

The Effect of Earthworm Meal Addition as an Attractant in Feed on the Growth of Catfish (*Clarias gariepinus*)

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ABSTRACT

Keywords:
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Catfish is one type of carnivorous fish that can adapt to artificial feed formulations. attractants from animal sources such as earthworm meal can be used as attractants in feed. Attractants added to feed in small amounts can stimulate appetite and fish growth. This study aims to determine the best dose of earthworm meal addition as an attractant in feed so that it affects the growth of catfish. This study used experimental method of Completely Randomised Design (RAL) with 5 treatments and 3 replicates. The treatment used was the addition of earthworm meal attractant in catfish feed at a dose of 0% (A), 5% (B), 7,5% (C), 10% (D), and 12,5% (E). The results showed that the addition of 10% earthworm meal attractant in feed (Treatment D) was the best dose for catfish growth which was able to increase absolute length growth by 6,85 cm and specific growth rate (SGR) by 4,74%/day.

INTRODUCTION

Catfish (*Clarias gariepinus*) is one type of freshwater consumption fish that is included in the list of main commodities of aquaculture and is very prospective for cultivation in Indonesia. This is evidenced by the rapid development of catfish production centres both in the hatchery, breeding and enlargement segments (Harianto & Budiardi, 2021). Catfish production has a main market as a stock fulfilment, one of which is in the pecel lele sales business (Heriyanto et al., 2020). According to KKP (2023), the volume of national catfish cultivation production from 2020 - 2022 has increased. In 2020 catfish production was 993.768 tonnes, in 2021 it was 1.041.422 tonnes, and in 2022 it was 1.377.580 tonnes. The increase is due to the increasing needs and demand for catfish. Many people are interested in catfish for consumption because catfish has a high protein content, good taste, easy to process and a relatively affordable price (Ratnasari et al., 2020).

Increasing catfish production is inseparable from several factors, one of which is the availability of feed. Feed availability is the most important part of fish farming that affects fish growth (Tiyanto et al., 2022). Feed greatly affects the

process of fish farming activities due to the high cost of feed incurred ranging from 60%-70% of total production costs (Manullang et al., 2018). The obstacle faced in catfish farming is that feeding still relies on commercial feed whose prices tend to increase and are expensive. The high cost of commercial feed is inseparable from the high cost of protein source feed raw materials. Commercial feed has a protein content of 26%-30%, if the feeding management is poor and a lot of feed is not eaten due to low feed palatability, it can cause ammonia accumulation which can accelerate the decline in water quality in fish rearing media (Rohmana, 2009; Stickney, 2005). When water quality in catfish rearing media decreases, it can cause a decrease in fish feeding response and can make their growth slow. Efforts that can be made to increase the feeding response of fish for fast growth is the use of attractants from local alternative raw materials of animal sources as an additional ingredient in the manufacture of artificial feed formulations. Attractants are additives to feed in small amounts to stimulate fish appetite, increase feed consumption and fish growth (Khasani, 2013). One alternative local feed ingredient that can be used as an attractant is earthworm meal.

Earthworms that have become meal can be added as an attractant in the composition of artificial feed formulations because they contain quite complete amino acids (Amalia et al., 2019). The amino acid content in earthworms is an attractant substance, namely glycine, which can provide a more sensitive eating response in carnivorous fish species (Evans et al., 2013). Catfish is a type of carnivorous fish, so the selection of earthworm meal added as an attractant in artificial feed is expected to increase feed palatability and can spur growth.

Previous research conducted by Evans et al., (2013), the addition of earthworm meal attractants with different dosage levels in snakehead fish feed can increase the daily weight growth rate. The results of research by Amalia et al., (2019), the addition of earthworm meal attractants with different dosage levels in pangas catfish feed can increase absolute weight growth and specific growth rate. The results of research by Astino et al., (2021), the addition of earthworm meal attractants with different dosage levels in baung fish feed can increase the daily growth rate. Based on the results of previous studies, no research has been conducted on the addition of earthworm meal attractants to catfish feed, therefore this study aims to determine the best dose in the addition of earthworm meal as an attractant in feed so that it affects the growth of catfish.

