Improving Growth Performance of Redtail Catfish (*Hemibagrus nemurus*) on Low Stocking Density through Monosodium Glutamate Dietary Supplementation

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ABSTRACT

This study investigated the different supplementation doses of MSG in diets on growth performance and blood chemistry profiles of redtail catfish under low stocking density condition (10 fish/rearing container). This study applied a completely randomized design with five dietary MSG supplementation dose treatments and four replications, namely 0 g/kg diet (K), 0.5 g/kg diet (M1), 1 g/kg diet (M2), 1.5 g/kg diet (M3), and 2 g/kg diet (M4). The 10 fish (58.70±7.20 g) were stocked in a net cage (2 m × 1 m × 1 m) at 20 m × 10 m pond. Fish were fed with different MSG supplemented diets and reared for 45 days. In growth performance, parameters were composed of, weight gain (WG), feed intake (FI), specific growth rate (SGR), and survival rate (SR). All data were analyzed using a one-way analysis of variance (ANOVA) to determine the significant effect among treatments, then further analyzed using the Duncan's multiple range test (DMRT). Different dosage of MSG dietary supplementation showed a significant difference on each observed parameter. For growth performance, the M3 dose obtained the highest WG (5,133±0,825 g) and SGR (0,187±0,014 %/day), but showed no significant difference with other dose. Also, the K dose showed significant difference with other doses on FI (825,67±10,10 g) and SR (93,33±6,67 %) but SR showed no significant difference with M2, M3, and M4 (90,00±5,77 %, 83,33±8,81 %, 86,67±3,33 %). Therefore, this study concludes a positive effect of 1,5 g/kg diet MSG to improve the growth performance (WG and SGR).

Keywords: *Blood, Catfish, Growth, MSG.*

INTRODUCTION

The beong fish (*Hemibagrus nemurus*) is an endemic freshwater fish from the Progo River in the Magelang region (9). Beong fish have the potential to be developed into superior fishery products in the aquaculture sector. However, the beong fish population has significantly declined due to overfishing and imbalanced breeding practices. One of the efforts to develop fisheries businesses in anticipation of decreased catches from public waters is to carry out sustainable aquaculture development (15). Research on beong fish continues to be conducted to identify the most effective cultivation activities for the beong fish. Cultivation of beong fish has been trialed in several locations in the Magelang area, one of which is the Fish Seed Center or Balai Benih Ikan (BBI) (3).

BBI Sawangan has been sustainably cultivating beong fish and has begun selling them directly to the local community. However, the survival rate during the maintenance of these fish only reaches about 30-50% (13). his is due to the cannibalistic nature of beong fish, which causes them to attack each other. Cannibalism often arises from the varying sizes of the fish and low feeding frequency. The disparities in size and inadequate feeding can intensify competition for food, causing some beong fish to be marginalized (1). Therefore, research focused on reducing cannibalism in beong fish is essential, particularly in exploring the use of feed additives to improve feed efficiency, growth, and minimize cannibalism. Monosodium glutamate is one potential feed additive that can be incorporated into beong fish feed.

Monosodium glutamate (MSG) is a compound resulting from the interaction between glutamic acid and sodium salt (8). This substance can be produced through the fermentation of sugarcane molasses, utilizing the *Brevibacterium lactofermentum* bacteria, which synthesize glutamic acid compounds. The combination of these compounds with sodium carbonate leads to the formation of MSG (4). The discovery of MSG dates back to 1908, when Kikunae Ikeda identified its presence in *Laminaria japonica* seaweed. MSG plays a significant role in stimulating taste receptors, thereby facilitating the umami flavor experience that enhances sensory perception and appetite (2). Furthermore, the glutamate in MSG supports liver function, improving metabolic processes and aiding in stress regulation (7).

Previous research on monosodium glutamate (MSG) as a feed additive in fish has demonstrated its efficacy in enhancing feed efficiency and growth in African catfish (*Clarias gariepinus*), achieving a feed efficiency value of 96.4%, a specific growth rate of 3.79% per day, and an absolute growth of 109.5 g at a dosage of 0.87% MSG (10). Additionally, the incorporation of 1% MSG into the feed of carp (*Cyprinus carpio*) resulted in a feed efficiency value of 59.91% and a specific growth rate of 3.51% per day (14). According to (6), the inclusion of 2 g/kg MSG in the feed of *Lophiosilurus alexandri* yielded a survival rate of 88.33% and a specific growth rate of 2.55% per day. However, research investigating the impact of MSG in commercial feed on catfish growth performance has yet to be conducted, necessitating further studies to evaluate the effectiveness of MSG supplementation in commercial feed for enhancing catfish growth performance.

