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Effects of Oxytetracycline as a Growth Promoter and its Concentration on Carcass of African Catfish (*Clarias gariepinus* Burchell, 1822) in Maiduguri

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Abstract: *The use of Oxytetracycline as a growth promoter and its concentration on carcass of African catfish (Clarias gariepinus) was carried out. The aim was to assess the effect of OTC on growth performance, survival of Clarias gariepinus fingerlings fed OTC base diet and the concentrations of the Oxytetracycline on the carcass of the fish fed. Three hundred gram of oxytetracycline was procured from gidan madara shopping complex in Maiduguri and incorporated into a normal diet of 40 % crude protein at 0, 50, 100 and 150g and fed to Clarias gariepinus fingerlings for the period of 3 months. Growth indices were estimated and calculated. Carcass samples from each group were collected and analysed for the presence and concentration of the oxytetracycline. Data obtained were subjected to analysis of variance. The result showed higher weight gain (215.98) in 50% OTC inclusion level diet and final total length (129.17 mm) recorded in 100% OTC inclusion level while survival rate was higher in 150 inclusion level of the OTC. The concentration of the oxytetracycline in the carcass of the fish was higher (0.42µg/g) in 100% OTC inclusion level. Therefore oxytetracycline can be included at 50, 100 and 150% in fish diet as it promotes the growth of Clarias gariepinus with less residual effect on the carcass.*

Key words: *Effects, Oxytetracycline, growth, carcass, concentration, Clarias gariepinus*

Introduction

Clarias gariepinus or African sharp tooth catfish is a species of catfish of the family claridae known as the air breathing catfishes. They are found throughout Africa and Middle East and live in fresh water lakes, rivers, and swamps as well as human-made habitats such as oxidation ponds or sewages system (FAO, 2006). The African sharp tooth catfish was introduced all over the world in the early 1980s for aquaculture purpose. In Nigeria catfish of the family claridae comprises the most commonly cultivated fish. The catfish *Clarias gariepinus* from biological perspective is undoubted one of the most ideal fish species for agriculture world wide (CP, 2006). The species are fast growing, hardy and easily

reproduced with high fecundity. The species has a high market value especially in Nigerian markets (Madu *et al,* 1984). Fish feed account for 70% of aquaculture operation (FAO, 1983). Antibiotics are drugs of natural or synthetic origin that have the capacity to kill or inhibit the growth of micro-organisms (European Centre for Disease Prevention and Control 2014). Antibiotic growth promoters (AGPs) are administered at low doses in the feed and they act by specifically reducing the number of pathogenic bacteria in the gut (Dafwang *et al*., 1987). Antibiotics such as oxytetracycline play an important role on the growth and survival rate of *Clarias gariepinus* fingerlings. Oxytetracycline has the formular C22H24 N2 O9 and molar mass of 460.434g/mol. It was the second of the broad spectrum tetracycline group without protein, the bacteria cannot grow, multiply and increase in numbers (Datwang *et al*., 1987). Research have been conducted to promote the growth of fish using drugs such as Rasha *et al*. (2013) on the effect of tetracycline and florfenicol as a growth promoter on the health status of cultured fish. Camila *et al*., (2018) on the role of probiotic bacteria as healthy alternative for fish aquaculture. Yilmas (2019) on the effects of dietary blackberry syrup supliment on growth, antioxidant, and immunological response, and resistance of nile tilapia, (*Oreocromis niloticus*) to *Plesiomonas shigelloides.* Muyideen *et al*. (2012) on the effects of oxytetetracycline (OTC) and Furasol (FRS) on the growth performance and stomach wall lining of *Clarias gariepinus*. Chik-Boon *et al*. (2014) on the effects of a dietary organic acid blend and oxytetracycline on the growth, nutrient utilization and total cultivable gut microbiota of the hybrid tilapia, Orechomis sp, and resistance to *streptococcus agalacticae* and Julinta *et al*. (2019) on dietary influences of oxytetracycline on the growth serum biomarker of *Oreocromis niloticus*. Upon all the effort in the utilization of oxytracycline and other growth promoters in fish, many fish farmers in Nigeria complained on slow growth of their farm fish. No information was documented on the use of oxytetracycline as growth promoter on *Clarias gariepinus* in Maiduguri. This research is therefore looks at the effect on the use of Oxytetracycline on growth, survival and health status of *Clarias gariepinus.*

MATERIALS AND METHOD

Study Area

The experiment was conducted at the Teaching and Research Fish Farm of Department of Fisheries, University of Maiduguri situated between latitude 11^0 51^1 N and longitude 13^0 05^1 E. the area is characterized with cool dry climate from January to march and on average, the warmest month of April. It has a mean annual rainfall of over 800mm. The rainy season usually begins in May and ends in October. The relative humidity of the study area is 5-54.5% and atmospheric temperature ranging from 38-40^0 during the day and drops to 29-31^0 during the night (Premium Time Nigeria, 2015).