LITERATURE REVIEW

Palatability is a characteristic of the physical and chemical performance of feed. Palatability is described by organoleptic characteristics such as appearance, smell, taste, texture, size, color and shape. These characteristics can increase the attraction and stimulation of fish to consume food. Feed palatability is closely related to the attractiveness provided by amino acids which in turn will influence

the search, absorption and swallowing response (acceptability) which is related to several amino acids such as taurine, glycine, arginine, alanine, betaine, nucleotides and organic acids (Grey et al., 2009; Guillaume et al., 2001). The level of palatability affects the amount of feed consumed by fish. The increasing amount of feed consumption indicates a high level of feed palatability, conversely, if the amount of feed consumption decreases then the level of feed palatability is low (Pamungkas, 2013).

The process of eating in fish begins with the stimulation of appetite caused by hunger, then continues with the response of looking for the source of food stimulation and eating the food. If the taste of the food is liked by the fish, then the food will be eaten. On the other hand, if the taste of the feed is not liked then the feed is not eaten (Noviana et al., 2014). Food that is not eaten or left for too long in the fish rearing medium can cause a buildup of ammonia which can accelerate the decline in water quality in the fish rearing medium (Stickney 2005 in Rohmana 2009). If the water quality in the fish cultivation medium decreases, it can cause a decrease in the fish's feeding response and can cause slow growth.

The addition of attractants to feed can increase palatability. When feed palatability increases, feed consumption and fish growth also increase (Ho, 2009). Feed that is given an attractant will have a distinctive smell that is fresher than feed that is not given an attractant, because the smell of the attractant and the taste of the food produced can stimulate fish to approach and consume the food provided. Feed odor is determined by the type and amount of attractant added during the feed manufacturing process (Afrianto & Liviawaty, 2005).

METHOD

Time and Location of Research

This research was conducted from February to April 2024 at the Aquaculture Laboratory, Faculty of Fisheries and Marine Science, Universitas Padjadjaran, Jatinangor.

Tools and Materials

The tools used in this research are aquarium size 25 cm x 25 cm x 4 cm, fibre tub, DO meter, mini grinder, heater, blower, stone and aeration hose, oven, millimeter block, pH meter, digital scale, 100 mesh sieve, fish scraping, potato ricer, and basin. The materials used in this study were 5-7 cm sangkuriang catfish fry, feed formulation consisting of fish meal, soybean meal, bran, yellow corn meal, earthworm meal, progol, and premix, unides aqua.

Research Methods

This study used a completely randomised design (RAL) experimental method consisting of 5 treatments and 3 replications. The treatments used were:

- A: without the addition of earthworm meal attractant in feed (control)
 B: the addition of 5% earthworm meal attractant in the feed
 C: addition of 7,5% earthworm meal attractant in the feed
 D: addition of 10% earthworm meal attractant in feed
 E: addition of 12,5% earthworm meal attractant in feed

Research Procedure

The manufacture of earthworm meal refers to Rahmawati & Wahyuni (2021), which is modified, namely the earthworms are cleaned with running water, then the earthworms are boiled for 5 minutes to remove mucus and microbes that are still attached, then the earthworms are oven for 5 hours at 60 ° C, the dried earthworms are ground using a mini grinder, after which the earthworm powder is filtered using a 100 mesh sieve to get fine meal grains.

The preparation of the test feed refers to Islama et al., (2023), which was modified, namely all feed ingredients were weighed according to the formulation, the feed ingredients were mixed one by one into a basin with warm water added and stirred until the mixture was well mixed, the dough was moulded using a potato ricer, the moulded feed was then dried in an oven at 60°C for 5 hours. After drying, the feed was cut and stored in a closed container away from direct sunlight. The test feed was formulated using the pearson square method with a protein content of 35% (iso-protein). The formulation results and feed nutrient content for each treatment can be seen in Table 1.

