Effect of various organic acid supplementation diets on Clarias gariepinus BURCHELL, 1822: Evaluation of growth, survival and feed utilization [version 1; referees: 3 approved]

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RESEARCH NOTE

Effect of various organic acid supplementation diets on *Clarias gariepinus* BURCHELL, 1822: Evaluation of growth, survival and feed utilization [version 1; referees: 3 approved]

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Abstract

Background: The purpose of the current study was to determine the growth status, survival and feed utilization of catfish (*Clarias gariepinus* BURCHELL, 1822) fed various organic acid supplementations.

Methods: In total, 1600 fish were randomly distributed into 20 tanks and fed different types of diet: A, control diet without organic acid supplementation; B, control diet supplemented with 0.05% formic, acetic, and propionic acid; C, control diet supplemented with 0.1% formic, acetic, and propionic acid; D, control diet supplemented with 0.05% butyric acid; E, control diet supplemented with 0.01% butyric acid. The control diet was a commercial diet, containing 35% crude protein, 8.58% crude fat, and 2.75% fibre. All fish were fed using a satiation method, three times per day for 56 days. At the end of the trial, growth, survival and feed utilization were determined. Water quality parameters during the trial were also measured once a week.

Results: Fish fed diet type D had the significantly lowest ($P<0.05$) final weight (FW), weight gain (WG), and specific growth rate (SGR) of all diets. Similar FW, WG, and SGR were found for fish fed diets A-C and E. Meanwhile, the feed conversion ratio, feed efficiency, and survival rate of fish were not affected by any types of diet. The water quality parameters were not significantly different between tanks and weeks: dissolved oxygen 6.79-6.81 mg L^{-1}, pH 7.11-7.19, water temperature 28.97-29.32°C, nitrite (NO_2) content 0.48- 0.50 mg L^{-1}, and ammonia (NH_3) content 0.064-0.066 mg L^{-1}.

Conclusion: The supplementation of 0.05% butyric acid in the diet of *C. gariepinus* for 56 days reduced the growth performance of the fish. However, supplementation of an organic acid in the diet of *C. gariepinus* had no impact on feed utilization, survival, and water quality parameters.

Keywords

Organic acid, Growth, Survival Rate, Feed utilities, Clarias gariepinus

Open Peer Review

Referee Status: ✓ ✓ ✓

	Invited Referees 1	2	3
version 1 published 14 Sep 2018	✓ report	✓ report	✓ report

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Introduction

Optimum and balanced nutrition, especially in fish culture, is a significant requirement and contributes up to 40–60% of production cost of farmed fish[1,2]. The balance of a commercial diet that enhances optimum fish growth and health has attracted much research to develop a specific diet formulation[1]. It is also well known that the use of antibiotics or chemical substances as a growth promoter in the feed of fish may help to improve growth, survival, and feed utilization. However, wider concerns regarding the negative effects to the environment has led to a ban of the use of such chemical substances in the field of aquaculture[3].

Previous research stated that the use of non-chemical substances, such as acidifiers, to increase growth performa has been performed in several fish. Dietary supplementation of citric acid/formic acid increases the bioavailability of minerals, including phosphorus, magnesium, calcium and iron in rainbow trout (*Oncorhynchus mykiss*), sea bream (*Pagrus major*) and Indian carp (*Labeo rohita*)[4,5]. Some researchers also claimed that dietary acidifiers in the feed of fish reduce the pH in the stomach and foregut, which help improve pepsin activity, enhancing protein metabolism and mineral intake he intestines[4,6]. In addition, these short-chain organic acids are generally absorbed through the intestinal epithelia by passive diffusion, providing energy for renewing the intestinal epithelia and maintaining gut health[7].

Besides nutritional concern in aquafeed, generally aquaculture activities commonly produce waste, such as feed remains and feces, which can be converted into ammonia and nitrite. Further, the level of ammonia (NH_3) and nitrite (NO_2) increases rapidly in a closed culture system and can be harmful to fish[8,9]. Thus, water quality parameters are a major concern in the aquaculture system. Previous research revealed that the values of water quality parameters during fumaric acid feeding experiments on the African catfish (*Clarias gariepinus*) are relatively stable, providing a dissolved oxygen concentration 7.23-7.86 mg L^{-1}, water temperature 25.13-25.27°C and pH 7.23-7.48[10].