Collection and preparation of feed ingredient

Forty percent (40%) crude protein diet was formulated using fish meal, soya bean meal, groundnut cake, wheat bran, vitamin c, minerals premix and cassava starch (Table 1). The ingredient were procured from local market in Maiduguri and processed. Soya bean was toasted for 10-15minute, wheat brand, groundnut cake and fish meal were ground separately into powder using hammer miller and finally mixed. The formulated diet was analyzed for their proximate composition (Table 2) according to the method described by AOAC (1999).

Table 1: ingredient compositions in the formulated experimental diet

Ingredient	Oxytetracycline inclusion level (%)			
	0	**50**	**100**	**150**
Fish meal	2.32	2.32	2.32	2.32
G/nut cake	2.32	2.32	2.32	2.32
Soya beans	2.32	2.32	2.32	2.32
Maize	1.28	1.28	1.28	1.28
Wheat bran	1.28	1.28	1.28	1.28
Premix	0.047	0.047	0.047	0.047
Methionine	0.127	0.127	0.127	0.127
Lysine	0.173	0.173	0.173	0.173
Salt	0.0033	0.0033	0.0033	0.0033
Vitamin c	0.0033	0.0033	0.0033	0.0033
Bone meal	0.2	0.2	0.2	0.2

Table 2: Proximate Composition of Experimental Diet

	Inclusion level (%)			
	0	50	100	150
Crude protein	39.00	40.25	42.70	44.30
Moisture	7.38	12.61	18.16	22.11
Ether extract	6.21	6.38	6.64	6.74
Crude fibre	5.56	5.98	5.60	5.91
Crude fat	7.11	6.38	6.49	6.64
Ash	7.18	7.77	7.94	7.99

Collection and Preparation of Oxytetracycline

Three hundred grams (300) of oxytetracycline (6 sachets) were procured from Gidan Madara (milk shop) Maiduguri and convey to the Department of fisheries university of Maiduguri and were stored in refrigerator until require for the experimentation.

Experiment Fish

Forty two days old *Clarias gariepinus* fingerlings were procured from a Fish farmer at Damboa Maiduguri and convey to fish hatchery complex University of Maiduguri. The fish were stocked in concrete tank and starved for 24 hours prior to the commencement of the experiment to allow for digestion of already eaten food and also prepare the fish for the test diets

Experiment Design

The Oxytetracycline was incorporate into the formulated powdered diet at concentration of 0, 50, 100 and 150grams in three replicate. One hundred and twenty (120) healthy specimens (1.0-5.9 g) and (5.3-9cm) were selected and distributed into 12 hapa net at stocking density of 10 fingerlings per hapa. The test diets were fed twice daily at 5% biomass of the fish, administered between 9 to 10 am and 5 to 6 pm daily for a period of

three months. The experiment was conducted in a complete randomize design manner (CRD).

Growth Indices

The fish in each treatment were initially weight and total length measured before the commencement of the feeding trial using sensitive weighing scale and meter rule Ration allotment were adjusted bi-weekly according to new body weight changes. Body weight changes and feed intake were recorded from weight data and the quantity of feed consumed, feed utilization data were calculated by the following formulae:

i) Mean weight gain (mwg) = w_2 - w_1 where w_2 = the mean final weight of fish, w_1 = the initial mean weight of fish. (Pitcher and hart, 1982).

ii) Daily weight gain = MWG / initial mean weight x 100 (Pitcher and hart, 1982).

iii) Specific growth rate (SGR) =100($\log W_1$-$\log W_2$) x t

Where; $w_1$and w_2 = the logarithms of initial and final weights of fish, Respectively, T = the number of days for the feeding trial (Brown, 1957).

iv) Feed conversion ratio (FCR) = Dry weight of diet fed (g) / fish weight gain (g).