Table 1. Formulation and nutrient content of test feed

Material	Treatment (%)				
	A (0)	B (5)	C (7,5)	D (10)	E (12,5)
Fish Meal	37,23	33,26	31,27	29,28	27,30
Soy Meal	37,23	33,26	31,27	29,28	27,30
Bran	13,77	15,73	16,73	17,72	18,70
Yellow Corn Meal	6,78	7,75	8,24	8,73	9,21
Earthworm Meal	0	5	7,5	10	12,5
Binder (Progol)	4	4	4	4	4
Vitamin (Premix)	1	1	1	1	1
TOTAL (%)	100	100	100	100	100
Protein (%)	35,01	35,01	35,01	35,01	35,02
Fat (%)	6,73	6,52	6,41	6,31	6,20
Crude Fibre (%)	6,05	5,81	5,87	5,81	5,75

Source: Personal Calculation Results (2024)

Preparation of the test container begins with the aquarium, fiber tub, hose and aerator stone being sterilized using unides aqua, then rinsed with running water and dried for 24 hours. After drying, the aquarium is arranged and filled with

10 L of settling/aquarium water, then a heater and aeration installation is installed in the aquarium. Next, the preparation of the test fish begins with the catfish acclimatization process in a fiber bath for 10 days to avoid stress and ensure the fish are healthy. After that, the fish were put into the aquarium at a density of 10 fish/aquarium (1 fish/L).

Test fish were kept for 40 days. Feeding is carried out twice a day (08.00 and 16.00 WIB) with a feed amount of 5% of the fish biomass. Efforts to manage water quality include suctioning out dirt that settles at the bottom of the aquarium every three days and changing the water by 10% of the total water volume. Fish length and weight data were collected every 10 days, namely on the 0th, 10th, 20th, 30th and 40th days.

Research Parameters

Absolute Length Growth

Absolute length growth can be calculated using the formula according to Lucas et al., (2015), as follows:

$$L = L_t - L_0$$

Information:

L : Absolute length growth (cm)

L_t : Length of fish at the end of the study (cm)

L₀ : Length of fish at the start of the study (cm)

Specific Growth Rate (SGR)

The specific growth rate can be calculated using the formula according to Muchlisin et al., (2016), as follows:

$$SGR = \frac{\ln(W_t) - \ln(W_0)}{t} \times 100\%$$

Information:

SGR : Specific Growth Rate (%/day)

W_t : Weight of fish at the end of the study (g)

W₀ : Weight of fish at the start of the study (g)

t : Research time (day)

Water Quality

Water quality measured includes temperature, dissolved oxygen (DO) and acidity degree (pH). Water quality measurements were carried out every 10 days during the research period, namely days 0, 10, 20, 30 and 40.

Data analysis

The data obtained from observations of absolute length growth and specific growth rate were analyzed using analysis of variance (ANOVA) with a confidence level of 95%. If the results are significant and significantly different ($P < 0.05$), then proceed with Duncan's multiple range test to determine the differences between treatments and determine the best treatment. Data from water quality measurements were analyzed descriptively.

RESULT AND DISCUSSION

Absolute Length Growth

The results of observing the absolute length growth of catfish with the addition of earthworm meal attractant to the feed at different dose levels during 40 days of rearing can be seen in Table 2.