A strain of African catfish, *Clarias gariepinus* BURCHELL, 1822, is a popular species for aquaculture industry in Asian countries. In Indonesia, the production of catfish is been the second largest after tilapia, reaching a production from 144,755 in 2009 to 644,221 MT in 2013[11]. Catfish has pseudo-lungs, long bodies and a high capacity to produce mucous as a form of adaptation to live in stagnant environments or drought conditions. It is omnivorous, feeding on various feeds, such as plant material, plankton, arthropods, molluscs, fish, reptiles, and amphibians[12]. Compared to other species, catfish is more resistance to diseases, handles stressors well and has a high growth performance[13]. To increase growth performance, aquaculturists and researchers have added various supplementations to the diet of catfish[14–16]. However, the information regarding supplementation of organic acid (formic, acetic, propionic a butyric acid) in the diet of catfish is very ra Thus, the aim of the current experiment was to evaluate the growth performance, feed utilization, and survival of catfish fed different types of diet, containing organic acid.

Methods

Site and time

The research was performed at PT Suri Tani Pemuka *Unit Research and Development*, Ciranjang, West Java, Indonesia from March to May 2018. All *C. garipienus* were provided by PT Suri Tani Pemuka (Cisarua, Tegal Waru, HIAT Purwakarta Regency, West Java, Indonesia). The fish were kept in oxygenated polythene bags and transported by truck to PT Suri Tani Pemuka, Research and Development Farm, Ciranjang West Java, Indonesia. Then, the fish had been adapted and grown under farming conditions.

The study was carried out within The PT Suri Tani ethical protocols of the farm.

Experimental design

Five groups in five separate tanks, namely: A, control diet without organic acid supplementation; B, control diet supplemented with 0.05% formic, acetic, and propionic acid; C, control diet supplemented with 0.1% formic, acetic, and propionic acid; D, control diet supplemented with 0.05% butyric acid; E, control diet supplemented with 0.01% butyric acid. The control diet which was provided from a commercial diet (provided by PT Suri Tani Pemuka, Purwakarta, West Java, Indonesia), containing 35% crude protein, 8.58% crude fat, and 2.75% fibre. The study was repeated fo times. All fish were maintained in a plastic tank (vol. 520 L) at a stocking density of 80 fish per tank and reared for 56 days.

Fish culture and feeding trial

In total 1600 fish with an initial average weight 8.78 g were randomly assigned into 20 plastic tanks (80 fish/tank) with a volume of 520 L. Each tank wa filled with fresh water up to 500 L and the fish were stocked at the density of 80 fish $tank^{-1}$. The fish were fed with diets A–E three times per day (01:00, 05:00 and 09:00 GMT) using satiation methods for 56 days.

Measured parameters

Biomass (g) of the fi per tank were measured at the beginning and the final day of the study. Meanwhile, the weight gain was calculated using equation:

$$W = (Wt/Nt)-(W0/N0)$$

where W is weight gain (g), Wt is the weight of the fish at the end of trial (g), and Wo is the weight of fish at the beginning of the trial (g). The feed utilization and survival rates were determined following equations that were previously used by Muchlisin[17] and Nugroho[18]:

$$\text{Feed efficiency (FE)} = 1/\text{FCR} \times 100\%$$

where FCR = feed conversion ratio:

$$\text{FCR} = F / (Wt - Wo)$$

where F= total feed intake (g).

$$\text{Survival rate (SR)} = (Nt/N0) \times 100\%$$

where Nt is total fish at the end of experiment and N0 is total fish at start of experiment.

The water quality parameters such as dissolved oxygen (DO) and temperature were measured using a digital water checker (YSI™ Model 550A Dissolved Oxygen Meter; Fisher Scientific, USA). pH was measured with a pH-meter (CyberScan pH 11; EuTech Instruments, Singapore). Meanwhile, NO_2 and NH_3 were detected using Sera test kit (Sera GmbH D52518, Heinsberg, Germany). All the water quality parameters were measured once a week.

