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Research Article

Cinnamon Flour Enriched Commercial Feed (*Burmese Cinnamon*) With Different Dosage on the Growth of Cantang Group Fish (*Ephinephelus Fuscoguttatus X Lanceolatus*)

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Abstract.

The cantang grouper is the result of a cross between the tiger grouper and the kertang grouper (*Ephinephelus fuscoguttatus x lanceolatus*). It inhabits the bottom of tropical and subtropical sea waters, typically solitary, but forms groups when spawning, and is nocturnal. The selling price is quite expensive which makes it attractive. The purpose of this study was to determine the effect of adding cinnamon flour at different doses to commercial feed on the growth of cantang grouper. This study employed a quantitative experimental approach. The experimental design adopted was Completely Randomized Design (CRD), consisting of 4 treatments, each replicated 3 times. Parameters observed included Feed Conversion Ratio (FCR) value, the highest value was in treatment A and the lowest was in treatment B, namely in the treatment of giving cinnamon flour 0.5 g/100 g of feed. The survival rate of cantang grouper was notably high, with an average of 100% throughout the duration of the study. The addition of cinnamon powder in feed had a very significant effect on the growth of cantang grouper. The most substantial growth was observed in treatment B, where cinnamon powder was added at a rate of 0.5 g/100 g of feed, resulting in an average growth of 4.68 grams. The study of cantang grouper was supported by water quality parameters (DO, pH, turbidity, salinity), which remained conducive for the maintenance of cantang grouper juveniles.

Keywords: cantang grouper, water quality, growth

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1. INTRODUCTION

Indonesia has an important position in the main economic activity of fisheries. With abundant marine wealth, currently the growth of seafood production reaches 7% per year, thus placing Indonesia as the largest producer in Southeast Asia (MP3EI 2011 – 2025). Minister of Marine Affairs and Fisheries Decree Number 19/2022 contains

Estimation of Potential Fish Resources, Allowable Fish Catches (JTB), and Levels of Utilization of Fish Resources in the Republic of Indonesia's Fisheries Management Areas. Based on data from the Center for Data, Statistics and Information, Ministry of Maritime Affairs and Fisheries (KKP) of the Republic of Indonesia, the volume of grouper production in 2020 reached 3,632.89 tons. Data from the World Food Organization (FAO) show that Indonesia still ranks third in the world as a producer of cultivated grouper, while China still dominates the top list. Fish growth is one of the problems faced by grouper fish farmers, in which this problem often requires a large amount of money to feed grouper fish. Cantang grouper is easy to cultivate in ponds because this type of grouper grows faster than other groupers. According to Tesivadi, (2006) the growth of grouper fish is influenced by several factors such as food, environmental conditions, type of food, time of feeding and so on. Groupers are carnivorous fish that eat all types of small fish they usually prey on (Asma et al., 2016).

Cantang grouper is a crossbreed grouper between female tiger grouper and male kertang grouper resulting in a hybrid cantang grouper which has a faster growth rate, is more resistant to disease and has a higher tolerance to environmental factors compared to tiger grouper and clam grouper (Ismi and Asih, 2011). The cantang grouper is the result of BPBAP Situbondo research and is a marriage of the tiger grouper (*Epinephelus fuscoguttatus*) female and Kertang grouper (*Epinephelus lanceoulatus*) male (Ariadi et al, 2022).

According to Mariskha and Abdulgani, (2012), the morphological characteristics of the cantang grouper include a flat and relatively rounded body shape with a head width almost equal to the width of the body, blackish brown skin color with 5 black stripes across its body, all fins (pectoral, anal, ventral, dorsal and caudal) patterned like a kertang with a yellow base equipped with black spots, black spots are also widely scattered on the head and near the pectoral fins with a different number in each individual, dorsal fin widens towards the back, dorsal fin fused fins consisting of 11 spines and 15 soft rays, pectoral fins consisting of 17 soft rays, ventral fins consisting of 1 hard spine and 5 soft rays, anal fin consisting of 2 rays hard and 8 soft rays, while the caudal fin consists of 13 soft rays. The shape of the cantang grouper's tail tends to be rounded, the shape of the mouth is wide, superior (the lower lip is longer than the upper lip), the type of stenoid (serrated) scales and the shape of sharp teeth (Ridho and Enggar, 2016; Ariadi et al, 2022).