Table 2. Absolute Length Growth of Catfish

Treatment	Absolute Length Growth (cm)
A (without earthworm meal attractant)	2,91±0,29 ^a
B (5% earthworm meal attractant)	4,27±0,10 ^b
C (7,5% earthworm meal attractant)	5,40±0,54 ^c
D (10% earthworm meal attractant)	6,85±0,83 ^d
E (12,5% earthworm meal attractant)	6,01±0,22 ^c

Note: Different superscript letters indicate significantly different effects for each treatment ($p < 0.05$)

Based on Table 2, the highest absolute length growth value for catfish was in treatment D (10% Earthworm meal attractant) at 6,85 cm, followed by treatment E (12,5% Earthworm meal attractant) at 6,01 cm, treatment C (7,5% Earthworm meal Attractant) was 5,40 cm, treatment B (5% Earthworm meal attractant) was 4,27 cm and the lowest treatment was control treatment A (0% Earthworm meal attractant) at 2,91 cm. The results of analysis of variance (ANOVA) with a 95% confidence level showed that the addition of earthworm meal as an attractant to catfish feed had a significant effect ($P < 0,05$) on the absolute length growth of catfish.

The results of the research, adding earthworm meal as an attractant to catfish feed that was reared for 40 days, resulted in the highest absolute length growth, namely 6,85 cm in treatment D (10% Earthworm meal attractant), which gave higher results than the absolute length growth studied by Defrizal & Khalil (2015), stated that the addition of earthworm meal to the feed formulation for African catfish that were reared for 30 days resulted in absolute length growth of 5,23 cm and was much higher than the research results of Zainuri et al., (2017), the addition of various types of attractants to snakehead fish seed feed that were reared for 30 days resulted in absolute length growth of 1,24 – 1,33 cm. The high growth in absolute length of catfish in treatment D (10% Earthworm meal attractant) is not only caused by the nutritional balance contained in the feed formulation in treatment D, earthworm meal also contains attractive amino acids which enable the

fish to consume feed more quickly. according to Evans et al., (2013), earthworms contain quite a complete range of amino acids, including attractive amino acids such as glycine, proline and valine which provide a more sensitive feeding response in carnivorous fish. Catfish is a type of carnivorous fish that likes animal based feed, therefore the addition of earthworm meal attractant to feed has been proven to have a real effect in increasing the absolute length growth of catfish.

Specific Growth Rate

The results of observing the specific growth rate values for catfish with the addition of earthworm meal attractant to the feed at different dosage levels for 40 days of rearing can be seen in Table 3.

Table 3. Specific Growth Rate of Catfish

Perlakuan	SGR (%/day)
A (without earthworm meal attractant)	2,16±0,13 ^a
B (5% earthworm meal attractant)	3,18±0,16 ^b
C (7,5% earthworm meal attractant)	4,01±0,09 ^c
D (10% earthworm meal attractant)	4,74±0,12 ^e
E (12,5% earthworm meal attractant)	4,48±0,05 ^d

Note: Different superscript letters indicate significantly different effects for each treatment ($p < 0.05$)

The results of the Duncan test on specific growth rates in Table 3 show that the addition of earthworm meal as an attractant to catfish feed had a significant effect ($P < 0.05$) on the specific growth rate of catfish in each treatment. This research resulted in the highest specific growth rate in catfish of 4,74%/day, namely in treatment D (10% Earthworm meal attractant) which was maintained for 40 days. The specific growth rate observed by Amalia et al., (2019), the addition of 10% earthworm meal attractant to pangas catfish feed that was reared for 42 days resulted in a specific growth rate of 1,97%/day and the research results of Astino et al., (2021), The addition of 10% earthworm meal attractant to the feed of baung fish seed that was reared for 53 days resulted in a daily growth rate of 4,28%/day. Based on this, it can be said that catfish respond more quickly and digest food supplemented with earthworm meal attractant compared to other types of fish as evidenced by the higher specific growth rate values produced. According to Grasela et al., (2022), catfish is a type of fish that tends to be carnivorous and greedy in consuming food, catfish do not like food that comes from plant sources. The addition of earthworm meal as an attractant to catfish feed is very popular because it produces a distinctive smell which can increase the catfish's appetite so that the growth rate of the catfish increases. The higher value of the specific growth rate for catfish in treatment D (10% Earthworm meal attractant) is due to the quality of the feed in the treatment D formulation being good and balanced in accordance with the nutritional needs of catfish. Yanuar (2017), fish growth rate is influenced by the type and quality of feed as well as good environmental conditions. Feed is one of the

