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Effect of the Addition of *Allium sativum* and *Curcuma domestica* on Catfish (Clarias sp.) Cultured in a Biofloc System

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Abstract
Catfish, as an economic commodity in Indonesia, is experiencing growth in line with the need for increased production. This study aimed to determine the effect of adding garlic and turmeric feed additives to catfish using a biofloc system. This study used a completely randomized design with three treatments, one control, and three replications for each treatment. Observed parameters included weight and length increase, daily growth rate, feed conversion ratio, and survival rate. Supporting parameters observed included water quality, including temperature, pH, DO, and ammonia. The results showed that the addition of turmeric and garlic at different percentages significantly affected absolute weight and length, daily growth rate, and survival rate of catfish. Furthermore, the addition of turmeric and garlic significantly improved the feed conversion ratio and feed efficiency. The addition of turmeric and garlic in the P1 treatment (5 g lactobacillus + 11 g garlic + 7.5 g turmeric) consistently produced the best results in terms of catfish growth characteristics and feed conversion ratio. Addition of turmeric and garlic as feed additives not have any impact to water quality.

Keywords: Biofloc system, Catfish, Garlic, Growth, Turmeric.

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1. Introduction

Catfish is a leading economic commodity in Indonesia. Demand for catfish continues to increase in line with increasing awareness of protein consumption derived from fish. Therefore, catfish cultivation continues to be improved through high stocking densities, one of which is utilizing the biofloc system. Biofloc is a technology that uses bacteria, both heterotrophic and autotrophic, to intensively convert organic waste into a collection of microorganisms called flocs, which can then be utilized by fish as a food source. Flocs contain several constituent organisms, including bacteria, plankton, fungi, algae, and suspended particles, which influence the structure and nutritional content of the biofloc (Patma *et al.*, 2020).

Fish cultivated in intensive systems, including biofloc, are susceptible to stress due to poor water quality if not managed properly. Cultivation media contaminated by waste from feed residues, fish excretion, and feces cause stress to the fish, resulting in slow growth and disease infection (Sukendar *et al.*, 2016). One way to improve fish growth and immunity to prevent disease is by providing supplemental feed or feed additives. Garlic and turmeric are ingredients that can

be added as feed additives. Garlic (*Alliium sativum*) is a flavoring and traditional medicine used to improve health because it can boost immunity (Permatasari, 2025). Garlic has the ability to increase serum catalyst activity and lower plasma glucose levels in fish (Nwabueze, 2012). A previous study (Rijal *et al.,* 2021) found optimal results when adding garlic to tilapia feed using a biofloc system at 22.5 g/kg of feed.

Turmeric (*Curcuma domestica*) is a rhizome containing 9.61% curcumin, 1-3% essential oil, 8% protein, 3% fat, 30% carbohydrates, and mineral salts such as phosphorus, iron, magnesium, and vitamin C (Sukendar *et al.,* 2021). Curcumin in turmeric is an active ingredient that can increase animal appetite (Prastiyo *et al.,* 2025). Previous research (Haetami *et al.,* 2023) indicated that the optimal dose of turmeric extract added at 15 ml/kg of feed can increase growth in catfish. Based on this finding, research is needed to determine the optimal dose of garlic and turmeric added to catfish feed using a biofloc system on their growth response. This study aimed to determine the effect of adding garlic and turmeric feed additives to catfish using a biofloc system.

2. Methods

2.1 Study Site and Treatment

This research was conducted from June 1-30, 2025. The location of this research was in Pandu Jotosanur Village, Lamongan. Study This study used a completely randomized design (CRD) with four treatments, each repeated three times (Table 1).