Grouper fish have a habitat at the bottom of tropical and subtropical sea waters. In general, groupers are solitary, but when they are about to spawn, the fish are grouped together. Grouper larvae generally avoid the surface of the water during the day (Soeprapto et al, 2023). On the contrary, at night they are found more on the surface of the water. This vertical distribution corresponds to the nature of grouper as organisms which during the day mostly hide in coral burrows while at night they actively move in the water column to look for food (Mariskha and Abdulgani, 2012).

The cantang grouper is a carnivorous animal, like other types of grouper fish, namely small fish, crabs and crustaceans, while its larvae prey on mollusk larvae (trochophores), rotifers, micro crustaceans, copepods and zooplankton (Soeparpto and Ariadi, 2022). In the production of cantang grouper seeds, several types of feed are used, namely liquid feed, rotifers, Artemia naupli, artificial feed (pellets) and rebon shrimp (Ariadi et al, 2023).

Pellets are given to 6-day-old larvae in the form of micro pellets with a protein content of 25%. The cantang grouper is a carnivorous fish that has a habit of eating shrimp, small pelagic fish and worms at night. The favorite food for cantang grouper is shrimp with a percentage of 72.37-90%, small pelagic fish from 11.33 to 27.63% and worms 12.49% (Ridho and Enggar, 2016).

2. METHOD

The research method that will be used in this study is a quantitative experimental method. The experimental design used was Completely Randomized Design (CRD). Using 4 treatments with three replications for each treatment, among others

Treatment A : Feed without the addition of cinnamon flour

Treatment B : Provision of cinnamon flour 0.5 gr/100 gr of artificial feed

Treatment C : Provision of cinnamon flour 1 gr/100 gr of artificial feed

Treatment D : Provision of cinnamon flour 1.5 gr/100 gr of artificial feed

Fish rearing was carried out for 30 days with feeding three times a day at 07.00, 11.00 and 17.00 WIB with the amount of feed being 5% of the weight of the fish in each treatment. Kordi (2011) stated that the frequency of feeding 2-5 times a day resulted in good growth. In addition, siphoning is carried out every day to maintain water quality. The total volume of water siphoned is 10% of the maintenance container. Quality as a

support that is measured is temperature, pH and dissolved oxygen (DO). Water quality measurements are carried out once a week.

2.1. Making Cinnamon Flour

Making flour from cinnamon leaves by washing it with water until clean, then draining it and airing it. Dried cinnamon was ground and sifted through an 80 mesh sieve.

2.2. Cantang Fish Feed Supplies

The addition of flour from cinnamon leaves to the feed is according to the dosage, the addition is done little by little so that it is evenly mixed, then added enough water. Then let it dry for about 60 minutes. If during drying there is a change in color and smell, the feed is discarded and must be remade.

2.3. Parameters Observed Include

Survival Rate/Survival Rate (SR)

Fish survival was calculated manually by subtracting the initial number from the number that died so that the number of live fish was obtained at the end of the observation. The calculation of fish survival uses the formula according to (Penggabean et al, 2016), as follows:

SR = **Nt/No** ×**100%**

Information :

SR : Survival percentage (%)

Nt : Number of live fish at the end of rearing (tails)

No : Number of live fish at the beginning of rearing (tails)

2.3.1. BiomassGrowth

The formula used to calculate weight growth according to Panggabean et al, (2016):

W = **Wt -- Wo**

Information :

W : Biomass Gain (grams)

Wt : Final research fish biomass (grams)