Data analysis

Results are expressed as means ± standard error (SE) and data were analysed using SPSS version 22 (SPSS, Inc., USA). The data of survival (%) was transformed using arc sine before statistical analysis. Meanwhile, growth analysis and water quality were subjected to analysis of variance (ANOVA), followed by Duncan post hoc test to evaluate significant differences among the groups of treatments. All significant tests were at $P>0.05$.

Results

Based on the statistical analysis, the present results showed that both the control diet (A) and the supplementation organic acid in the diet of *Clarias gariepinus* (B–E) had no significant effect ($P>0.05$) on the feed conversion ratio (FCR), feed efficiency (FE), and survival rate (SR). The trial also showed that fish fed diet D had the significantly lowest ($P<0.05$) final weight, weight gain, and specific growth rate (SGR), but a similar final weight, weight gain, and SGR were found on fish fed diets A–C, and E (Table 1).

The water quality parameters during the study showed that the supplementation organic acid in the diet of *Clarias gariepinus* had no effects on the water quality culture. Dissolved oxygen ranged 6.81–6.88 mg L^{-1}; pH 7.12–7.21, and water temperature 27.07–29.50°C. Meanwhile, nitrite (NH_2) content ranged from 0.045 to 0.057 mg L^{-1} and the ammonia (NH_3) content ranged from 0.372 to 0.50 mg L^{-1} (Table 2).

The data showing the growth parameters such as initial and final weight, total weight gain, and total feed consumed by fish for every experimental group, and water quality parameters can be seen in Dataset 1.

Dataset 1. The initial and final weight, body weight gain, survival, and total feed consumed by fish for every experimental group (A–E) and water quality parameters

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Discussion

The present results revealed supplementation of organic acid in the diets had no significant effect ($P>0.05$) on the feed conversion ratio (FCR), feed efficiency (FE), and survival rate (SR). However, dietary supplementation of 0.05% of butyric acid (D) in the diet of *C. gariepinus* resulted in a significantly lower ($P<0.05$) final weight, weight gain, and SGR compared with other diets. A similar final weight, weight gain, and SGR were also found for fish fed a control diet (A), and those fed with 0.05% (B) and 0.1% (C) mix of formic, acetic, and propionic acid, and 0.1% (E) of butyric acid. These findings are in line with a previous study where dietary 0.5 g kg^{-1} butyric acid supplementation in the diet of *Clarias gariepinus* found no significant difference in weight gain, SGR, SR, and FCR. In contrast, weight gain, SGR, SR, FE and FCR of *Oreochromis niloticus* were significantly improved after being fed 0.5 g kg^{-1} butyric acid supplementation in the diet[16].

According to Da Silva *et al.*[19], butyrate acid in shrimp diets could be feed attractants for fish, which improve feed intake. Organic acids such as butyric acid improve the feed intake, gut and gastrointestinal tract activity of a red hybrid tilapia, *Oreochromis* sp., by the reduction in pH[3,20]. The other benefits of butyric acid for improving growth is attributed to the aroma which acts as an attractant in the diet of shrimp[21]. However, a past study found that the increasing levels of dietary organic acid such as fumaric acid (1.5–2 g kg^{-1}) in the diet of *C. gariepinus* significantly reduced growth performance and feed utilities and improved survival rate after a challenge test with bacteria[10]. These findings might be correlated with pH balance in the gut of the fish fed dietary high

Table 1. Mean ± SE growth and feed utilities of *Clarias gariepinus* BURCHELL, 1822 fed organic acid supplementation in the diet for 56 days.

