

Effects of *Moringa oleifera* Leaves Powder in Fish Feed Toward Growth Rate and Health of *Colossoma macropomum*

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Abstract. Tambaqui (*Colossoma macropomum*) is one of freshwater fish that preferred by the community and also in high demand by fish farmers. It has a high selling value and easy to maintain but the growth is slow. One alternative that can be used to improve the fish growth is making rations with the addition of *Moringa oleifera* leaves. The aim of this study was to determine the effect of *Moringa* leaves powder on the growth rate and health of *C. macropomum*. This study used an experimental method with Completely Randomized Design (CRD) with 6 treatments and 4 replications. The data were analyzed using ANOVA Test in $\alpha = 95\%$. The results showed that P3 with the addition of 30% *Moringa* leaves powder could increase the growth of *Colossoma macropomum*. An increase in fish body weight, width, and length was 40.1%, 21.6%, and 6.4% respectively. Results of ocular, reflex, and defensive test showed that the fish were in healthy condition compared to their condition before acclimatization. The conclusions of this study is that the addition of *Moringa* leaves powder in an influential ration can increase the growth and maintain the health of *C. macropomum*. *M. oleifera* daily supplement can be used as a substitute for soy flour to promote growth and health of *Colossoma macropomum* in the seed phase. The addition of *M. oleifera* can be used as feed supplements to improve the growth and health of *Colossoma macropomum*.

Key words: *Colossoma macropomum*; *Moringa* Leaves Powder; Fish Health

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INTRODUCTION

Aceh province has great potential in freshwater fish breeding. It was seen by the high demand on freshwater fish, so that the cultivation of freshwater fish would be an alternative for the farmers. One of the freshwater fish that have economic value is Tambaqui (*Colossoma macropomum*) (Taufiq et al., 2016). Demand and consumption of *Colossoma macropomum* fish is high in the Banda Aceh community. However, increase in demand could not be fulfilled because of low production with the constraints of slow growth and high feed prices. Fish health is also one factor that must be considered in aquaculture. Healthy fish is a fish that free of disease as well as chemicals that could harm the consumers. Conditions of fish that is susceptible to disease will reduce the productivity, so it takes a feed that not only sufficient for the nutritional needs of fish but also can improve their health.

Moringa oleifera has been used in herbal medicine as antioxidant, antimicrobial, anti-inflammatory, anticancer and antidiabetic. *M. oleifera* leaves contain protein nutrients (Matic et al., 2018). Feeding animals with *M. oleifera* leaves results in both weight gain and improved nutritional status (Mendieta-Araica et

al., 2011). *Moringa* leaves have large amounts of β -carotene and vitamin A. *Moringa* leaves have even 10 times higher vitamin A concentration than carrots, and 12 times higher vitamin C concentration than orange (Stohs & Hartman, 2015).

This study aimed to determine the effect of *M. oleifera* leaves powder on growth and health of Tambaqui. The addition of *M. oleifera* was expected to replace soy flour in *Colossoma macropomum* feed to improve fish health and feed efficiency.

METHODS

This study used an experimental research design, which aimed to determine the effect of *Moringa* leaves powder on growth rate and health of *Colossoma macropomum*. The study design was a completely randomized design (CRD) with 6 treatments and 4 replications. The treatment consisted of formula P0 (control), P1, P2, P3, P4 and P5 with the addition of *M. oleifera* by 0%, 10%, 20%, 30%, 40% and 50% respectively (Table 1). This research was conducted at the Jatu Street Emperom, Jaya Baru sub-district, Banda Aceh District. The study was conducted in March-May 2018.

Table 1. Composition of Feed Test

Raw material	Treatment (%)					
	P0	P1	P2	P3	P4	P5
<i>Moringa</i> leaves	0	10	20	30	40	50
Soy flour	0	50	40	30	20	10
Fine Bran	0	5	5	5	5	5
Fish flour	0	10	10	10	10	10
Cornstarch	0	5	5	5	5	5
Starch	0	5	5	5	5	5
Premix (vitamin)	0	5	5	5	5	5
Mineral mix	0	5	5	5	5	5
Fish oil	0	5	5	5	5	
Pellet	100	0	0	0	0	0
Total	100	100	100	100	100	100

***Moringa* Leaves Powder Preparation**

Moringa leaves are picked, separated from the stems and put in a bucket. Then, *Moringa* leaves were air-dried and crushed using wooden mortar to powder. The powder was then filtered to obtain a more refined powder. *Moringa* leaves was then weighed according to the treatment doses as follow, P0 = 0%; P1 = 10%; P2= 20%; P3 = 30%; P4 = 40%; P5 = 50%.