Wo : Initial research fish biomass (grams)

2.4. FCR (Feeed Convertion Ratio)

FCR or feed conversion can be calculated by the formula (Panggabean et al, 2016)., namely:

$$FCR = \frac{F}{(Wt - D) - Wo}$$

Information:

FCR : Food Convertion Ratio

F : Total amount of feed given (grams)

Where : Fish biomass at the beginning of the study (grams)

Wt : Fish biomass at the end of the study (grams)

D : Weight of fish that died during the study (grams)

Based on the formulation of the problem that has been stated previously, the hypothesis to be tested in this study is as follows.

H_0 : The addition of cinnamon flour to feed with different doses is thought to have no effect on the growth of cantang grouper.

H_1 : The addition of cinnamon flour to feed with different doses is thought to have an effect on the growth of cantang grouper.

3. DATA ANALYSIS

Statistical data analysis used analysis of variance (ANOVA) to determine the effect of treatment. Before carrying out the analysis of variance, a pre-analysis is carried out which includes the normality test and homogeneity test. The data normality test was carried out using the Liliefors test (Sudjana, 1996) to determine the growth rate of each treatment which was normally distributed. Meanwhile, the homogeneity test of variance was carried out using the Bartlett test (Sudjana, 1996). The homogeneity test was carried out to see the similarity between two or more variants. If the results of the analysis of variance show that there are differences between the treatments, then the tukey test and water quality are carried out descriptively.

4. RESULTS AND DISCUSSION

4.1. Results

4.1.1. Increase in Cantang Grouper Biomass

Increase in seed biomass of cantang grouper weighed every 7 days for 30 days.

TABLE 1: Increase in Cantang Grouper Biomass (Gram) During Research.

Connected	Treatment				Total
	A	B	C	D	
1	2.83	4.76	3.50	3.13	
2	2.34	4.80	3.83	3.04	
3	2.69	4.47	3.76	3.03	
Amount	7.86	14.03	11.09	9.20	42.18
Rerata	2.62	4.68	3.70	3.07	

Information :

A : Feed without the addition of cinnamon flour.

B : Cinnamon flour 0.5 gr/100 gr feed.

C : Cinnamon flour 1 gr/100 gr feed.

D : Cinnamon flour 1.5 gr/100 gr feed.

Based on the data in the table above, it can be seen that the biomass of the cantang grouper has increased During the study according to the treatment of cinnamon flour with different doses, the average biomass was also different. The highest increase in biomass was shown in treatment B (0.5 g/100 g of feed), which was 4.68 g, followed by administration of cinnamon powder in treatment C (1 gr/100 g of feed) of 3.70 g, then treatment D (1.5 gr/100gr feed) of 3.07 g and the lowest was in treatment A which was 2.62 g.

Based on the results of the normality test and homogeneity test on the increase in cantang grouper biomass, it is known that for the normality test using the Liliefors method the data on the weight gain of cantang grouper biomass is L max (0.18) < L table (0.01) 0.275 and L table (0.05) 0.242 so that the data obtained is normally distributed (Appendix 3), and the results of the homogeneity test show that the data is homogeneous (Appendix 4), so the data can be tested by analysis of variance (ANOVA).

4.1.2. Analysis of Variances (ANOVA) of Absolute Biomass Growth

Calculation of data analysis of variance is presented in table 2 as follows:

TABLE 2: List of Absolute Biomass Growth Analysis of Cantang Grouper Fish.

SK	DB	JK	KT	F Count	F Table	
					5%	1%
Treatment	3	7.15	2.38	73.14**	4.07	7.59
Error	8	0.26	0.03			
Total	11	7.42				

Description: **Very Significantly Different

The results of analysis of variance on the increase in cantang grouper biomass can be seen that the calculated F value is greater than F table 1% and F table 5%, namely F (count) 73.14 > F (table 0.01) 7.59 and F (table 0 .05) 4.07, which means that the different doses of cinnamon powder had a very significant effect on the increase in cantang grouper biomass.

