

ORIGINAL RESEARCH ARTICLE

Effect of Ginger (*Zingiber officinale*) and Garlic (*Allium sativum*) Mixture on Growth Performance, Feed Utilization and Survival of *Clarias gariepinus* Fingerlings

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ABSTRACT

The study was conducted at the University Fish Farm, Federal University Dutsinma. The study aimed to determine the effects of dietary supplementation of *Allium sativum* and *Zingiber officinale* mixture on growth performance and feed utilization of *C. gariepinus* fingerling reared in a tank system. Thus, 120 fingerlings were randomly divided in triplicate (3) into four (4) treatments. Treatment groups had different Garlic and Ginger inclusions (1, 1.5, and 2g/kg) added to their diets. The control group's diet was free of Ginger and Garlic mixture. The diets containing 40% crude protein (CP) were fed twice daily, in the morning and evening (9 am and 4 pm daily) at satiation for twelve (12) weeks (84 days). The survival rate ranges from 90% - 100%, with the higher FMW (893.10) and PMW (942.65) compared to the control group and others. There was no significant difference ($p > 0.05$) in the FMW (893.10) of the fish fed 1.5g/kg of Garlic and Ginger diets than the control (687.00). The SGR (1.20) of fish fed Garlic and Ginger fortified diets shows no significant difference between treatments fed 1.5g/kg Garlic and Ginger and the control group. Generally, the experimental fish-fed Garlic and Ginger-Supplemented diets had an increased survival rate compared to the control.

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KEYWORDS

Clarias gariepinus, *Zingiber officinale*, *Allium sativum* and fingerlings

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INTRODUCTION

The African catfish *Clarias gariepinus* is a major cultivated fish of high commercial value in Nigeria, producing 257 368 tons in 2014 (FAO, 2016). Stressors such as poor water quality, overcrowding, transport, handling, size grading, and fish diseases in intensive farming negatively affect the aquaculture productivity and sustainability of fish species like *C. gariepinus* (Abdelwahab *et al.*, 2020). On the other hand, the risk of generating resistant pathogens and environmental pollution has arisen due to using antibiotics and chemotherapeutics to combat fish diseases (Abdelwahab *et al.*, 2020). There is a good conversion of feed to flesh by *C. gariepinus* (it can utilize 2g of feed to gain 1g of flesh), disease resistance, ability to reproduce in captivity, fast growth rate, and tolerance to a wide range of environmental conditions such as temperature and dissolved oxygen (Afe *et al.*, 2019). Expensive feeds hinder or limit the profitability of fish farming in Nigeria, reducing the expansion of farms to widen their production, consequently, low yield in terms of quality and quantity, which culminated in scarcity of fish, leading to the high cost of the few available ones (Muhammad 2017).

Favour (2021) reported in her work that using phyto additives in fish feed stimulates fish appetite as a nutritional additive and improves the nutritional value of the diet. Feed additives are edible substances that are supplemented to feeds in small amounts (alone or in combination) for a specific purpose, such as to improve fish performance and quality, to preserve the physical and chemical quality of the feed as well as that of the aquatic environment (Dada 2015).

MATERIALS AND METHODS

The Study Area

The study was conducted at the University Fish Farm, Take-off Campus of Federal University Dutsin-Ma, Katsina State.

Experimental Fish

A total of one hundred and twenty (120) fingerlings were purchased for this study. They were sourced from a reputable fish farm in Zaria Kaduna State and transported in 25-liter plastic containers to the fish farm, Federal University Dutsin-Ma Katsina State. This study used

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African catfish (*C.gariepinus*) fingerlings of a mean weight of 2.41g as the test fish species. The experimental fish were acclimatized and fed with Coppens feed of 2mm for two (2) weeks prior to the commencement of the research. The experiment lasted for about twelve (12) weeks.

Experimental Design

The experimental setup comprised four treatment (4) groups labeled as T1, T2, T3, and T4, respectively, each treatment replicated 3 times in a Completely Randomized Design (CRD). Treatment four(T4) served as the control experiment having zero 0% ginger and garlic (ZO-AS0%) inclusion of ginger and garlic, treatment one (T1) contained 0.5% ginger and 0.5% garlic (ZO-AS 1.0%), treatment two (T2) contained 0.75% ginger, and 0.75% garlic (ZO-AS 1.5%) while T3 contained 1% ginger and 1% garlic (ZO-AS 2.0%) respectively. The experiment was conducted in twelve (12) plastic containers of 10 liters each and filled at two-thirds. The fish were randomly allotted into four (4) treatments in the plastic tanks at a stocking rate of ten (10) fingerlings per tank in triplicates, filled at two-thirds (6.5 liters) with borehole water. All the containers were placed on supporting concrete or blocks to lift them from the beer floor and were supplied with borehole water. A clean environment was maintained around the research site. The fish were fed two times daily at their satiation per day (9:00 am and 5:00 pm). Weights were taken at one week intervals for ten (10) weeks. The quantity of feed was adjusted forth nightly after batch-weighing of experimental fish.