Table 1. Design Treatment for one kg feed

No	Code	Treatment feed (dose/kg)
1	P0	5 g *of lactobacillus*
2	P1	5 g *lactobacillus* + 11 g Garlic + 7.5 g Turmeric
3	P2	5 g *lactobacillus* + 16 g Garlic + 11 g Turmeric
4	P3	5 g *lactobacillus* + 22 g Garlic + 15 g Turmeric

2.2 Procedure Work

The container used in this study was a circular pond with a diameter of 1.5 m. Before use, the pond was thoroughly washed and left to stand for one day. Then, the pond was filled with 1000 L of water. A total of 21 g of salt was dissolved in the rearing medium, followed by 4 ml of probiotics and 16 ml of molasses. Wait approximately two weeks for the medium to be ready. The fish used in this study was catfish measuring 5 cm in length with an average initial weight of 6 g. Prior to the study, the fish underwent a 7-day acclimatization process with commercial feed. After the acclimatization process was complete, the fish fry were transferred to the rearing pond with a stocking density of 1,000 fish per pond.

The feed prepared in this study was commercial feed (pellets) with a crude protein content of 31%, crude fiber 8%, crude fat 5% with energy 2.01 kcal/g mixed with commercial garlic flour and commercial turmeric flour. The mixing method was to dissolve the garlic flour and turmeric flour according to the specified treatment dosage in 100 mL of water per 1 kg of feed and mix it into the feed. Then, it was dried for 15 minutes at room temperature or air-dried.

The fish were reared for 30 days, with growth checks conducted every 15 days. Growth checks included measuring the body weight and length of the fish by randomly sampling 10 fish. Feeding was carried out twice a day, with a dose of 5% of the biomass weight of the fish in the breeding pond. The calculation of feed at 5% of biomass weight is adjusted according to biomass calculations performed periodically. Water quality is also checked every 10 days, with parameters tested including pH, temperature, DO, and ammonia.

2.3 Data Analysis

Growth parameters observed in the study This is level continuity live (SR), weight absolute (W), length absolute (L), rate growth daily (LPH), ratio conversion feed (RKP) and efficiency feed

(EP) using Takeuchi (1988) protocol. Data were tabulated using Microsoft Excel 2019, and then an analysis of variance (ANOVA) test was performed using SAS 9.4 to determine the effect of the experiment. If a significant effect was observed between the treatments, a Duncan test with a 95% confidence interval was performed to determine the best treatment.

3. Results

The results of this study showed that the Anova test of the addition of garlic and turmeric to catfish feed with a biofloc system found that the survival rate, absolute weight, absolute length, daily growth rate, feed conversion ratio and feed efficiency had a significant effect ($P< 0.05$). The results showed that a dose of 11 g of garlic and 7.5 g of turmeric (P1), as well as a dose of 16 g of garlic and 11 g of turmeric (P2) had a significant impact ($P <0.05$) on the survival rate with values of 95 ± 1.08a and 90 ± 2.27ab (Figure 1). Meanwhile, the addition of a dose of 11 g of garlic and 7.5 g of turmeric had a significant impact ($P<0.05$) on the absolute weight of 38.53±0.85a (Figure 2), absolute length of 12.7±0.17a (Figure 3), daily growth rate of 6.58±0.18a (Figure 4), feed conversion ratio of 1.14±0.02c (Figure 5) and feed efficiency of 0.88±0.02a (Figure 6).

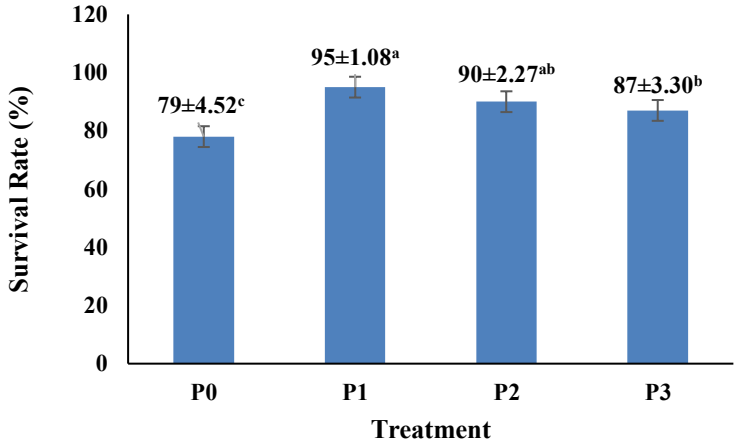

Figure 1. Effect of garlic and turmeric as feed additives on survival rate.

