GROWTH AND NUTRIENT RESPONSES OF *CLARIAS GARIEPINUS* FINGERLINGS FED DIETARY LEVELS OF *OCIMUM GRATISSIMUM* LEAF MEAL

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Abstract

Growth and nutrient utilization of *Clarias gariepinus* fingerlings fed 36% isonitrogenous dietary levels of 0%, 5%, 10% and 15% *Ocimum gratissimum* leaf meal (OGLM) were evaluated. The fingerlings were randomly assigned to 4 treatments – 0%(T_{zo}), 5%(TO_1), 10%(TO_2) and 15%(TO_3) OGLM in 3 replicates of 14 fingerlings each using 12 plastic aquaria of 250 x 150 cm dimension. The fingerlings were fed at 5% body weight twice daily within an experimental period of 56days. Mortality was least in the control (0%) treatment and highest in TO_3. Daily feed intake and protein intake were similar (P>0.05). T_{zo} had the highest body weight gain, followed by TO_3, TO_2 and TO_1. The specific growth rate for T_{zo} (control) treatment was significantly (P<0.05) higher than other treatments. This was followed by TO_3 (15%), while TO_1(5%) and TO_2(10%) were significantly (P<0.05) the least. This followed similar trend with the feed conversion ratio. The protein efficiency ratio of the control treatment was significantly (P<0.05) higher than other treatments, while there was no significant (P>0.05) difference on the production protein value (PPV) of the fish. Dietary level of OGLM at 15% inclusion level therefore showed a seemingly significant contribution as feedstuff in the diet of *Clarias gariepinus* fingerlings in sustaining good performance and overall yield of the fish.

{**Citation:** Offor, J.I.; Anyanwu, D.C.; Ugwuoke, C.U.; Onogu, B.; Mbachu, M. Growth and nutrient responses of *Clarias Gariepinus* fingerlings fed dietary levels of *Ocimum Gratissimum* leaf meal. American Journal of Research Communication, 2014, 2(2): 167-177} www.usa-journals.com, ISSN: 2325-4076.

Introduction

One of the major problems facing the aquaculture industry today is the high cost of fish feed. Nutritionists all over the world are in constant search of the dietary feedstuff sources that will maximize growth and increase production within the shortest possible time, and at the lowest

cost (Adewolu, 2008). This is because the traditional or conventional feedstuffs are becoming costly and less available, hence the need for unconventional feedstuff sources, especially those of plant origin.

Most leaf meals have been reported to provide essential nutrients required in livestock feeds, including fish (Yousif *et al*, 1994; Ali *et al*, 2003; Bairagi *et al*, 2004; Adewlu, 2008) as in *cassava, alfalfa, Carica papaya, Leucaena leucocephala* and *Ipomea batatas* leaf meals respectively. *Ocimum gratissimum* leaf meal has the potentials for use in feeds because of its nutrient content of energy, crude protein, lipids, ash and other essential nutrients (Edeoga *et al*, 2006). Its use however has been limited majorly by the presence of antinutritional substances, especially *safrole* which is a potentially dangerous compound that can inhibit digestion of cell walls in ruminants because of their antimicrobial activity, thereby decreasing productivity.

Clarias gariepinus are known for their characteristic hardiness, disease resistance, high yield and omnivorous food habits (Babalola and Apata, 2006; Anyanwu, 2008). This study therefore was aimed at determining the level of *Ocimum gratissimum* leaf meal that will support growth and nutrient utilization of *Clarias gariepinus*.

Materials and Methods

The experiment was carried out in the Dept. of Agricultural Science, Alvan Ikoku Federal College of Education, Owerri (Farm Unit), Imo State. Owerri lies between Latitude 5^{O} and 6^{O}N and Longitude 6^{O} and 7^{O}, within the rainforest zone of Nigeria. Twelve plastic aquaria (250 x 150cm), covered with mosquito mesh screen, to prevent fish from jumping out and possible predation were used.

The *Ocimum gratissimum* leaves were harvested from private backyard farms within Owerri capital territory, Imo state. These were spread under the sun and dried for 3 days until they became crispy while still retaining the green colouration. The dry leaves were milled, using a hammer mill to produce the leaf meal. The leaf meal was used to make three 36% crude protein isonitrogenous diets at inclusion levels of 5, 10 and 15% for TO_1, TO_2 and TO_3 respectively. Maize was used as the major source of energy in the diets, while soyabean meal and fish meal as major sources of protein (Table 1).