Preparation of the Experimental Feed

Fresh ginger (*Zingiber officinale*) and fresh garlic bulbs (*Allium sativum*) were procured from a local market (Katsina Central Market). The samples were then peeled using a knife and were crushed using a gritter, and then

dried for seven (7) days under the sun in other to reduce moisture and enhance the easy mixture in the feed when its particle size is made very smooth, after which the ginger and garlic cloves which were crushed and grinded using the Corona manual blender.

Feed ingredients used for the experimental diets were ground into powder, including ginger powder, garlic powder, fish meal, soybean, maize, Wheat offal, vitamin/mineral premix, palm oil, and bone meal. The formulation was based on the percentage composition of the ingredient. Each diet's dried and ground ingredients were weighed and mixed thoroughly in a bowl. Palm oil and warm water were added slowly to the mixture and mixed manually for about 30 minutes to achieve proper consistency. The resulting mixture was pelletized (2 mm) using an electric pelleting machine (model number KI-150)) and was sundried for 24h before being packed into airtight containers and stored at room temperature to be crumbled before used. Formulated diet samples (10 g) were analyzed according to (AOAC 2019). Ginger and garlic powder were added to the diets at 0g/kg, 1.0g/kg, 1.5g/kg, and 2.0g/kg of feed.

Four iso-nitrogenous (40% CP) diets were formulated using Pearson’s square method and distributed to *C. gariepinus* fingerlings divided into four treatments. Dietary treatments included T4 (0%AS/ZO), in which fingerlings were fed basal diet as control diet, T1 (1.0%AS/ZO), T2 (1.5%AS/ZO), and T3 (2.0%AS/ZO) in which fingerlings were fed with basal diet containing ginger and garlic powder respectively.

Statistical analyses

All the data from the experiments was analyzed using Analysis of Variance (ANOVA) in Systat software (SAS Institute 2003). Significantly (P<0.05), different means were separated using Duncan’s Multiple Range Test (DMRT) as contained in the SAS (1999) package.

Table 1 Formulation and proximate composition of experimental diets (g/100 g dry weight).

Ingredients	T4	T3	T2	T1
Maize	28.75	28.75	28.75	28.75
Groundnut cake	20.00	20.00	20.00	20.00
Soybean	9.00	7.00	7.50	8.00
Fish meal	40.00	40.00	40.00	40.00
Ginger	0.00	1.00	0.75	0.50
Garlic	0.00	1.00	0.75	0.50
Binder	0.50	0.50	0.50	0.50
Premix	1.00	1.00	1.00	1.00
Lysine	0.20	0.20	0.20	0.20
Methionine	0.10	0.10	0.10	0.10
Salt	0.20	0.20	0.20	0.20
Vegetable oil	0.25	0.25	0.25	0.25
Total	100	100	100	100

RESULT AND DISCUSSION

Growth performance, feed utilization, and survival rate

Table 2 shows that Higher FMW, MWG and PWG (893.10g/kg, 798.33g/kg, 942.65g/kg, 727.80g/kg, 632.90g/kg, and 767.10g/kg) were obtained in T2 and T1 with (G & G 1.5g/kg & 1g/kg) when compared with the control (T4) which has lower FMW, MWG and PWG (687.00g/kg, 590.73g/kg and 712.30g/kg) respectively. The result shows no significant difference (P>0.05) between T1, T2, and T4 regarding FMW, MWG, and PWG. The result also shows that T3 has higher values of FI and PI (1103.81g/kg & 441.52g/kg, respectively) when compared with T4 (control), even though they are statistically the same in terms of FI and PI. With regards to SGR and PER, the result shows that T1 and T2 concurrently have values (of 1.20g/kg, 1.10g/kg, 1.90g/kg & 1.50g/kg) while T3 recorded the lowest value of SGR and PER (0.93g/kg & 1.24g/kg) respectively. Significant difference (P>0.05) exists between T1, T2, T4 and T3, respectively. There was a significant increase in the SGR and PER of fish fed 1g/kg & 1.5g/kg inclusion of ginger and garlic than the fish fed the T4 (control) diet except for T3, fed 2g/kg inclusion of ginger and garlic. There are no significant differences (P>0.05) between T1, T2, and T4 in terms of SGR and PER, but there are significant differences (P>0.05) between T3 and T4, T2, T1 respectively in terms of SGR and PER. The FCR in T3 (174.20) is significantly higher compared to T1 and T2 (146.20 & 119.20). It was recorded that T1 has the lower/

or no mortality rate and higher survival rate (MR and SR) (0.00% & 100%) among all the treatments with ginger and garlic inclusion level of 1g/kg. Whereas T2 and T3 have (MR and SR) (3.33%, 6.70% and 96.70%, 93.33%) mortality rates and survival rates with ginger and garlic inclusion levels of (1.5g/kg & 2g/kg). Higher MR and SR were recorded in T4 (control) (10.00% & 90.00%) respectively. However, they are statistically the same.