TABLE 3: Tukey Test Results.

Treatment	Rerata	Difference			
		D	C	B	A
B	4.68				
C	3.70	0.98**			
D	3.07	1.61**	0.63**		
A	2.62	2.06**	1.08**	0.45**	

Description: ** Very Significantly Different

The results of the tukey test on the growth of cantang grouper biomass showed that the data on the results of all treatments showed a highly significant different effect.

4.2. FCR (Feed Convertion Ratio)

FCR (Feed Conversion Ratio) results data are presented in table 4. As follows.

The best FCR value was obtained in treatment B, which was 1.15, followed by treatment C with a value of 1.34 and treatment D, namely 1.58. While the highest value was obtained in treatment A with a value of 1.76.

Survival Rate/Survival Rate (SR)

Table 4: Data Hasil Feed Convertion Ratio (FCR).

Information	Treatment			
	A	**B**	**C**	**D**
Where	3.55	3.94	3.56	3.69
Wt	6.17	8.62	7.26	6.75
F	4.60	5.40	4.95	4.86
FCR	**1.76**	**1.15**	**1.34**	**1.58**

The survival rate of cantang grouper fish can be known through observational data on the survival rate of cantang grouper seeds presented in the following table

Table 5: SR(Survival Rate) of Cantang Grouper.

Information	Cinnamon Flour Dosage Treatment			
	A	**B**	**C**	**D**
1	5	5	5	5
2	5	5	5	5
3	5	5	5	5
Amount	15	15	15	15
SR (%)	**100**	**100**	**100**	**100**

Based on the data in table 5, the survival rate of barramundi fry showed very good results in all treatments.

4.2.1. Water Quality

Data on the range of water quality during the maintenance period is presented in table 5 as follows.

Table 6: Water Quality Parameters During Research.

Treatment	Water Quality Parameters			
	Temperature (OC)	pH	DO (ppm)	**Salinity (ppt)**
A	29,5 – 30	7,2 – 7,6	4,0	**28 -- 32**
B	28 – 30	7,2 – 7,8	4,0 – 4,5	**25 -- 28**
C	28 – 30	7,4 – 7,7	3,5 – 4,0	**27 -- 30**
D	29,5 - 31	7,2 – 7,8	4,0	**28 -- 30**
Optimum Value	28 – 32	7,5 – 8,5	4,0	**24 -- 33**

Water quality parameters observed during the study were water temperature, water pH, dissolved oxygen in water and salinity. The range of water temperature during the study was between 28 - 31^{O}C, the pH of the water ranges from 7.2 – 7.8, dissolved oxygen ranges from 3.5 – 4.5 ppm and the salinity ranges from 25-32 ppt. The changes observed in the water quality parameters were still within the tolerance limit for the survival of the cantang grouper.

5. DISCUSSION

The highest growth was in treatment B due to cinnamon flour which is one of the phytopharmaca ingredients containing cinnamaldehyde which is used by fish in metabolic processes so that absolute growth in the treatment experienced an increase in growth. This is in accordance with the statement (Jayaprakasha and Rao, 2011) The content of cinnamaldehyde in cinnamon leaves can increase fat metabolism, in addition to functioning as an antioxidant. According to Takasao et al. (2012), adding the cinnamaldehyde content of cinnamon can activate insulin-like growth factor (IGF-1) which increases the biosynthesis of protein and collagen in body tissues thereby increasing protein deposition in the body to form muscle (meat).