Parameters	Diets				
	A	B	C	D	E
Initial weight (g)	702.50±2.50^{a}	702.50±2.50^{a}	702.50±2.50^{a}	702.50±2.50^{a}	700.00±2.50^{a}
Final weight (g)	7065.00±136.16^{ab}	7007.50±161.10^{ab}	7307.50±199.30^{a}	6702.50±206.37^{b}	7205.00±163.01^{ab}
Weight gain (g)	87.07±2.09^{a}	84.42±2.59^{ab}	87.09±3.06^{a}	78.78±1.78^{b}	87.96±2.11^{a}
SGR (% day^{-1})	4.26±0.04^{a}	2.21±0.05^{ab}	4.26±0.05^{a}	4.10±0.03^{b}	4.29±0.03^{a}
FCR	1.16±0.03^{a}	1.14±0.03^{a}	1.11±0.03^{a}	1.15±0.02^{a}	1.12±0.02^{a}
FE (%)	86.41±2.23^{a}	87.71±2.30^{a}	90.20±2.74^{a}	86.73±1.45^{a}	89.25±1.95^{a}
SR (%)	92.18±1.72^{a}	94.06±1.72^{a}	95.31±0.59^{a}	95.62±1.19^{a}	93.12±0.36^{a}

Different alphabets (a, b) indicate significantly different means for different group of diets at $P < 0.05$. A = control diet without organic acid supplementation; B = supplemented-control diets with 0.05% mix of formic, acetic, and propionic acid; C = supplemented-control diets with 0.1% mix of formic, acetic, and propionic acid; D = supplemented-control diets with 0.05 % of butyric acid; E = supplemented-control diets with 0.1% of butyric acid; SGR = Specific growth rate, FCR = Feed conversion ratio, FE = Feed efficiency, SR = Survival rate. The control diet was a commercial diet, containing 35% crude protein, 8.58% crude fat, and 2.75% fibre.

Table 2. Mean ± SE water quality parameters the cultured media of *Clarias gariepinus* BURCHELL, 1822 during the trial.

Parameters	Diets				
	A	B	C	D	E
Dissolved oxygen (mg L^{-1})	6.81±0.01[a]	6.81±0.01[a]	6.78±0.01[a]	6.81±0.01[a]	6.79±0.01[a]
pH	7.17±0.04[a]	7.21±0.05[a]	7.06±0.04[a]	7.11±0.04[a]	7.19±0.04[a]
Temperature (°C)	29.33±0.21[a]	29.53±0.20[a]	28.71±0.22[a]	29.05±0.26[a]	29.11±0.18[a]
NH_3 (mg L^{-1})	0.06±0.001[a]	0.06±0.001[a]	0.06±0.001[a]	0.06±0.001[a]	0.06±0.001[a]
NO_2 (mg L^{-1})	0.46±0.02[a]	0.48±0.01[a]	0.50±0.00[a]	0.50±0.00[a]	0.50±0.00[a]

Mean ± SE followed by same superscript letter (a) indicated not significantly different at $P < 0.05$. Water quality parameters were measured once a week during the study. A = control diet without organic acid supplementation; B = supplemented-control diets with 0.05% mix of formic, acetic, and propionic acid; C = supplemented-control diets with 0.1% mix of formic, acetic, and propionic acid; D = supplemented-control diets with 0.05 % of butyric acid; E = supplemented-control diets with 0.1% of butyric acid. The control diet was a commercial diet, containing 35% crude protein, 8.58% crude fat, and 2.75% fibre.

levels of organic acid. Furthermore, various concentrations of the organic acids such as propionic acid and acetic acid, have been determined to have effects on the feeding behaviour of *Oreochromis niloticus*. The supplementation of propionic acid at 10^{-4}–10^{-6} M can stimulate feeding[22]. However, dietary propionic acid at 10^{-3} M may suppress feeding. In addition, past research has also found that dietary supplementation of acetic acid at 10^{-5} M had no effect on fish feeding. Lim *et al.*[23] revealed that the beneficial of the organic acid supplementation in the diet of fish may vary among fish and tend to be inconsistent, depend on the dietary ingredient, culture system, and water quality.

It is clear that feed remains in the water medium might change the water quality. Current findings stated that the water quality parameters during the trials showed no effects on the medium fish culture during the present study (Table 2). These findings are consistent with a past study by Omosowone and Adeparusi[16], stating that water quality parameters such as temperature, dissolved oxygen and pH measured in a similar current experimental setups are all within the accepted range for the culture of fin fishes in tropical regions, as recommended by National Research Council (USA)[24].