Contrary to the findings of Mahmoud *et al.* (2019), which reported no significant difference in FBW between fish fed 1.5g ginger & garlic and the basal control group. However, the FCR and SGR of Nile tilapia fed 1.5g garlic powder significantly decreased compared with those fed a control diet. From this finding, it was observed that 1g/kg & 1.5g/kg inclusion levels of ginger and garlic in the diets of fingerlings *Clarias gariepinus* improved growth performance, feed utilization, and, indeed, survival rate. This result is in agreement with the finding of Nyadjeu *et al.* (2021), who reported that growth performances and feed utilization of *C. gariepinus* fry fed with a basal diet supplemented with either garlic powder or ginger powder showed better growth and feed utilization in term of weight gain, length gain, specific growth rate, feed intake, feed conversion ratio, mortality rate, survival rate as well as protein efficiency ratio compared to control diet. Contrary to the results obtained by Mahmoud *et al.* (2019), who found poor growth and feed utilization in terms of specific growth rate and feed conversion ratio after feeding *Oreochromis niloticus* fingerlings for 60 days with 1.5g ginger and garlic compared to a basal control diet.

Table 2 Growth Performance and Nutrient Utilization of African catfish (*Clarias gariepinus*) Fingerlings fed varying Levels of Ginger and garlic for 84 days. Meal ± SEM.

PARAMETERS	T4 (control)	T3 (2g)	T2 (1.5g)	T1 (1g)	SEM
Initial Mean Weight (g/kg)	96.30	94.43	94.80	94.90	1.20
Final Mean Weight (g/kg)	687.00 ^b	639.90 ^a	893.10 ^b	727.80 ^b	45.30
Mean Weight Gain (g/kg)	590.73 ^b	545.43 ^a	798.33 ^b	632.90 ^b	44.70
Percentage Mean Weight (g/kg)	712.30 ^b	677.60 ^a	942.65 ^b	767.10 ^b	44.20
Feed Intake (g/kg)	1086.22 ^{ab}	1103.81 ^b	1062.04 ^a	1061.80 ^b	10.80
Protein Intake (g/kg)	434.50 ^{ab}	441.52 ^b	424.82 ^a	424.71 ^b	4.32
Specific Growth Rate (%)	1.03 ^b	0.93 ^a	1.20 ^b	1.10 ^b	0.03
Protein Efficiency Ratio	1.40 ^b	1.24 ^a	1.90 ^b	1.50 ^b	0.10
Feed Conversion Ratio	159.54 ^a	174.20 ^b	119.20 ^a	146.20 ^{ab}	9.40
Mortality Rate (%)	10.00	6.70	3.33	0.00	3.73
Survival Rate (%)	90.00	93.33	96.70	100	3.73

a,b,c,d,e superscripts. Means in the same row with the same superscripts are not significantly different (p > 0.05), SEM = standard error of the mean

The results of the present study are in accordance with those obtained by Jahanjoo *et al.* (2018), who recorded better growth performance and feed utilization in Sobaity Sea Bream (*Sparidentex basta*) fry fed with a basal diet containing 1g of garlic and ginger respectively for 8 weeks. In addition, the highest values of growth performance and feed utilization were observed in fish fry fed the basal diet containing 1g of ginger and garlic compared to the control diet and even diet with 2g of plant material. Iheanacho *et al.* (2017) reported a significant increase in weight gained, specific growth rate, and final weight when *C. gariepinus*

juveniles were exposed to varying concentrations (0.25, 0.50, 0.75, and 1.0 g/35 L) of ginger as compared to the control. Therefore, the positive response to growth in treated fish, especially those receiving a 1g/kg inclusion level of ginger and garlic, could be attributed to the average proximate content of ginger, which is a good source of mineral elements, vitamins, and contains good number of phytochemicals constituent that enhance growth and health of animals through actions as the stimulation of the secretion of pancreatic enzymes and the bile from the liver that induce fast feed digestion and helps

to balance the intestinal bacteria (Platel and Srinivasan 2004). The findings of this research regarding feed utilization and increased performance can be explained with respect to (Irabor *et al.*, 2021), who stated that garlic enhances energy utilization and digestion by increasing intestinal flora function due to its allicin content. Although there was a significant ($P > 0.05$) difference in final weight across treatments, the control exhibited a lower final weight.