Notes: P0: 0 g garlic and 0 g turmeric, P1:11 g garlic and 7.5 g turmeric, P2: 16 g garlic and 11 g turmeric, and P3: 22 g garlic and 15 g turmeric. The mean ± standard deviation (n=3) followed by different letters indicate significant differences ($P<0.05$) based on DMRT α=5%.

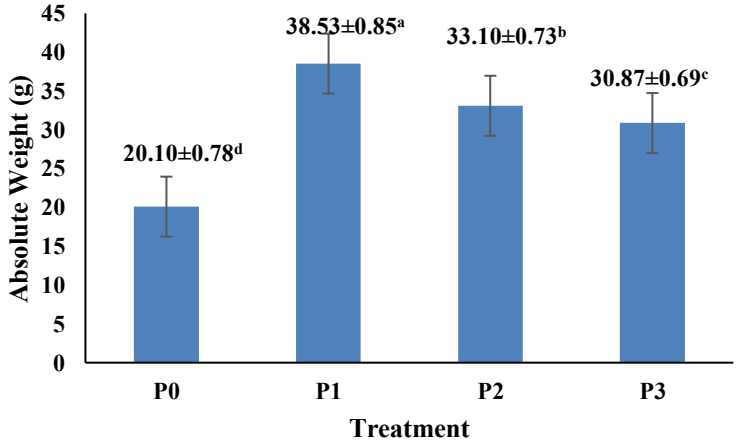

Figure 2. Effect of garlic and turmeric as feed additives on absolute weight.

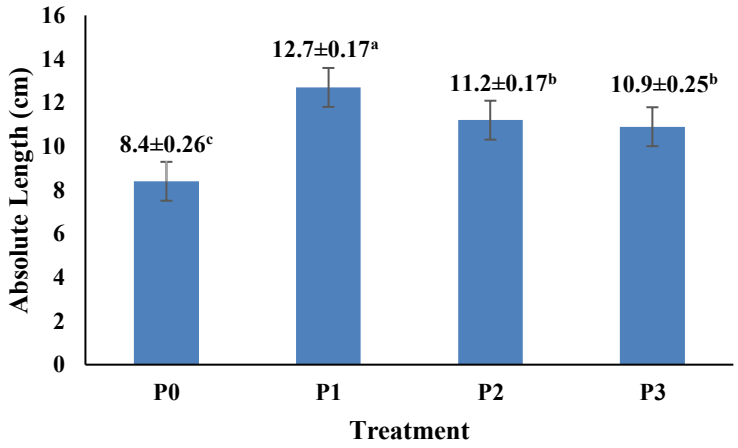

Figure 3. Effect of garlic and turmeric as feed additives on absolute length.

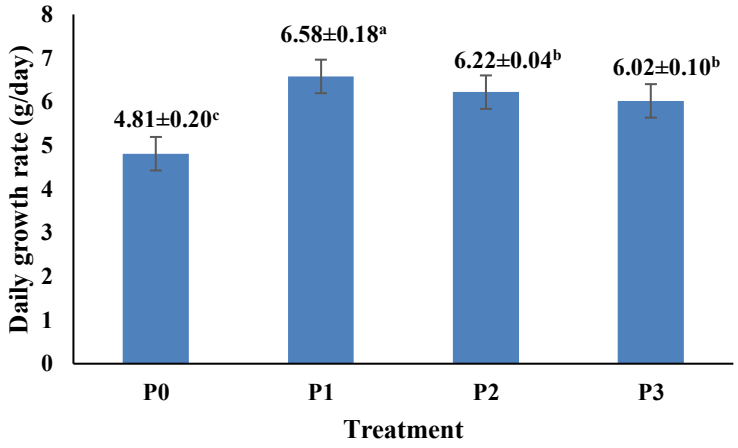

Figure 4. Effect of garlic and turmeric as feed additives on daily growth rate.