MATERIAL AND METHODS

This study was conducted at the Sawangan Fish Hatchery from July to August 2024. Redtail catfish fish were reared for 45 days in hapa cages measuring 2x1x1.5 m^3, with 10 fish net cage. The redtail catfish fish used were 11-15 cm in size. The research employed an experimental method using a Completely Randomized Design (CRD) with 5 treatments and 4 replications. Treatment K was the control without MSG addition, M1 used commercial feed with 0.5 g/kg MSG, M2 with 1 g/kg MSG, M3 with 1.5 g/kg MSG, and M4 with 2 g/kg MSG. Each feed treatment was given *ad satiation* in the morning and evening. The research parameters included weight gain (Wg), total feed consumption (FI), specific growth rate (SGR), and survival rate (SR). The parameter data were analyzed using ANOVA, followed by Duncan's multiple range test for further analysis.

RESULT

Based on the Table 1, the absolute weight (WG) of each treatment was not significantly different with a p-value of (0.611)> 0.05, the total feed consumption (FI) of each treatment showed a significant difference with a p-value of (0.002)< 0.05, the specific growth rate of each treatment was not significantly different with a p-value of (0.568)>0.05, and the survival rate (SR) of each treatment was also not significantly different, with a p-value of (0.116)> 0.05.

Table 1. ANOVA result

Parameters	Level of Knowledge	
	p-value	α 5%
Wg	0.611	>0,05
FI	0.002	<0,05
SGR	0.568	>0,05
SR	0.116	>0,05

Figure 1 shows the weight gain in each treatment with MSG supplementation. The MSG dose in treatment M3 provided the highest weight gain compared to other treatments. Although other treatments showed an increase, there was no significant difference among treatments, with a p-value (0.611)>0.05. This suggests that MSG at M4 can effectively increase fish weight.

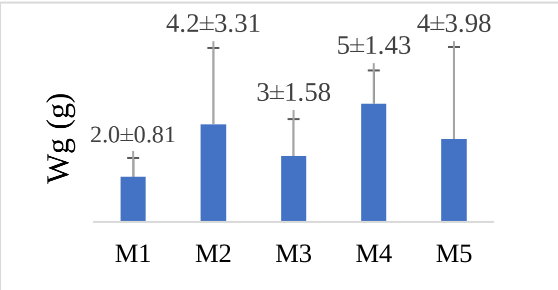

Figure 1. Weight gain

Figure 2 shows significant differences among treatments, with p-value (0.002)<0.05. The M1 showing the highest feed intake. Increased feed intake does not necessarily correlate with significant weight gain or growth rate. The high feed intake in the control may be due to greater adjustment to basic nutritional needs. Treatment with MSG in M3 provided better feed efficiency, despite the lower feed intake

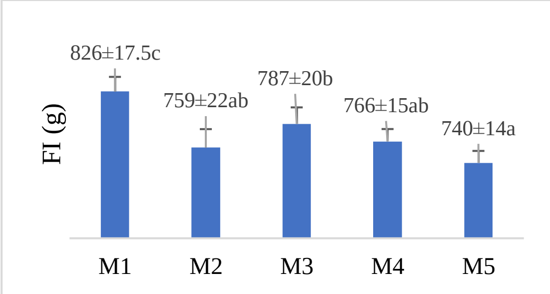

Figure 2. Feed intake

Figure 3 illustrates the specific growth rate for each treatment, with treatment M3 showing the highest SGR. This indicates that MSG supplementation at a dose of 1.5 g/kg supports an increase in growth efficiency. Although there are differences among treatments, the results do not show strong statistical significance, with a p-value (0.568)>0.05. This suggests that the MSG dose of 1.5 g/kg may be more optimal in enhancing the growth rate.

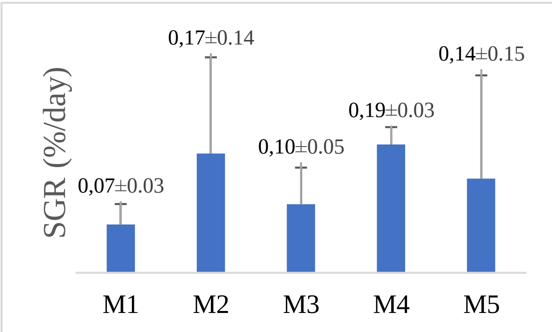

Figure 3. Specific growth rate

Figure 4 shows the fish survival rate in each treatment, with no significant differences observed. Treatments without MSG and doses of 1 g/kg, 1.5 g/kg, and 2 g/kg showed similar survival rates, with a p-value (0.116)> 0.05. This indicates that MSG supplementation at different doses does not significantly affect fish survival. All treatments showed stable survival rates, demonstrating that MSG is safe to use at the tested doses.

