EVALUATION OF GINGER (ZINGIBER OFFICINALE) AND GARLIC (ALLIUM SATIVUM) EFFECT ON GROWTH PERFORMANCE AND SURVIVAL RATES OF CLARIAS GARIEPINUS FINGERLINGS

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ABSTRACT

The study was conducted at the University Fish Farm, Federal University Dutsinma. The aim of the study was to evaluate the effects of Allium sativum and Zingiber officinale supplementations on growth performance and survival of C. gariepinus fingerling raised in tank rearing systems. The experimental setup comprised of four treatment (4) groups labeled as T1, T2, T3 and T4, each treatment replicated 3 times with ten (10) fingerlings in each replicate respectively. Treatment 1 contained 0.5% of Zingiber officinale and 0.5% of Allium sativum (ZO - AS: 1.0%), Treatment 2 contained 0.75% Zingiber officinale, and 0.75% garlic (ZO-AS: 1.5%) while T3 contained 1% ginger and 1% Allium sativum (ZO-AS: 2.0%) respectively. The experiment lasted for twelve (12) weeks (84 days). The survival rate ranges from 90% - 100%. With the higher Final Mean Weight (893.10) and Percentage Mean Weight (942.65) as compared to the control group and others. The results of the study obtained shows that there was no significant difference ($p > 0.05$) in the FMW (893.10) of the fish fed 1.5g/kg of Garlic and Ginger supplements and the control experiment (687.00). SGR (1.20) of fish-fed Zingiber officinale and Allium sativum supplementsshows that there was no significant ($p > 0.05$) difference between treatments fed 1.5g/kg Zingiber officinale and Allium sativum and the control group. As indicated from the results, there was an increased in the survival rate of the fish in the experiment carried out when fed Zingiber officinale and Allium sativum-supplemented diets as compared to the control.

KEYWORDS

evaluation, ginger, *Zingiber officinale , Allium sativum, fingerlings,*

1. INTRODUCTION

Fish production has been one of the fastest growing food producing sectors in the world (Abdelhamid, *et al.*, 2002). Consequently, as it is one of the most evolving and growing industrial sector in aquacultural industry, it demands prompt and rigorous research approaches with scientific, digital, technical developments and innovations in the different aspect of production sectors including the search for natural, safe, and affordable alternative growth promoters to be used in fish feeds (Alicia, *et al.*, 2005). With this regards, so many experiments have been done in many developing nations in an attempt to findings new dietary supplementation strategies in which various health and growth promoting compounds like probiotics, prebiotics, synbiotics, phytobiotics and other important dietary supplements can be used (Denev, 2008). In fisheries production sectors, one of the means to increasing the defense mechanism and disease preventions and management in fish is through prophylactic administration of immune stimulants

in the fisheries industries (Raa, *et al.,* 1992), this recent advancement and innovations have drawn the attention of fish production sectors to the immune protection of fish besides the growth as sustainable fish production depends on perfect balance between growth and health condition of fish. Stressors such as poor water quality, overcrowding, transport, handling, size grading, fish diseases in intensive farming negatively affect aquaculture productivity and sustainability of fish species like *C. gariepinus* (Abdelwahab, *et al.,* 2020). Fisheriesproduction industries in Africa and many other developing nations involves both intensive and semi-intensive system of production, these systems are daily gaining momentum globally. From the recent increase of fish contribution in Africa and to the world fish production and the fastest growth of both captured and artisanal fish in Africa cannot be discussed without making reference to Nigeria. Nigeria being the second highest producer of cultured fish in Africa (second to Egypt) and the highest producer of the second most important fish product in Africa (*Clarias gariepinus*) (FAO, 2012) . Favour (2021) documented that the use of phyto-additives in fish feed stimulates fish appetite as a nutritional additive and also improve the nutritional value of the feed.

2. MATERIALS AND METHODS

2.1. The Study Area

The study was conducted at the University Fish Farm, the take-off Campus of Federal University Dutsin-Ma, Katsina State. The area lies between Latitude 12°27‟18‟‟N and Longitude 7°29‟29‟‟E, and 605 meters above the sea level. Dutsin-Ma is a local government area in Katsina State North-western Nigeria. The local lies between latitude 12^{0}26’00’’N and longitude 007^{0}29’00’’E. It shares boundaries with Kurfi and Charanchi L.G.A to the north, Kankia L.G.A to the east, Safana and Dan-Musa L.G.A to the West, and Matazu L.G.A to the South-east as shown in figure below. Dutsin-Ma L.G.A has a land size of about 552.323 km2 with a population of about 169, 829 (National Population Commission NPC, 2006). The people are predominantly farmers, cattle rearers and traders (Baraya *et al.,* 2020).