5.1. FCR

The highest FCR value was found in treatment A and the lowest feed conversion ratio was found in treatment B, namely in the treatment of 0.5 gr/100 g cinnamon powder. Table 4 shows that the administration of cinnamon flour to the feed obtained a lower FCR than without the addition of cinnamon flour. This is presumably because of the cinnamaldehyde content in cinnamon leaves which can increase fat metabolism, in addition to functioning as an antioxidant (Jayaprakasha and Rao, 2011). In addition, the FCR value was caused by an increase in the digestibility value of the feed so that all the substances the amount of food eaten was less than without treatment. The addition of cinnamon leaf powder to feed can increase body protein, protein retention and protein digestibility (Setiawan et al, 2014). While the other ingredients of cinnamon flour are flavonoids, flavoniods can act as prebiotics or supplements for good bacteria which can increase the growth rate of bacteria.*Lactobacillus* which is good bacteria for fish. Flavonoids are secondary metabolite compounds produced by plants, these

compounds have a biological effect on growth, endurance, anti-stress, anti-bacterial, anti-viral and anti-fungal (Handayani, 2017). The low FCR value is supported by good feed quality. The different FCR values for each treatment indicated that the addition of cinnamon powder in the feed was better than without the addition of cinnamon flour. According to Saputra et al. (2018), that the low feed conversion value means the higher the feed efficiency and conversely the higher the feed conversion value, the lower the efficiency.

5.2. Survival Rate (SR)

Survival Rate is the percentage of fish that manage to survive out of all the fish kept. The results showed that the addition of cinnamon powder to the feed had no effect on the survival of the cantang grouper because the average survival rate from the beginning to the end of the study was 100%. Feed given through the addition of cinnamon flour or without the addition of cinnamon flour is able to provide sufficient energy and can be utilized by groupers for bodily activities so that the fish kept can continue their lives. The survival rate of fish is also influenced by water quality, stocking density, environmental conditions, nutrition and others. The factor that is often associated with survival is water quality. According to (Panggabean et al., 2016), water quality is the main factor determining the survival percentage of cultured fish because water is the main medium for fish life. In addition, good feed quality requires additional active compounds to maintain its survival rate. The additional compound used is cinnamon flour which has active chemical content, namely flavonoids, saponins, and tannins. According to (Withanawasam, 2002) alkaloid compounds, saponins, tannins and flavonoids can act as anti-inflammatory, antioxidant, antibacterial and antiviral. In addition, saponins, tannins and flavonoids can enhance the fish's immune response, and also stimulate fish growth and can maintain the balance of microorganisms in the water. Management of water and feed quality in good rearing containers and maintained for the life of cantang grouper fry. A good survival rate also proves a good and appropriate adaptation process so that it can survive and grow in controlled maintenance containers.

5.3. Water Quality

Water quality factors that play an important role in fish growth include temperature, dissolved oxygen content, degree of acidity (pH) and salinity (Carman, 2013). The

results of DO measurements during the study ranged from 3.5 – 4.5 ppm. This value is still feasible for cantang grouper cultivation, the recommended range is a minimum of 4 ppm Indonesian national standards (SNI, 2014), water quality requirements in the maintenance of cantang grouper. In accordance with the opinion (Anggraini et al, 2018, for good grouper cultivation 4-9 ppm.

Fish growth has decreased in environments with low pH (Carman, 2013). The results of pH measurements during the study ranged from 7.1 – 7.8, the measurement results were still fairly suitable for the maintenance of cantang grouper which was still within the recommended range of 7.5-8.5 by the Indonesian national standard (SNI, 2014), requirements water quality in the maintenance of cantang grouper. According to (Saputra et al., 2018) the pH value shows the number 5.5-8.5 which is still suitable for the maintenance of grouper seeds.

According to Kordi (2011), salinity is the average concentration of all salt solutions contained in water.The results of salinity measurements during the study ranged from 25–32 ppt. according to SNI, (2014), the salinity for the maintenance of cantang grouper ranges from 24-33 ppt.

6. CONCLUSION

Based on the results of the study, the addition of wood flour to commercial feed gave very significant results on the growth of cantang grouper and the best growth was obtained in the treatment of 0.5 gr/100 g cinnamon powder of feed with an average growth of 4.68 gr.

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