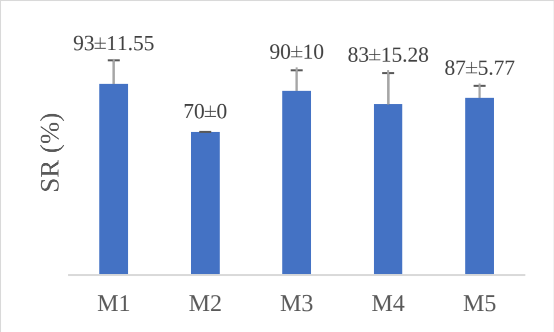

Figure 4. Survival rate

DISCUSSION

The results indicate that the addition of MSG at a dose of 1.5 g/kg (M3) resulted in the highest weight gain, though it was not significantly different from other doses. This suggests that MSG may enhance fish growth by improving feed palatability and nutrient assimilation, which in turn stimulates appetite and growth (11). The umami taste of MSG likely plays a role in increasing feed intake efficiency, as seen in studies on other fish species that showed similar improvements with MSG (12). Thus, while weight gain was not statistically significant among treatments, MSG appears to contribute positively to the fish's ability to utilize nutrients for growth. MSG plays a role in increasing glutamate levels in the fish's body. Glutamate can be used to detoxify ammonia into glutamine (5). However, this detoxification process reduces the amino acids required for body development. The glutamate in MSG can replenish the glutamate used for converting ammonia into glutamine (10).

The significant variation in feed intake among treatments, particularly with the control group consuming the most feed, raises interesting considerations. Higher feed intake in the absence of MSG might indicate that fish are compensating for a lack of enhanced flavor or nutrient attraction found in MSG-supplemented diets (17). However, despite consuming more feed, the control group did not achieve higher growth rates, implying that the addition of MSG may make feed utilization more efficient (18). This finding aligns with previous research that suggests MSG can increase feed conversion efficiency, reducing the need for excess feed intake.

Although treatment M3 had the highest SGR, differences in SGR among treatments were not statistically significant, indicating that all doses of MSG tested may generally support growth without drastically altering growth rates. The lack of significant differences might suggest that, beyond a certain threshold, MSG's effect on growth does not increase proportionally with dosage. This points to a potential optimal MSG dose for SGR, as higher doses (M4) did not yield better growth rates. Future studies could focus on refining this dose to confirm the most effective concentration for sustainable growth in fish.

The SR values in this study better than those reported by (16), where SR ranged between 50-77%. The similar survival rates across treatments highlight that MSG did not negatively impact fish health, as all groups maintained stable survival rates. Cannibalism, a known challenge in rearing redtail catfish, was not notably affected by MSG supplementation, suggesting that factors such as stocking density and feeding frequency might play a more crucial role in survival than MSG dosage (6). The stable survival rates imply that MSG is safe to use in aquaculture at the tested concentrations, providing an additional benefit without risking fish mortality (3). This outcome aligns with the hypothesis that MSG might support stress resilience, enhancing fish health in crowded environments.

The results of this study have practical implications for aquaculture feed formulation, as MSG appears to enhance growth performance without increasing mortality rates or requiring higher feed intake (7). For aquaculture practitioners, adding MSG to feed at an optimal dose could improve feed efficiency, potentially reducing overall feed costs while supporting healthy growth. This study also emphasizes the importance of balancing feed additives with fish behavior and environmental factors, as MSG's effects might differ with changes in these conditions.

Future research should consider a longer study duration and explore different MSG doses to fine-tune its effects on growth performance, feed efficiency, and overall health. Additionally, examining how MSG interacts with other common feed additives could offer insights into developing more effective feed formulations. Other variables, such as stress markers, immune response, and behavioral changes, should also be assessed to understand the broader impact of MSG in aquaculture settings fully.

CONCLUSION

The study titled "Improving Growth Performance of Redtail Catfish (*Hemibagrus nemurus*) on Low Stocking Density through Monosodium Glutamate Dietary Supplementation" concludes that dietary supplementation of monosodium glutamate (MSG) positively impacts the growth performance of redtail catfish. Specifically, the dosage of 1.5 g/kg diet (M3) yielded the highest weight gain (WG) and specific growth rate (SGR) during the 45-day trial. The results indicate significant differences in various growth parameters, such as weight gain, feed intake, and survival rates among the different MSG supplementation doses. The study emphasizes the effectiveness of MSG in enhancing growth performance under low stocking density conditions.

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