2.2. Experimental Fish and Experimental Design

African catfish (*C.gariepinus*) fingerlings of mean weight 2.1g were used for this study. The fish was sourced from a reputable fish farm and transported in 50liter plastic container to the experimental site. The fingerlings was acclimatized and fed with feed of 2mm for two (2) weeks prior to the commencement of the experiment. The experiment was set up comprising of four treatments (4) groups (T1, T2, T3 and T4,) which replicated 3 thrice with ten (10) fingerlings in each replicate respectively. Treatment 4 served as the control experiment having zero (0) inclusion of ginger and garlic, Treatment 1 contained 0.5% of ginger and 0.5% of garlic (0.5% Z.O and 0.5% A.S which made up 1.0% Z.O and A.S), Treatment 2 contained 0.75% ginger, and 0.75% garlic (0.75% Z.O and 0.75% A.S which made up 1.5% Z.O and A.S) while Treatment 3 contained 1% ginger and 1% garlic (1.0% Z.O and 1.0 % A.S which made up 2.0%% Z.O and A.S) respectively. The experiment was conducted in twelve (12) transparent squares plastic containers of 10 litres each, and filled at one-third of the transparent squares’ plastic containers. The water which was adjusted as the fish grew to two-third of the transparent square plastic containers. The fish were randomly allotted into four (4) treatments in the transparent squares plastic containers at a stocking rate of ten (10) fingerlings per tank in triplicates. All the containers were mounted/placed on a supporting block to lift them from the beer floor and was supplied with borehole water. A clean environment was maintained around the research room. The fish were fed two times daily at their satiation per day (9:00 a.m. and 5:00 p.m.). Weights were taken at the intervals of one week for ten (10) weeks. Quantity of feed were adjusted as the experimental fish grows.

2.3. Preparation of the Experimental Feed

Fresh ginger (*Zingiber officinale*) and 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 easy mixture in the feed when it's particle size is made very smooth. After which the ginger and garlic were crushed and grinded using the Corona manual blender. Feed ingredients used for the experimental diets were grinded into powder and they include: ginger powder, garlic powder, fish meal, soybean, maize, Wheat offal, vitamin/ mineral premix, and palm oil. Ingredients of each treatment was weighed and mixed thoroughly in a container containing palm oil and warm water which was added slowly alongside the ingredients and mixed manually to achieve a proper consistency. The ingredients was pelletized using an electric pelleting machine and was sundried before being packed into containers and was stored at room normal room temperature. Formulated diet samples (10g) was analyzed according to (AOAC, 2019). Ginger and garlic powder was added into the diets at the concentration of 0g/kg, 1.0g/kg, 1.5g/kg and 2.0g/kg of feed.

2.4. Statistical Analyses

All data collected during experimental period were subjected to a one-way analysis of variance (ANOVA) using completely randomized design in accordance with SAS and Duncan's multiple range tests was employed to reveal significant differences ($P<0.05$) among the means using Systat software (SAS Institute 2003) as contained in SAS (1999) package.

3. RESULT AND DISCUSSION

3.1. Growth Performance, Feed Utilization and Survival Rate

Table 1 Growth Performance, Nutrient Utilization and survival rate of African catfish (*Clariesgariepinus*) 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 mean

Table 1 shows that FMW, MWG and PWG in treatment 2 has the Highest values obtained (T2 893.10g/kg, 798.33g/kg and 942.65g/kg respectively). The result shows that, there was no significant difference ($p > 0.05$) between T1, T2, and T4. The differences observed in FMW, MWG and PMW might be as a result of the presence of ginger and garlic supplements included in the diet and also the performance of the fish fed the supplemented diets in FMW, MWG and

PWG over control diet could be due to the presence of growth promoters: the presence of ginger and garlic in 1%, 1.5% & 2% ginger and garlic. The result of this study agrees with the finding of Mahmoud, *et al.* (2019) who documented that there was no significant difference in FBW between fish fed 1.5% ginger & garlic and basal control group. Equally, (Iheanacho, *et al.*, 2017) also affirmed that there was significant increase in weight gain, specific growth rate and final weight of *C. gariepinus* fingerling when fed varying level concentrations of ginger and garlic (0.25, 0.50, 0.75 and 1.0 g/35 L) as compared to the control. Hence, the good response to growth in fish fed varying level of ginger and garlic, more especially, those who were fed 1g/kg ginger and garlic maybe as a result of the average proximate compositions of ginger which served as a rich source of mineral elements, as well as vitamins and it also contains good number of phytochemical constituent that improved growth and health of fish 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). On the contrary (Adegbesan, *et al.,* 2019) reported that a general increase in weight gain and highest growth performance observed in fish fed 1% and 3% gingerroot-powder. Fingerlings that were fed 1% ginger root-powder supplement have the best growth index in terms of Percentage Weight Gained (PWG). Samson, (2019) also indicated in his findings that, there are no significant differences in the performance of the red tilapia with the inclusion of different concentrations of garlic in the diet. The result of the study shows that the final length and weight were not improved by garlic supplementation in feeds. The result however also agrees with the findings of Fall and Ndong , (2007) , where they stated that there was no significant differences on growth of hybrid tilapia (*Oreochromis niloticus* × *Oreochromis aureus*) fed garlic supplementation for about 4 weeks. In addition, [Sahu , *et al.,* 2007; Thanikachalam, *et al.,* 2010] reported that there were no significant differences on growth parameters of *Labeo rohita, Clarias gariepinus, Huso huso* and *Cyprinus carpio* after adding different levels of garlic in their diets.