Conclusion

The inclusion of organic acid in the diet of *C. gariepinus* had no impact on the feed utilities, survival, and water quality parameters in the present study. However, the inclusion of 0.05% butyric acid in the diet of *C. gariepinus* for 56 days reduced growth performance and feed utilization. Further research needs to be conducted to evaluate the effects of organic acid supplementation in the diet of fish on digestive enzyme activity, gut bacteria population, and fillet proximate analysis.

Data availability

Dataset 1: The initial and final weight, body weight gain, survival, and total feed consumed by fish for every experimental group (A–E) and water quality parameters. DOI, 10.5256/f1000research.15954.d216486[25].

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References

1. Craig S, Helfrich LA, Kuhn D, *et al.*: **Understanding fish nutrition, feeds, and feeding.** 2017.
Reference Source

2. Fadri S, Muchlisin Z, Sugito S: **Growth performance, survival rate and feed utilization of Nile tilapia, *Oreochromis niloticus* fed experimental diet contains jaloh leafs, *Salix tetrasperma* Roxb at different levels of EM-4 probiotic.** *Jurnal Ilmiah Mahasiswa Kelautan dan Perikanan Unsyiah.* 2016; **1**(2): 210–221.

3. Luckstadt C: **The use of acidifiers in fish nutrition.** *Perspectives in Agriculture, Veterinary Science, Nutrition and Natural Resources.* 2008; **3**(044): 1–8.
Publisher Full Text

4. Jun-sheng L, Jian-lin L, Ting-ting W: **Ontogeny of protease, amylase and lipase**

in the alimentary tract of hybrid juvenile tilapia (*Oreochromis niloticus* × *Oreochromis aureus*). *Fish Physiol Biochem.* 2006; **32**(4): 295–303.
Publisher Full Text

5. Vielma J, Lall S: **Dietary formic acid enhances apparent digestibility of minerals in rainbow trout, *Oncorhynchus mykiss* (Walbaum).** *Aquac Nutr.* 1997; **3**(4): 265–268.
Publisher Full Text

6. Lückstädt C: **Effect of organic acid containing additives in worldwide aquaculture–sustainable production the non-antibiotic way.** *Acidifiers Anim Nutr.* 2008; **71**.

7. Abu Elala NM, Ragaa NM: **Eubiotic effect of a dietary acidifier (potassium diformate) on the health status of cultured *Oreochromis niloticus*.** *J Adv Res.* 2015; **6**(4): 621–629.
PubMed Abstract | Publisher Full Text | Free Full Text

8. Sakala ME, Musuka CG: **The effect of ammonia on growth and survival rate of tilapia rendalli in quail manured tanks.** *International Journal of Aquaculture.* 2014; **4**.

9. Sidik A: **The effect of stocking density on nitrification rate in a closed recirculating culture system.** *Jurnal Akuakultur Indonesia.* 2007; **1**(2): 47–52.
Publisher Full Text

10. Omosowone O, Dada A, Adeparusi E: **Effects of dietary supplementation of fumaric acid on growth performance of African catfish *Clarias gariepinus* and *Aeromonas sobria* challenge.** *Croatian Journal of Fisheries.* 2015; **73**(1): 13–19.
Publisher Full Text

11. Fauji H, Budiardi T, Ekasari J: **Growth performance and robustness of African Catfish *Clarias gariepinus* (Burchell) in biofloc-based nursery production with different stocking densities.** *Aquac Res.* 2018; **49**(3): 1339–1346.
Publisher Full Text

12. Vitule JR, Umbria S, Aranha J: **Introduction of the African catfish *Clarias gariepinus* (BURCHELL, 1822) into Southern Brazil.** *Biol Invasions.* 2006; **8**(4): 677.
Publisher Full Text

13. Putra I, Rusliadi R, Fauzi M, *et al.*: **Growth performance and feed utilization of African catfish *Clarias gariepinus* fed a commercial diet and reared in the biofloc system enhanced with probiotic [version 1; referees: 2 approved].** *F1000Res.* 2017; **6**: 1545.
PubMed Abstract | Publisher Full Text | Free Full Text

14. Chris UO, Singh N, Agarwal A: **Nanoparticles as feed supplement on Growth behaviour of Cultured Catfish (*Clarias gariepinus*) fingerlings.** *Materials Today: Proceedings.* 2018; **5**(3): 9076–9081.
Publisher Full Text