v) Protein intake (P I) = protein content in the diet x daily feed intake.

vi) protein efficiency ratio (PER) = mean weight gain / mean protein intake. (Burel *et al*., 2000)

Antibiotic Residues in Carcass

After the feeding trial, carcass samples from each group were collected and tested for the level of oxytetracycline residues using the method described by (Senyuva *et al*., 2000). The carcasses collected were homogenized in a blender for 2 minutes and 0.1g of citric acid was added. 1ml nitric acid (30%), 4ml methanol and 1ml deionised water were added to the mixture and put in a voltex for proper mixing. The mixture was kept in a ultrasonic and bath for 15 minutes. They were further centrifuged for 10 minutes at 5300 rpm and finally filtered using nylon filter with 0.45µm. 20µl of the mixture was added to high performance liquid chromatographic for the analysis.

Data Analysis

The data obtained from the study were subjected to one way analysis of variance (ANOVA) differences in mean were separated using least significant differences (LSD) at p=0.05 level of significant differences using statistix 8 package.

Results and Discussions

Figure 1 and 2 showed the effect of oxytetracycline doses on the growth and survival of *Clarias gariepinus*. Final weight was observed to be higher in treatment 3 (100% OTC inclusion level) with a value of 253.91g, followed by treatment 2 and 4 recording the values of 246.86 and 223.55g respectively. Treatment 1 (0% OTC inclusion level) recorded the value of 214.38g. There was no significant differences ($p<0.05$) among all the treatments (0, 50, 100 and 150%). Final weight presented in this study was higher than the final weight reported by Muyideen *et al*. (2012) as 117.62g. Final total length was higher in fish fed 150% OTC inclusion level with a length of 136.22mm followed by fish fed with the control diet (0% OTC inclusion level) with a value of 130.35mm, fish fed 100% OTC inclusion level presented the value of 129.17mm while the least value (124.98mm) was in

fish fed 50% OTC diet. The total length presented no significant differences ($p<0.05$) among all the treatments (0, 50, 100 and 150%). Lower value of the final total length (121.93) was reported by (Hosea, 2018). Weight gain was observed to be higher in treatment 3 (100% OTC) with a weight of 229.13g, followed by treatment 2 and 4 (50 and 150% OTC) presenting the values of 215.98 and 196.56g. The fish fed control diet (0% OTC) showed the least value of 175.17g. There was no significant differences ($p<0.05$) among all the treatments (0, 50, 100 and 150%) in term of the weight gain. The weight gain recorded in this study was higher than the result reported by Muyideen *et al*, 2012 as 98.62g after feeding *Clarias gariepinus* juveniles with oxytetracycline and furasol for the period of ten (10) weeks. The reason for the differences in the weight gain could be as a result of the differences in the crude protein level of the experimental diet and level of the inclusion of oxytetracycline and furasol used. The specific growth rate was revealed to be higher in treatment 2 (50% OTC inclusion level) with a specific growth rate of 85.41%, followed by treatment 3 and 4 (100 and 150% OTC inclusion level) the values of 82.94 and 80.72% respectively while the fish treated with control diet recorded the least value of 74.96%. There was no significant differences ($p<0.05$) among all the treatments (0, 50, 100 and 150% OTC inclusion level) in the specific growth rate. Higher food conversion ratio was seen in treatment 1 (control diet) with a value of 7.74% followed by treatment 4 and 2 (150 and 50% OTC inclusion level) as 6.61 and 5.86% respectively. Treatment 3 (100% OTC inclusion level) showed the least food conversion ratio of 5.46%. There was no significant differences ($p<0.05$) among all the treatments (0, 50, 100 and 150% OTC inclusion level) in term of the food conversion ratio. Specific growth rate and food conversion ratio presented in this work were all greater than the findings of Solomon *et al*. (2015) that reported the values of 2.25 and 2.06% respectively on their work on growth performance and haematological parameters of *Clarias gariepinus* fed varied levels of *Cola nitida* meal. Condition factor was calculated to be higher in fish treatment 100% OTC inclusion level with the condition of 3.42. Treatment 2 and 4 (50 and 150% OTC inclusion level) recorded the condition factor values of 3.22 and 2.92. Lower value (2.28) of the condition factor was revealed in the control diet. The condition factor also presented no significant differences ($p>0.05$) among the entire treatments (0, 50, 100 and 150 OTC inclusion level). The condition factor of the fish are revealed in this work is closed to the value laid down by Mohammed *et al*. (2017) as 3.37 on their work on the potential of camel testicles for the growth and survival of masculinized nile tilapia. Percentage survival of the experimental fish showed higher value (96.66%) in treatment 4 (150% OTC inclusion level). The percentage survival of the fish treated 50 and 100% OTC inclusion level gave the value of 86.66 each. Treatment 1 which is the control revealed the least percentage survival of 83.33%. No significant differences ($p<0.05$) was observed among all the treatments (0, 50, 100 and 150 OTC inclusion level). The percentage survival of the fish reported in this study was less than the finding of Julinta *et al.* (2019) as 100% when worked on effect of oxytetracycline dosing on the growth, safety and intestinal histology of nile tilapia juveniles.