Procedure of Maintenance Animal Test

C. macropomum used was 6.5 cm. Each fish's weight was measured using a weight scale, the width

and length of the fish were measured using calipers and the level of health was tested by scoring. Furthermore, the treatment was given to *C. macropomum* for 60 days. During maintenance, Tambaqui were fed in accordance with a predetermined concentration of as much as 3 grams.

Procedures of Tambaqui Health Measurement

The health level of fish was measured at the time of acclimatization (0, 15, 45, 60 days of observation) according to indicators on the Table 2.

Table 2. Indicators of Fish Health Measurement

Parameter	Indicator	Scoring
Ocular Test	Eyes colored clear, slightly protruding outward, eyes looking up and move laterally	3
	Eyes colored clear, slightly bulging out, eyes looking upward	2
	Eyes colored clear, and convex	1
Reflex Test	The fish move in opposite direction when the tank is tapped, body fin and tail expand when the head is held in hanging position.	3
	The fish move in opposite direction when the tank expands when patted and fin fish head is held	2
	The fish move in opposite directions when the tank is tapped	1
Defensive Test	Fish flounder with regular heights, fish flounder in certain intervals, and the gill opening and closing simultaneously.	3
	Fish flounder with regular heights and fish floundering in a certain time interval	2
	The fish move in opposite directions when the aquarium is patted.	1

(Source: Kurniaji, 2014)

Statistical analysis

Statistical analysis was done at a significance level (α) of 0.05. Measurement scores were subjected to analysis of variance (ANOVA). When significant differences in ANOVA were detected, the mean values were compared using the LSD and HSD test.

Data obtained by observing the health of Tambaqui fish were analyzed by descriptive quantitative and tabulated into a table of ocular, reflex, and defensive test scoring (1 = very unhealthy, 2 = unhealthy, and 3 = healthy).

RESULTS AND DISCUSSION

The results showed that the growth of *C. macropomum* had an average value of length, width in each treatment (Figure 1,2,3). P3 treatment showed that growth fish was the best compared to other treatments. Statistical analysis on body length of *Colossoma macropomum* after being treated for 60 days showed significantly different from the Fcount value of 288.15 > Ftable 2,773. In order to determine the differences among the treatments, the data was tested further with advanced test BNT 0,05 (Table 4).