CONCLUSION

The present study showed that dietary supplementation of ginger and garlic powder is encouraging to improve the growth and health of catfish (*C. gariepinus*) fingerlings due to the growth promoting and immunostimulation properties. In addition, ginger and garlic have been shown to positively influence the hematological profile of fish. However, ginger and garlic inclusion of 2g/kg and above are considered dangerous to the fish life, as observed from this result in the MR scores (at 2g/kg: 6.70%). Hence, the study concluded that 1g/kg ginger and garlic powder dietary supplementation in cultured *C. gariepinus* could improve the fish's growth, feed utilization, survival, and health activities. The result obtained stated that there are no lower PCV values that can contribute to anaemia. Thus, the present study reveals that there is no tendency for anaemia. Hence, the result of the finding can be used anywhere with ginger and garlic inclusion levels at 1g/kg to 2g/kg.

REFERENCES

- Abdelwahab M. Sabry M., and Sami Al-Khamees: (2020). Influence of Dietary Garlic (*Allium sativum*) and/or Ascorbic Acid on Performance, Feed Utilization, Body Composition and Hemato-Biochemical Parameters of Juvenile Asian Sea Bass (*Lates calcarifer*). *Animals* 2020, 10, 2396; [Crossref]
- Afe O.E. and Omosowone O.O. (2019). Growth and feed utilization in *Clarias gariepinus* fingerlings fed on *Acacia auriculiformis* leaf-supplemented diets. *International Journal of Fisheries & Aquaculture*, 11(3), 55-61. [Crossref]
- AOAC (2019). Association of Official Analytical Chemists international (AOAC). Official methods of analysis, 17th edition AOAC International, Gaithersburg, MD, USA.
- Dada AA (2015). Improvement of Tilapia (*Oreochromis niloticus* Linnaeus, 1758) growth performance fed three commercial feed additives in diets. *J Aquac Res Development* 6: 325. Link: <https://bit.ly/34gbLKg>.
- FAO, Food and Agricultural Organization of United Nations (2016). The State of World Fisheries and Aquaculture. *Contributing to Food Security and Nutrition for All*. Rome, 200. <http://www.fao.org/3/i5555e/i5555e.pdf>.
- Favour E. A. (2021). Effect of Garlic on growth performance and survival of Nile Tilapia (*O. niloticus*) fingerlings.
- He J, Qiang J, Gabriel NN, Xu P, Yang R (2015). Effect of off-feeding-intensity stress on biochemical and hematological indices of GIFT tilapia, *Oreochromis niloticus*. *Turkish J. Fisheries Aquat. Sci.* 15: 305-312. [Crossref]
- Iheanacho, S.C., Nworu, S.A., Ogueji, E.O., Nnatuanya, I., Mbah, C.E., Anosike, F., Okoye, C., Ibrahim, U.B., Kogi, E. and Haruna, M. (2017). Comparative Assessment of Proximate Content Organoleptic Quality of African Catfish (*Clarias gariepinus*) Processed by Smoking and Solar Drying Method. *African Journal of Agricultural Research*, 12, 2824-2829. [Crossref].
- Irabor, A. E. Ekelemu, J. K. Ekokotu, P. A. and Nwachi, O. F. (2021). Effect of garlic concentrates on performance of hybrid catfish fingerlings (*Heterobranchus longifilis* x *Clarias gariepinus*). *International Journal of Agricultural Technology* 2021 Vol. 17(2):503-516 Available online <http://www.ijat-aatsea.com> ISSN 2630-0192 (Online).
- Jahanjoo V. M. Yahyavi, R. Akrami, A.H. Bahri (2018). Influence of adding garlic (*Allium sativum*), ginger (*Zingiber officinale*), thyme (*Thymus vulgaris*) and their combination on the growth performance, haemato-immunological parameters and disease resistance to photobacterium damsela in Sobaity Sea Bream (*Sparidentex hasta*) Fry, *Turk. J. Fish. Aquat. Sci.* 18 (4) 633–645. [Crossref]
- Mahmoud R, Aziza A, Marghani B, Eltaysh R (2019). Influence of ginger and garlic supplementation on growth performance, whole body composition and oxidative stress in the muscles of Nile tilapia (*O. niloticus*). *Adv Anim Vet Sci* 7: 397-404. [Crossref]
- Nyadjeu P, Tamko Ndjuissi NA, Mane Yemdjie DD, Chamsy Dedou NY, Fonkwa G, et al. (2021). Dietary inclusion effect of ginger (*Zingiber officinale*) and garlic (*Allium sativum*) blend on growth, feed nutrients utilization and retention in African Catfish (*Clarias gariepinus*) fry in intensive system. *Int J Aquac Fish Sci* 7(2):014-023. DOI: [Crossref].
- Platel, K. and Srinivasan, K. (2004). Digestive Stimulant Action of Spices: A Myth or Reality. *Indian Journal of Medical Research*, 119, 167-179.