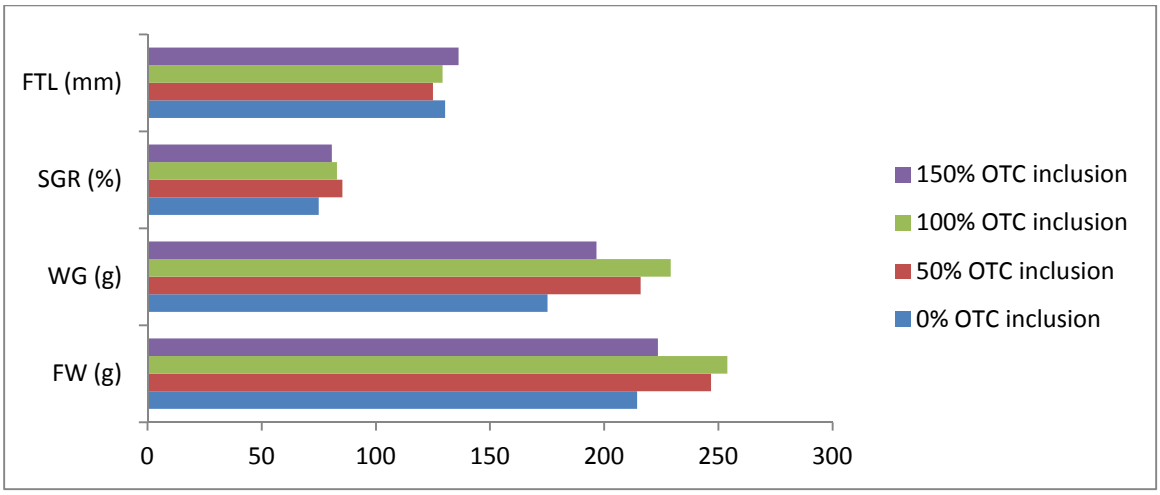

Figure 1: Effect of Oxytetracycline on African catfish growth performance
Key: FW = Final weight (g), WG = Weight gain (g), SGR = Specific growth rate (%), FTL = Final total length (mm).

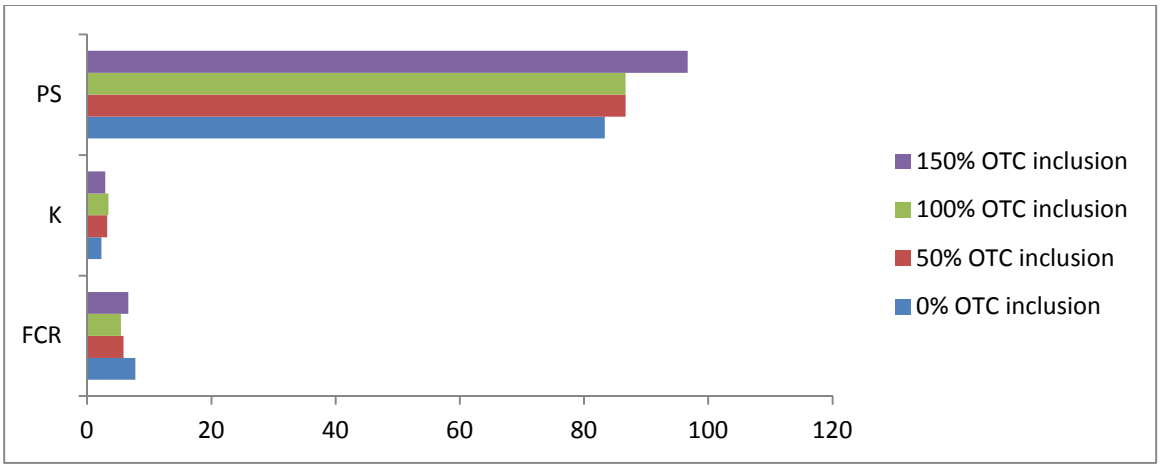

Figure 2: Effect of Oxytetracycline on African catfish growth performance
Key: FCR = Food conversion ratio, K = condition factor, PS= percentage survival (%)