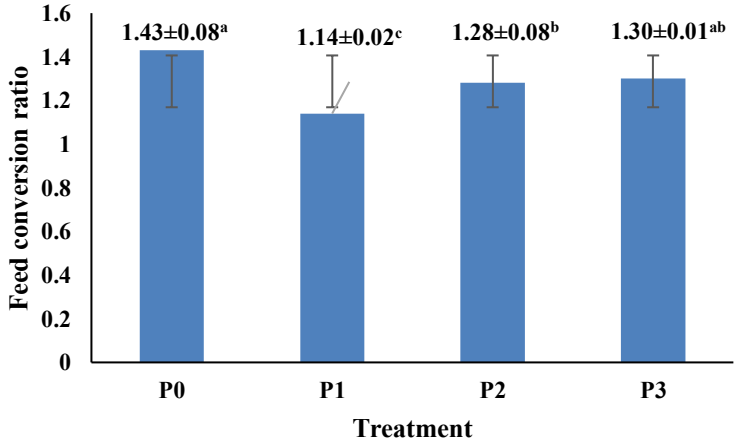

Figure 5. Effect of garlic and turmeric as feed additives on of feed conversion ratio.

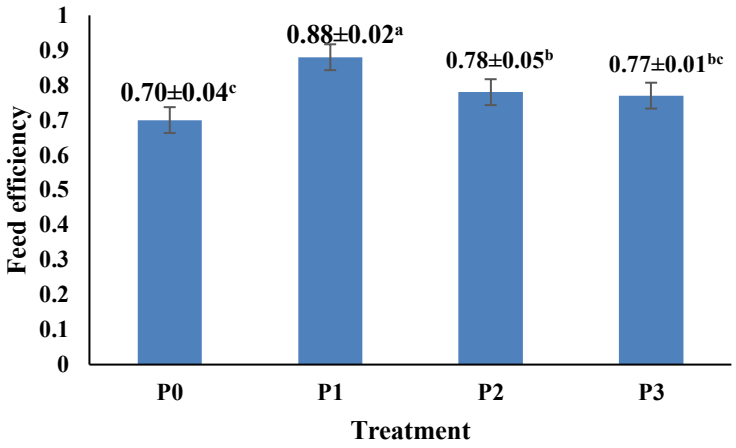

Figure 6. Effect of garlic and turmeric as feed additives on feed efficiency.

The results of water quality measurements including pH, temperature, dissolved oxygen and ammonia are presented in Table 1. Where the water quality is still in the good range to support the growth of catfish.

Table 1. Measurement results water quality

Treatment	pH	Temperate(° C)	Dissolved oxygen (mg/L)	Ammonia (mg/L)
P0	6.7 – 7.4	27.5 – 29.8	4.57 – 5.29	0.12 – 0.20
P1	6.8 – 7.3	27.2 – 28.9	4.72 – 5.84	0.10 – 0.18
P2	6.7 – 7.2	27.3 – 29.2	4.43 – 5.94	0.14 – 0.21
P3	6.9 – 7.4	27.2 – 29.1	4.27 – 5.54	0.12 – 0.23

Notes: P0: 0 g garlic and 0 g turmeric, P1:11 g garlic and 7.5 g turmeric, P2: 16 g garlic and 11 g turmeric, and P3: 22 g garlic and 15 g turmeric.

4. Discussions

The growth of catfish body weight shows that there is an increase in weight in P1 (11 g of garlic and 7.5 g of turmeric) the largest is 38.53 ± 0.85 g, then P2 (16 g of garlic and 11 g of turmeric) is 33.10 ± 0.73 g, then P3 (22 g of garlic and 15 g of turmeric) is 30.87 ± 0.69 g, and the smallest in P0 (0 g of garlic and 0 g of turmeric) is 20.10 ± 0.78 g. This occurs because the pellet feed used has been given additional garlic and turmeric with different doses to increase appetite in catfish. According to Pudiarianti and Farizal (2022), based on the results of the phytochemical test of single garlic ethanol extract, the garlic content is as follows: positive containing Alkaloids, Flavonoids, Saponins, Tannins and negative containing Steroids. In previous research, garlic also worked well as an antibacterial against *Staphylococcus aureus* with an extract concentration of 100%, having an inhibition zone diameter of 9 mm, with (moderate) antibacterial strength. Siddique (2025) added that garlic contains bioactive compounds such as allicin, diallyl sulfide, and other sulfur compounds that have antibacterial and antioxidant activity. These compounds can suppress the growth of aquatic pathogens (e.g., *Aeromonas hydrophila*, *Edwardsiella* spp.). By reducing the pathogen load, fish experience less disease stress, thus increasing the potential for feed conversion and weight gain.