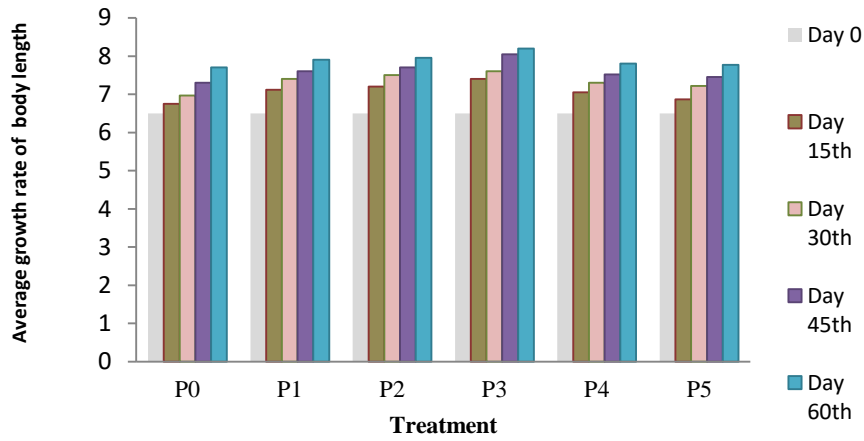


Figure 1. The average growth rate of *C. macropomum* body length

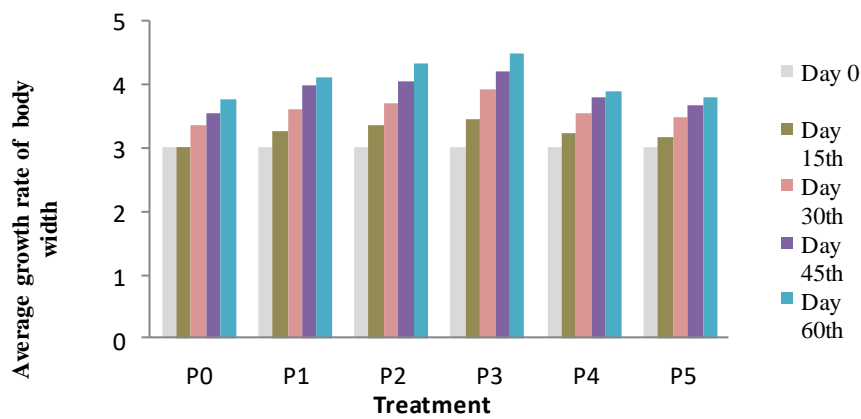


Figure 2. The average growth rate of *C. macropomum* body width

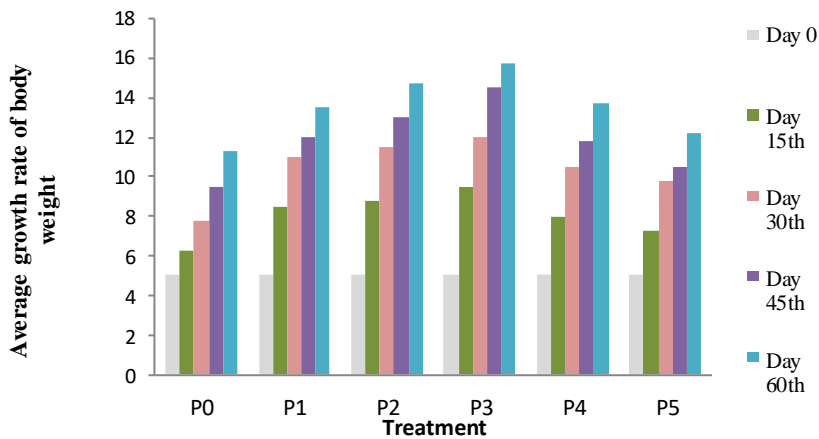


Figure 3. Average growth rate of *C. macropomum* body weight

Table 4. Average Length, Width, and Weight of *Colossoma macropomum*

Treatment	Average length	Average Width	Average Weight
P0	7.04a	3.33a	7.95a
P1	7.30d	3.59d	10.00c
P2	7.37e	3.69e	10.60d
P3	7.55f	3.81f	11.35e
P4	7.23c	3.50c	9.80c
P5	7.16b	3.43b	8.95b

Statistical test results have shown that the addition of *Moringa* leaf powder in a certain ratio significantly influences the growth of *C. macropomum*. The highest growth rate was obtained from P3 with the concentration of *Moringa* leaves powder as much as 30%. A balance feed composition contained in P3 is more suitable for the growth of *C. macropomum*. This is in accordance with Dienye et al., (2014) that stated that the addition of *Moringa* leaves powder with a concentration of 30% for *Tilapia* feed has been recommended as an alternative to artificial feed that can support the growth well. According to Aminah et al. (2015), the protein content of *Moringa* leaves have increased from 22.7% to 28.44% after being processed to powder. Fish seed needs of protein is also relatively low, 25% protein content in the diet has been able to support its growth (Mahyuddin, 2011).

Calcium also has an important role in the growth of living things. The amount of calcium in fresh and dried *Moringa* leaves are 350-550 mg and 1600-2200 mg respectively. *Moringa* leaf flour can be used for better fish seed growth. According to Asfiya (2017), the growth rate of fish is closely related to body weight and it is closely related to the protein content as well. Protein in *Moringa* leaves as powder is higher than that in the fresh one. This is in line with the increase in the carbohydrate content of *Moringa* leaves if used as powder. It is inversely proportional

to the content of the water that decreases. Aminah et al. (2015) stated that the water content of fresh and dried *Moringa* leaves are 94.01% and 4.09% respectively. Therefore, the addition of *Moringa* leaves in the form of powder will improve feed quality.

One of the essential nutrients needed by fish is protein. This is because protein is a substance that is needed for their growth. The utilization of protein for fish growth is influenced by several factors, including the size and age of the fish, the quality of protein and energy content of the feed, the water temperature, and the frequency of feeding. Protein is one of the nutrients that fish need for growth (Dani et al., 2005). The protein obtained from feed added with *Moringa* leaves will help to accelerate the growth of fish by increasing the volume and mass of cells, causing the fish to grow well. According to Bello et al. (2013), *Moringa* leaf flour supplementation as a substitute for fish powder with a concentration of 10% can accelerate the growth of fish.

