed. Turmeric (*Curcuma domestica* Val) is a spice and medicinal plant from Southeast Asia that can be used as a feed additive because it can be easy to obtain at low prices and contains essential oils curcumin. One way to increase feed efficiency is by adding feed additives to the feed. Turmeric flour can be used as a feed additive because it stimulates appetite [5]. This study aimed to determine the addition of turmeric to the feed on the growth and survival rate of Nilasa red tilapia.

2. Material and methods
2.1. Material
The materials used in this study was Nilasa red tilapia with an average length of 9.27 cm and an average weight of 15.59 grams of 300 fish/pond, turmeric flour, feed (HI-PRO-VITE 781-2) with a protein content of 31-33%. Nilasa red tilapia are reared in 2 rectangular concrete ponds with a length of 6.5 meters, wide of 1.85 meters, high of 0.85 meters.

2.2 Method
The research was conducted at the Cultivation Fisheries Technology Development Center (BPTPB), Cangkringan, Sleman, Special Region of Yogyakarta. The method used in this study was the experimental method by comparing two treatments (t-student); 1. Fish was fed with the addition of turmeric 2% / kg of feed, 2. Fish was fed without the addition of turmeric

2.3. Preparing feed
The first process of making feed with the addition of turmeric is to weigh 20 grams of turmeric flour and 1000 grams of pellets using a digital scale. Then weigh the progol as much as 0.005% / kg of feed dissolved in 125 ml of water. Then stir until evenly distributed and dry in the shade and avoid exposure to direct sun for 1-3 days.

2.4. Fish rearing
Nilasa red tilapia were reared for 30 days with a stocking density of 25 ind/m². The amount of feed given is 3% /day of the fish biomass with a frequency of feeding 2 times in the morning (08.00) and evening (15.00). The type of feed given was commercial pellets (HI-PRO-VITE 781-2) and a water change of 1/3 of the volume of pond water which is carried out every two weeks.

2.5 Measuring parameters
The parameters measured in this study include growth (G) = Wt - Wo, Growth Rate (GR) = \( \frac{W_t - W_0}{t} \), Specific Growth Rate (SGR) = \( \frac{\ln W_t - \ln W_0}{t} \times 100\% \), Feed Conversion Ratio (FCR) = \( \frac{F}{W_t - W_0} \), and Feed Efficiency (EP) = \( \frac{W_t - W_0}{F} \times 100\% \). Measurement of water quality includes DO, pH, and temperature using water quality control which is carried out twice a day in the morning (09.00) and evening (16.00).

3. Result and discussion
3.1. Growth of Nilasa red tilapia
The growth of Nilasa red tilapia with the addition of turmeric and without the addition of were reared for 30 days, the results in Table 1. The results of a statistical analysis based on the t-test showed that growth (G), growth rate (GR), specific growth rate (SGR), feed conversion ratio (FCR), and feed efficiency (EP) with the addition of turmeric were 48.34 g, 1.61 g / day, 5.48 g% / day, 0.81, and 122.81% so that the results showed that there was a significant difference between the addition of turmeric and without the addition of turmeric.

The level of feed consumption is affected by palatability. Palatability is the level of preference shown by cultivated animals to consume a given feed ingredient within a certain period. The palatability of feed is determined by the shape, size, taste, smell, aroma, and colour, which are the feed's physical and chemical factors [3]. This is because the curcumin content in turmeric functions to increase palatability, thereby stimulating fish appetite, which results in increased growth [2]. The total feed intake is also related to the capacity and rate of gastric emptying. The high rate of gastric emptying causes the fish to get hungry quickly, and their appetite increases [11].

Table 1. Growth List of Nilasa Red Tilapia (Oreochromis sp.) Feed with Addition of Turmeric
### Parameters

| Parameter | Addition of turmeric | Without addition of turmeric |
|-----------|----------------------|-----------------------------|
| Lo (cm)   | 8,81 ± 0,71          | 10,25 ± 0,77                |
| Lt (cm)   | 13,47 ± 1,18         | 12,35 ± 0,69                |
| Wo (g)    | 11,73 ± 1,94         | 13,48 ± 3,72                |
| Wt (g)    | 60,07 ± 3,08         | 40,51 ± 3,63                |
| G (g)     | 48,34 ± 3,30         | 27,03 ± 4,97                |
| GR (g/hr) | 1,61 ± 0,11          | 0,90 ± 0,17                 |
| SGR (g %/hr) | 5,48 ± 0,57 | 3,77 ± 0,93 |
| FCR       | 0,81 ± 0             | 1,12 ± 0,01                 |
| EP (%)    | 122,81 ± 0,19        | 89,25 ± 1,01                |

Note: growth (G), growth rate (GR), specific growth rate (SGR), feed conversion ratio (FCR), and feed efficiency (EP).

Good feed efficiency values can be caused by the type of feed ingredients that are easily digested. The essential oil in turmeric can prevent the release of excess stomach acid, thereby facilitating the absorption of food substances [7]. Another addition, curcumin can increase the fish's immune system, so that indirectly with a healthy fish condition, the appetite for fish will increase, which impacts the final weight of the fish.

### 3.2. Survival rate of Nilasa red tilapia

The low SR value at the addition of turmeric can be caused by the insufficient feeding percentage resulting in cannibalism between the reared Nilasa red tilapia fish (figure 1). The existence of cannibalism among the fish being kept is caused by the fish's increased appetite, stimulating the fish to attack other fish that are weak, which can cause death.

![Figure 1. Graph of the survival rate of Nilasa red tilapia](image)

Curcumin extract can increase fish appetite because it can improve the digestion of carbohydrate, fat, and protein feed ingredients, so that nutrient absorption is better [6]. Besides, the cause is suspected that the fish experience stress because the fish cannot accept the excess herbal addition. The survival value of tilapia is between 83-100% El Hasan et al. [1].

### 3.3. Water quality

Data on average water quality during reared using the addition of turmeric and without the addition of turmeric in Table 2. Based on the water quality measurement data, the temperature results are between 27.09-27.99°C. Tilapia growth will be disrupted at low temperatures reaching 14°C and at high temperatures 38°C. Tilapia will die at 6°C and 42°C [8]. The water temperature measured at the time of the study was still in the proper range for red tilapia growth. The pH value obtained ranged from 7.23-
7.6. The optimal pH for rearing tilapia is 6.5-8.5. Measured pH is still suitable for the growth and survival of Nilasa red tilapia.

Table 2. Quality water with the addition of turmeric and without the addition of turmeric

| Parameters | Addition of turmeric | Without addition of turmeric |
|------------|----------------------|-----------------------------|
| pH         | 7.23                 | 7.33                        |
| Temp.      | 27.74 ºC             | 27.99 ºC                    |
| DO         | 6.58 mg/l            | 6.48 mg/l                   |

The DO levels obtained ranged from 6.48 to 6.77 mg/l. [9] The optimal dissolved oxygen level for rearing tilapia is more than 3 mg/l. During the study, the DO levels were still at the optimal limit to support the growth of Nilasa red tilapia. The colour of the pond water with the addition of turmeric becomes yellowish cloudy, which can cause the fish to experience stress to harm the fish. This can be because turmeric flour does not stick strongly to the pellets to be given when feeding.

4. Conclusion
The addition of turmeric in feed gives in higher growth to Nilasa red tilapia than fish without the addition of turmeric. The addition of turmeric 2% / kg feed can increase the growth of Nilasa red tilapia with the survival rate is 85.67%.

5. References
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