In the growth of the increase in length of catfish in P1 (11 g of garlic and 7.5 g of turmeric) the largest is 12.7 ± 0.17 cm, then P2 (16 g of garlic and 11 g of turmeric) is 11.2 ± 0.17 cm, then P3 (22 g of garlic and 15 g of turmeric) is 10.9 ± 0.25 cm and the smallest in P0 (0 g of garlic and 0 g of turmeric) is 8.4 ± 2.6 cm. Fish can develop and grow quickly if the food consumed is in accordance with the type of feed given and the amount of feed, then a fish can grow and develop quickly. The growth of sangkuriang catfish occurs due to the supply of energy contained in the feed. The energy contained in the feed consumed by catfish exceeds the energy needs needed for body maintenance and other body activities, so that the excess energy is used for growth. Growth

rate is closely related to the digestive process, the better the fish are at digesting feed, the higher their growth rate will be (Silalahi, 2024).

The daily growth rate of catfish in P1 (11 g of garlic and 7.5 g of turmeric) was 6.58 ± 0.18, then P2 (16 g of garlic and 11 g of turmeric) was 6.22 ± 0.4, then P3 (22 g of garlic and 15 g of turmeric) was 6.02 ± 0.10 and the smallest in P0 (0 g of garlic and 0 g of turmeric) was 4.81 ± 0.20. In previous research by Pangaribuan (2022) catfish fed with garlic and black garlic extraction treatments had high levels of immunity, this was because garlic and black garlic contained allicin compounds which could increase the immune system in fish thereby stimulating fish appetite and accelerating the growth of catfish. In biofloc systems, the antibacterial effects of garlic have the potential to alter the composition of the water and biofloc microbiota. These changes can be beneficial (reducing opportunistic pathogens), but excessive doses can disrupt the beneficial microbial community (Siddique *et al.,* 2025).

In the Survival Rate (SR) in this study, the largest catfish in P1 (11 g of garlic and 7.5 g of turmeric) was 95 ± 1.08%, then P2 (16 g of garlic and 11 g of turmeric) was 90 ± 2.27%, then P3 (22 g of garlic and 15 g of turmeric) was 87 ± 3.30% and the smallest in P0 (0 g of garlic and 0 g of turmeric) was 79 ± 4.52%. In previous research, Wulandari and Junianto (2024), Garlic (*Allium sativum*) is one of the functional plants that can be used for health, one of which is as an ingredient that can increase immunity. The content in garlic that makes it can be used as an immunostimulant is Allicin content, and followed by saponins, selenium, vitamin C and polysaccharides which all have roles as anti-microbials and anti-inflammatory. Thus, the use of garlic and turmeric in catfish feed can increase immunity and also affect the survival rate of the catfish.

In the feed conversion ratio, in this study, the smallest catfish in P1 (11 g of garlic and 7.5 g of turmeric) was 1.14 ± 0.02, then in P2 (16 g of garlic and 11 g of turmeric) it was 1.28 ± 0.08, then in P3 (22 g of garlic and 15 g of turmeric) it was 1.30 ± 0.01, then for the largest feed conversion ratio in P0 (0 g of garlic and 0 g of turmeric) it was 1.43 ± 0.08. In previous research (Robbani 2023), the formed Biofloc has the potential as an additional feed that has protein-rich nutrition that can increase growth and increase efficiency. Factors that influence the high and low feed efficiency are each type of feed source and the nutritional content of the feed. So the use of biofloc and the addition of active ingredients in this study also greatly affect the value of the feed conversion ratio.