Residual level of Oxytetracycline in Carcass

After the analysis of the carcass for oxytetracycline residues, fish fed 100% OTC inclusion level showed higher concentration of residues in the carcass (0.42µg/g) followed by fish fed 50 and 150% inclusion level of the OTC with values of 0.41 and 0.37µg/g respectively (figure 3). The value of the OTC residue concentration indicated in this research was higher than the value reported by Rasha *et al.* (2013) as 0.05µg/g muscle. The presence of antibiotics in human is associated with several adverse public health effects, including hypersensivity, gastrointestinal disturbance, tissue damage, and neurological disorders (Babapour *et al.*, 2012), these adverse effects can be seen when the antibiotics are consumed above the maximum acceptable level in the animal tissue. The results of the residual concentration of oxytetracycline obtained in this research are within the

acceptable maximum residues level to be consumed in the liver, muscle and kidney of animals as 200, 600 and 1200µg/kg respectively (Abbasi *et al*., 2012).

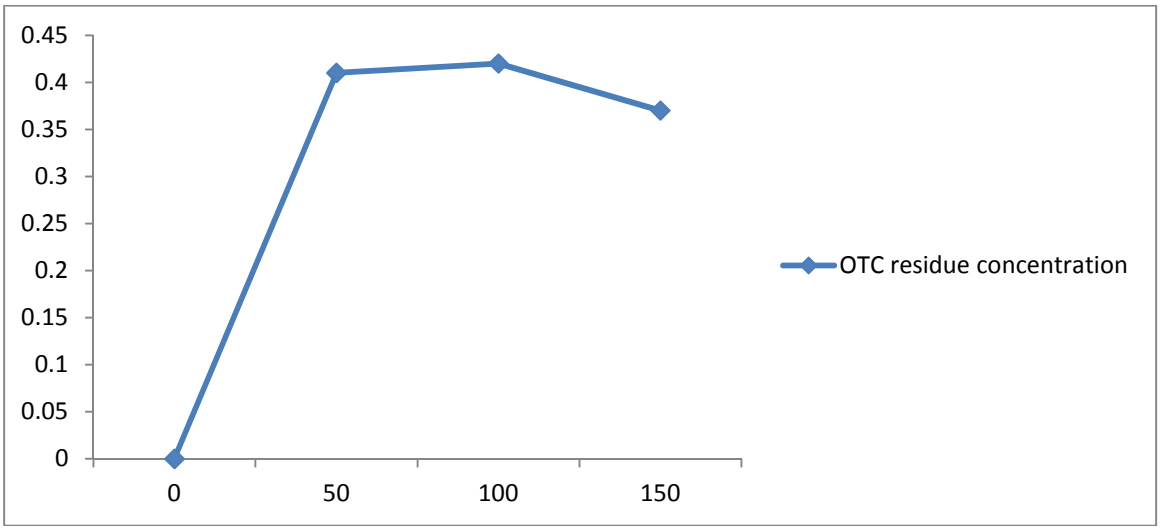

Figure: 3. Residues concentration of oxytetracline in carcass of *Clarias gariepinus* fed different level of OTC

Conclusion

Base on the result obtained in this study, inclusion of OTC at 50 and 150% promotes the growth and survival of *Clarias gariepinus* fingerlings. The residual values of OTC in the carcass were below the maximum acceptable level. Therefore, the treated fish can be consume without harm.

Recommendation

It is recommended that OTC should be included in fish diet at lower level to promote growth and survival. Because the use of antibiotics in human food is associated with several adverse public health effects, including hypersensivity, gastrointestinal disturbance, tissue damage, and neurological disorders, studies should also be conducted with lower percentage inclusion level of the OTC in order to reduce its effect on the fish muscles.

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