15. El-Husseiny OM, Hassan MI, El-Haroun ER, *et al.*: **Utilization of poultry by-product meal supplemented with L-lysine as fish meal replacer in the diet of African catfish *Clarias gariepinus* (Burchell, 1822).** *Journal of Applied Aquaculture.* 2018; **30**(1): 63–75.
Publisher Full Text

16. Omosowone O, Dada A, Adeparusi E: **Comparison of dietary butyric acid supplementation effect on growth performance and body composition of *Clarias gariepinus* and *Oreochromis niloticus* fingerlings.** *Iranian Journal of Fisheries Sciences.* 2018; **17**(2): 403–412.
Publisher Full Text

17. Muchlisin ZA, Arisa AA, Muhammadar AA, *et al.*: **Growth performance and feed utilization of keureling (*Tor tambra*) fingerlings fed a formulated diet with different doses of vitamin E (alpha-tocopherol).** *Archives of Polish Fisheries.* 2016; **24**(1): 47–52.
Publisher Full Text

18. Nugroho RA, Manurung H, Nur FM, *et al.*: ***Terminalia catappa* L. extract improves survival, hematological profile and resistance to *Aeromonas hydrophila* in *Betta* sp.** *Archives of Polish Fisheries.* 2017; **25**(2): 103–115.
Publisher Full Text

19. da Silva BC, do Nascimento Vieira F, Mouriño JLP, *et al.*: **Salts of organic acids selection by multiple characteristics for marine shrimp nutrition.** *Aquaculture.* 2013; **384–387**: 104–110.
Publisher Full Text

20. Ng WK, Koh CB, Sudesh K, *et al.*: **Effects of dietary organic acids on growth, nutrient digestibility and gut microflora of red hybrid tilapia, *Oreochromis* sp., and subsequent survival during a challenge test with *Streptococcus agalactiae*** *Aquac Res.* 2009; **40**(13): 1490–1500.
Publisher Full Text

21. Da Silva BC, Vieira FdN, Mouriño JLP, *et al.*: **Butyrate and propionate improve the growth performance of *Litopenaeus vannamei*.** *Aquac Res.* 2016; **47**(2): 612–623.
Publisher Full Text

22. Xie S, Zhang L, Wang D: **Effects of several organic acids on the feeding behavior of *Tilapia nilotica*.** *J Appl Ichthyol.* 2003; **19**(4): 255–257.
Publisher Full Text

23. Lim C, Luckstadt C, Klesius P: **Use of organic acids, salts in fish diets.** *Global Aquaculture Advocate.* 2010; **13**(5): 45–46.
Reference Source

24. NRC: **Nutrient requirements of warmwater fishes and shellfishes.** Washington D. C.: Subcommittee on Warmwater Fish Nutrition. National Research Council. National Academies. 1983.
Reference Source

25. Asriqah L, Nugroho RA, Aryani R: **Dataset 1 in: Effect of various organic acid supplementation diets on *Clarias gariepinus* BURCHELL, 1822: Evaluation of growth, survival and feed utilization.** *F1000Res.* 2018.
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Open Peer Review

Current Referee Status: ✔ ✔ ✔

Version 1

Referee Report 09 October 2018

doi:10.5256/f1000research.17425.r38343

✔ **Indra Suharman**
Department of Aquaculture, Faculty of Fisheries and Marine Science, Universitas Riau, Pekanbaru, Indonesia

This papers reports on the growth performance of fish fed supplementation of organic acid in the diets of catfish. From this point of view the article is very interesting and deserves to be accepted for publication.

The Abstract is quite clear and provide a concise conclusion of the research work. However, it is better to state the initial average weight of fish in the “Abstract”.

The Introduction is strong supported by the literature cited and the objective of this study is clear stated.

The Methods is quite clear and the analysis correctly explained what has been obtained from the designed work and appropriately reflects the topic studied.

The Discussion is clear explained and the Conclusion has justified the basis of the results.

Overall, the paper is well written and data well analyzed. I have found very interesting results as the effect of organic acid supplementation in the diets on growth performace and feed utilization of catfish.

Is the work clearly and accurately presented and does it cite the current literature?
Yes

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: No competing interests were disclosed.