factors that greatly influences the specific growth rate of catfish. In accordance with Khasani (2013), the main factor that influences fish growth rate is feed, both in terms of nutritional content and quantity. Quality artificial feed, apart from having a high nutritional content, also has a high level of palatability. Fish will respond more quickly to food containing attractants because their sense of smell is stimulated by the distinctive odor produced from attractants through a receptor mechanism (Amalia et al., 2019).

In this study, all treatment feeds were formulated with iso-protein, namely 35%. These nutritional requirements are in accordance with the nutritional quality requirements for catfish feed according to SNI, (2006), namely protein min. 35%, fat min. 5% and crude fiber max. 6%. The high specific growth rate of catfish in treatment D (10% Earthworm meal attractant) was not only caused by supporting nutrition but also mainly due to the addition of attractant at the right dose in this study. In accordance with the research results of Evans et al., (2013), stated that the addition of earthworm meal attractant to snakehead fish feed at a dose of 10% provided optimal growth. According to Polat & Beklevik (1999); Zainuri et al., (2017), adding the right dose of attractant to feed can increase the speed of feed absorption, shorten the mixing time of feed nutrients in water, and at the same time provide additional nutrients for protein and energy metabolism. Catfish is a type of carnivorous fish that is active at night. Types of fish that are active at night usually like food that has a distinctive fishy odor because of their ability to rely on olfactory sensors so that if the food given has a distinctive odor it will respond quickly so that the absorption of nutrients will be faster by the fish's digestion (Hasyim et al., 2017). According to Julendra et al., (2010), stated that earthworms can act as feed additives to stimulate growth which can maximize nutrient absorption in the digestive tract, thereby stimulating growth. Earthworms also contain an anti-microbial substance called Lumbricine which is able to inhibit the development of pathogenic bacteria on the intestinal walls, if pathogenic bacteria in the digestive system are lost, the process of absorbing food substances will be faster and fish will not expend as much energy to digest their food substances. In addition, the worm's body does not have a skeleton (bones) so that feed containing worm meal can be digested more easily and quickly by the fish's intestines (Mullah et al., 2020).

Water Quality

The water quality measured during the catfish rearing period includes temperature, dissolved oxygen (DO), and degree of acidity (pH). The results of measuring the water quality of catfish rearing during the research can be seen in Table 4.

Table 4. Water Quality Measurement Results

Perlakuan	Parameter Kualitas Air		
	Suhu (°C)	DO (mg/L)	pH

A	26,1-29,8	6,0-7,3	6,9-7,4
B	26,1-29,0	6,1-7,8	6,9-7,4
C	26,2-29,3	6,3-7,4	7,0-7,6
D	26,2-29,0	6,0-7,8	7,0-7,7
E	26,5-29,3	6,0-7,7	7,0-7,3
SNI*	25-30	Min.3	6,5-8

Source: *SNI (2014)

Based on Table 4, the range of water quality values for catfish cultivation shows values that are in accordance with the Indonesian National Standard regarding water quality standard requirements for catfish cultivation (SNI, 2014). Based on this, it can be said that the addition of earthworm meal as an attractant in catfish feed does not have a negative impact on water quality. According to Arditya et al., (2019), the attractant added to the test feed was able to speed up the time the fish took the feed for consumption, so that the feed was consumed more quickly and there was no leftover feed that settled at the bottom of the rearing media. which can reduce water quality.

CONCLUSION

The addition of 10% earthworm meal attractant to the feed (Treatment D) was the best dose for catfish growth which was able to increase absolute length growth by 6.85 cm and specific growth (SGR) by 4.74%/day.

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