The result obtained shows that there was increased in the total FI and PI at higher level (2% Z.O & A.S) in treatment 3 (1103.81g/kg & 441.52g/kg) when compared with the treatment 4 (control) even though, they are statistically the same in FI and PI. The increased in FI and PI could be attributed to the allicin present in garlic, which promotes the performance of the intestinal flora, thereby improving feed intake and protein intake. *A . sativum* for its part is also known to have promote feed intake and protein intake. In support to this study Ndakalimwe, *et al.* (2019)discovered that supplementation of *Aloe vera* 100% powder at an inclusion level of 2.0%/kg diet was indicated to have significantly improved growth and feed utilization performance in GIFT *O. niloticus* strain. The results of the present study is also in accordance with those obtained by (Jahanjoo, *et al.,* 2018) who recorded better feed utilization in Sobaity Sea Bream (*Sparidentex hasta*) fry fed with basal diet containing 1g of *Z. officinal le* and *A. sativum* respectively for 8 weeks. The findings of Adegbesan, *et al.* (2019) does not agree with this study, where they discovered that there was a reduction in the total feed intake at higher levels of 2% and 3% of *Z. officinale* root-powder fed to *Fasasi*; this may probably be as result of lower palatability of ginger and garlic as a result of the presence of tannin in the ginger root-powder. The findings of Jahanjoo, *et al.* (2018), confirms that tannins might have probably interfere with digestion by displaying anti-trypsin and anti- amylase activity, forming complexes with vitamin B12 and interfering with the bioavailability of proteins.

It can also be observed that SGR and PER recorded the highest values (1.20% & 1.90% respectively) in treatment 2 with 1.5% *Z. officinale* and *A. sativum* mixture. This improvement in specific growth indices and protein can be attributed to the presence of immune-stimulation effects. Even though, there was no significant difference ($P>0.05$) between treatment 1, treatment 2 and treatment 4 (or control). (Khodadadi, *et al.* (2013) finds out in their study that the supplementation of ginger in the diets resulted in an enhanced specific growth rates and improved weight gain and reduced feed conversion ratio in *C. gariepinus*. The results of the present study

are in accordance with those obtained by (Ndakalimwe, *et al.,* 2019) who recorded better growth performance in Sobaity Sea Bream (*Sparidentex hasta*) fry fed with basal diet containing 1g of *Z. officinale* and *A. sativum* respectively for 8 weeks. An antagonistic result obtained Fall, and Ndong , (2007) finds poor growth and feed utilization in term of specific growth rate and feed conversion ratio after feeding *Oreochromis niloticus* fingerlings for 60 days 1.5g ginger and garlic compared to basal diet.

The result of this study on feed utilization and increased performance might further be explained in respect to Irabor, *et al.* (2021) who stated that garlic improved energy utilization and digestion by increasing intestinal flora function due to its allicin content. Although, there was significant (P> 0.05) difference in final weight across treatments but that of control exhibited a lower final weight.

4. CONCLUSION

The present study showed that ginger and garlic supplementation was encouraging to improve the growth, survival rate and reduced mortality of catfish (*C. gariepinus*) fingerlings, due to the supplementation of ginger and garlic as growth promoting and immunostimulation properties it contained. Furthermore, supplementation of ginger and garlic has in the diets of animals shown to influence the haematological profile of fish. However, ginger and garlic inclusion at 2g/kg and above are considered dangerous to the fish life based on this finding, as observed from this result in the MR scores (at 2g/kg: 6.70%). Therefore, this study finds out that supplementation of 1g/kg and 1.5g/kg ginger and garlic powder dietary in cultured *C. gariepinus* would effectively improve the growth, survival rate, and enhance mortality rates of the fish.

5. RECOMMENDATION

From the above findings, it is recommended that, supplementation of ginger and garlic concentrate can be conveniently introduced into complete fish diet of catfish at 1g/kg and 1.5g/kg inclusion level. However, further study is recommended to be carried out with higher inclusion rates to evaluate the effect of inclusion that would not be detrimental to the fish.

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