In this study, using the highest dose at P3 (22 g of garlic and 15 g of turmeric), then the next dose is P2 (16 g of garlic and 11 g of turmeric), then P1 (11 g of garlic and 7.5 g of turmeric) and the smallest dose is P0 (0 g of garlic and 0 g of turmeric). Of the four treatments, the optimal dose is P1 (11 g of garlic and 7.5 g of turmeric), both in terms of growth in catfish weight, growth/increase in catfish length, growth rate or feed conversion ratio. The best percentage of turmeric and garlic in the feed is treatment P1 for absolute growth in weight and length of catfish, this is because the ratio of the composition of the mixture of turmeric and garlic is right or appropriate for the growth of catfish.

This is according to Haetami *et al* (2023) The percentage of turmeric and garlic in the feed functions as an antioxidant, increases appetite, increases the growth of catfish. According to Sari et al, 2014 garlic functions to facilitate digestion and increase appetite. According to Pudiarianti and Farizal (2022), based on the results of the phytochemical test of single garlic ethanol extract, the garlic content is as follows: positive for Alkaloids, Flavonoids, Saponins, Tannins and negative for Steroids. In previous studies, garlic also works well as an antibacterial against Staphylococcus aureus with an extract concentration of 100%, having an inhibition zone diameter of 9 mm, with (moderate) antibacterial strength. The impact of excess turmeric and garlic is to cause deposits in the body that disrupt the balance of the fish's body, causing stress and even death (Wulandari *et al.,* 2024).

The results of water quality measurements during the study produced temperatures ranging from 27.2 - 29.2 0C. According to Effendi (2013) that the feasibility of life and growth of catfish is 26.5 - 31 0C. Temperature greatly affects the survival and growth of catfish. Temperature is inversely proportional to the saturation concentration of dissolved oxygen and directly proportional to the rate of consumption and metabolism of fish in water. (Boyd, 1982) in Prihatini,

2013). Nilson (2004) added dissolved oxygen saturation has a close positive relationship with the rate of oxygen consumption and metabolic activity of fish. Adequate DO to saturation allows fish to maintain efficient aerobic respiration, supports energy metabolism, and improves overall physiological performance. The NH_3 content during the study ranged from 0.12-0.23 mg/liter, this is still within the feasibility of catfish maintenance. in a biofloc system below 0.5 (Darmawan, 2007; Suprapto and Samtafsir, 2013). The NH_3 range that can be tolerated for the survival and growth of catfish ranges from 0 - 0.5 mg/liter (Effendi, 2013).

Dissolved oxygen measurements during the study showed between 4.27 - 5.94 mg / liter. This is in accordance with the opinion of Suprapto and Samtafsir (2013) is still suitable for catfish maintenance with a biofloc system above 4 mg / liter. Also according to the opinion of Fanani *et al.,* (2018) the maintenance of biofloc catfish dissolved oxygen content between 4 - 8 mg / liter Oxygen in the biofloc system is very necessary for bacteria to decompose feed waste, fish waste is converted into flocs that will be eaten by catfish. The results of pH measurements during the study showed between 6.7 - 7.4. This is in accordance with the opinion of Effendi, (2013) the suitability of water quality, pH between 6.5 - 8.5 for catfish maintenance, According to the opinion of Darmawan (2007) that the feasibility of fish cultivation, biofloc catfish pH is 6.5 - 7.5.

5. Conclusion

Addition of turmeric and garlic at different percentages significantly affected absolute weight and length, daily growth rate, and survival rate of catfish. Furthermore, the addition of turmeric and garlic significantly improved the feed conversion ratio and feed efficiency. The addition of turmeric and garlic in the P1 treatment (5 g lactobacillus + 11 g garlic + 7.5 g turmeric) consistently produced the best results in terms of catfish growth characteristics and feed conversion ratio. Addition of turmeric and garlic as feed additives not have any impact to water quality.

6. Acknowledgements

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