Feeds that have been developed in fish growth include the combination of *Hermetia illucens* larvae powder and *Manihot esculenta* leaf powder for fish growth (Aini et al., 2018). *Spirulina platensis* can be used as a food supplement in fish maintenance as a daily supplement (Simanjuntak et al., 2018). Fish feed combinations are also related to fish conservation efforts (Setiati et al., 2018)

Table 5. Results of Health Monitoring of *Colossoma macropomum* for 60 Days

Treatment	Day																	
	Before Acclimatization			0			15			30			45			60		
	Ocular test	Reflex test	Defensive test	Ocular test	Reflex test	Defensive test	Ocular test	Reflex test	Defensive test	Ocular test	Reflex test	Defensive test	Ocular test	Reflex test	Defensive test	Ocular test	Reflex test	Defensive test
P0	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
P1	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
P2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
P3	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
P4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
P5	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Information: 1 = Very unhealthy; 2 = Unhealthy; 3 = Healthy



Figure 4. Ocular test photo after giving treatment in *C. macropomum*

Based on the scoring through the ocular, reflex, and defensive test, fish were in healthy state after the addition of *Moringa* leaves powder in the ration during 60 days of maintenance. The results in Table 5 shown that fish that have been given *Moringa* leaves powder are still remain healthy, so this kind of diet can be used as an alternative feed for *Colossoma macropomum*.

The nutritional content of *Moringa* leaves are used in the form of powder can increase the amount of protein content. According to Aminah et al. (2014), amino acids contained in the dried *Moringa* leaves is higher than in fresh leaves. *Moringa* leaves contain compounds that can enhance the immune system. Furthermore, it has been proposed that *Moringa oleifera* leaves extracts contain a large number of phenolic compounds such as epicatechin, flavonoids, cinnamic acid, protocatechuic acid, vanillin, caffeic acid, ferulic acid, p-coumaric acid, kaempferol, gallic acid, catechin, and quercetin (Govardhan et al., 2013). The secondary metabolites identified from *Moringa* extract have been shown to protect against chronic diseases through the action of various biological profiles including antioxidant, analgesic, anti-diabetic, diuretic, antibacterial, anti-tuberculosis, anti-cancer, anti-spasmodic, antihypertensive, antimicrobial, antimalarial, cholesterol lowering and antioxidant activities (Saini et al., 2016). According Hurriyani (2013), the bioactive compounds such as flavonoids are also known to able to improve the work of the immune system as leukocytes produced more quickly and lymphatic system is activated. An increase in the number of leukocytes shows cellular immune response in addressing the influx of foreign substances in the body such as a bacterial infection. The leukocytes function as the immune system of fish react to interference from outside including pathogen infection. Flavonoids are thought to play an important role in increasing the resistance of fish to pathogens. This is related to the ability of antioxidants to boost the immune system performance. Antioxidants of flavo-

noids are known to increase the phagocytic activity which is a function of the non-specific cellular immune response.

The mechanism of antioxidant flavonoids, polyphenols and carotenoids in enhancing phagocytic activity (Iwama & Nakanishi, 1996). Flavonoids, major phenolic act as an antioxidant because they have a hydroxyl group that can donate a hydrogen atom to the free radical compounds and stabilizing the reactive oxygen species (ROS) and has a hydroxy ketone which can act as a catalyst in lipid peroxides (Rezaeizadeh et al., 2011).

Amino acids are also taking an important role on the immune system. If fish amino acid deficiency will result in amino acids cannot be used, while if advantages amino acids so that fish growth is compromised, it can be related to the physiological functions of the body of the fish (Asminatun, 2010).

This research can contribute to fish farmers to be able to provide *M. oleifera* supplements as a substitute for soybean flour. *M. oleifera* powder supplements can also be used as a daily supplement to improve the growth and health of *Colossoma macropomum* at the time of maintenance until the harvesting age.

CONCLUSION

Addition of *Moringa* leaves powder (*Moringa oleifera*) in fish feed could increase the growth rate and maintain the health of Tambaqui (*Colossoma macropomum*). Supplementation of *M. oleifera* daily can be used as a substitute for soy flour to promote growth and health of *Colossoma macropomum* at the seed phase.

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