Referee Expertise: Aquatic animal nutrition (Aquaculture)

I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Referee Report 01 October 2018

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Ilham Alimin
Feed and Nutrition Research Group, Department of Aquaculture, Jakarta Fisheries University (Sekolah Tinggi Perikanan Jakarta), Jakarta, Indonesia

Manuscript titled "Effect of various organic acid supplementation diets on *Clarias gariepinus* BURCHELL, 1822: Evaluation of growth, survival and feed utilization" could be acceptable. Study design, data processing, writing, etc. are relatively good. However, some revisions need to be made to index the manuscript.

Abstract
Results:
…were found for fish fed diets A-C and E - Kindly replace A-C with A,B,C
…were not affected by any types of diet - write type instead of types
Keywords:
…. Survival rate, …Clarias gariepinus should be in *italics*

Introduction
Paragraph 2:
Previous research stated that the use of …… - whose research? citation?
… which help improve pepsin activity, **thus** enhancing...

Paragraph 3:
Since the word "generally" also means "commonly", please use one of those words
… Previous research revealed that the values.... - whose research? citation?

Paragraph 4:
A strain of African catfish, *Clarias gariepinus* BRUCHELL, 1822 … - The species should be written as *C. gariepinus*
…. on various feeds, such as plan material,... - material should be in plural form, please add 's'
The role of organic acids should also be mentioned in the "Introduction" section.

Methods
Site and time:
Then, the fish had been adapted and …. - should be "Then, the fish **were** adapted and …..

Experimental design

Is it true that the study was repeated four times? Or do you mean "all treatments were designed in four replicates"?

Fish culture and feeding trial:
Again, kindly write diets A,B,C,D and E instead of diets A-E

Regarding feed intake, how did you measure the feed intake? Was there any uneaten feeds?

Measured parameters:
Kindly replace "W0" with "Wo" and "N0" with "No"in the formula

Results
When you rewrite the scientific name of the species i.e. *Clarias gariepinus*, kindly use *C. gariepinus*. The same concern also applicable in Discussion section. Also check it in the Table 1.

In Table 1 and Table 2, letter(s) ie. a,b.c should be written only when there was significant difference(s) among treatments. Therefore, FCR, FE and SR should not be highlighted with common superscript (a) since they were all statistically insignificant.

Discussion
Paragraph 2:
… and tend to be inconsistent, depend on the …. - kindly write "depending on" instead of "depend on"

Is the work clearly and accurately presented and does it cite the current literature?
Partly

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Yes

Competing Interests: No competing interests were disclosed.

I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Referee Report 19 September 2018

doi:10.5256/f1000research.17425.r38341

Gitartha Kaushik
Department of Zoology, North-Eastern Hill University (NEHU), Shillong, Meghalaya, India

The paper is scientifically sound in its current form and only minor, if any, improvements are suggested:

Kindly make these following corrections.

1. Introduction: It is also well known that the use of antibiotics or chemical substances as a growth promoter in the feed of fish may help to improve growth, survival, and feed utilization ---- **kindly cite the article stating this statement.**

2. Introduction: Previous research stated that the use of non-chemical substances such as acidifiers, to increase growth performance has been performed in several fish ---- **kindly cite some previous reports** .

3. Introduction: Besides nutritional concern in aquafeed, generally aquaculture activities commonly produce waste, such as feed remains and feces, which can be converted into ammonia and nitrite ---- **Who stated this? Kindly cite the article**

4. Introduction: Clarias gariepinus BURCHELL,1822 kindly write the nomenclature following FishBase. https://www.fishbase.de/summary/1934

5. Methods: All *C. **garipienus*** were provided: **Kindly check the spelling of the species**.

The paper has well experimented. It can be accepted after these minor corrections.

Is the work clearly and accurately presented and does it cite the current literature?
Partly

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Yes

Competing Interests: No competing interests were disclosed.

Referee Expertise: Fishbiology, molecular Taxonomy and adaptive modifications

I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Effect of various organic acid supplementation diets on Clarias gariepinus BURCHELL, 1822: Evaluation of growth, survival and feed utilization [version 1; referees: 3 approved]

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