Table 1: Dietary Compositions of the Experimental Diets of *Ocimum gratissimum* leaf meal

Ingredients	T_{zo}(0%)	TO_1(5%)	TO_2(10%)	TO_3(15%)
Maize	34.50	29.90	25.30	20.70
Fish meal	20.00	20.00	20.00	20.00
Blood meal	5.00	5.00	5.00	5.00
Soy. Bean meal	35.10	34.70	34.30	35.90
OGLM	0.00	5.00	10.00	15.00
Cassava Starch	2.00	2.00	2.00	2.00
Palm oil	1.00	1.00	1.00	1.00
Lysine	0.20	0.20	0.20	0.20
Methionine	0.20	0.20	0.20	0.20
Bone meal	1.00	1.00	1.00	1.00
Vit. Premix	0.50	0.50	0.50	0.50
Common Salt	0.50	0.50	0.50	0.50
Total (%)	**100**	**100**	**100**	**100**

Lysine and methionine at 0.2% levels of inclusion, and 1% bone meal were used, with vitamin/mineral premix and common salt at 0.5% levels of inclusion as main sources of vitamins and minerals. Cassava starch was used at 2% inclusion level as binding material. The feedstuff were finely ground and mixed up into a dough form in a plastic bowl using hot water. The mixture was then pelleted by passing it through a mincer of 2mm die to produce 2mm diameter size of pellets. The pellets were then sundried to about 10% moisture content, packed in polythene bags and kept safely dry for use.

One hundred and sixty-eight fingerlings of *Clarias gariepinus* were collected from the African Regional Aquaculture Centre (ARAC) fish farm, Port Harcourt were stocked and acclimatized for

7 days during which they were fed with the control diet of 36% CP and of zero leaf meal twice daily, 08.00 – 09.00hr and 17.00 – 18.00hr. At the end of the acclimatization period, the 168 fingerlings were completely randomized in 3 replicates of 14 fingerlings per replicate for the 4 treatments – T_{zo} (control), TO_1, TO_2 and TO_3. Feeding commenced an hour after weighing at 5% body weight, twice daily at 08.00 – 09.00hr and 17.00 – 18.00 hr.

Subsequently, body weight measurements were taken biweekly, and rations adjusted according to fish weight gain. The water in the aquaria was regularly monitored for the physico-chemical properties, and renewed completely every other day within the experimental period that lasted 56days of culture. Temperature was determined using mercury in glass thermometer calibrated from 0-100^{O}c; immersed 5cm deep on the water surface. The pH and dissolved oxygen readings were taken using pH and oxygen meters respectively.

The proximate analysis of the test feedstuff and diets were carried out to determine the moisture content, ash, lipid, crude protein, crude fibre and nitrogen free extract, using the A.O.A.C (2000) methods and Kekeocha (2001). Nutrient utilization and growth index were calculated according to Brown (1957) and A.O.A.C (2000) methods. Experimental data were subjected to analysis of variance (ANOVA) as described by Steel and Torrie (1980). Significance was tested using the Duncan Multiple Range Test (DMRT) at 95% confidence level, using Statistical Package for Social Sciences (SPSS) for windows (version 7.5).

Result

The proximate composition for the test feedstuff *Ocimum gratissimum* were 13.22%, 13%, 3.41% and 11.19% for crude protein, crude fiber, ether extract and ash respectively. The chemical composition of the experimental diets for crude protein were similar (36%CP) for the 0% (control), 5%, 10% and 15% dietary inclusion levels of *Ocimum gratissimum* leaf meal (Table 2).

Table 2: Chemical Composition of Experimental Diets

Parameters	T_{zo}(0%)	TO_1(5%)	TO_2(10%)	TO_3(15%)
Crude protein (%)	35.98	35.98	35.99	35.99
Crude fibre (%)	2.59	3.11	3.63	4.12
Ether extract (%)	13.06	12.90	12.74	12.46
Ash (%)	7.11	7.56	8.01	8.42
ME (Kcal/g)	3,221	3,045	2,881	2,695

The 15% OGLM diet had the highest crude fibre and ash content, followed by the 10% and 5% OGLM, while the control diet had the least. The ether extract and energy content of the diets decreased with increase in OGLM dietary inclusion levels, with the 0% (control) diet as highest, while the 15% diet was the least. The mean values for the water conditions of the experimental aquaria (Table 3) fall within 25.90 – 26.20^{o}C for temperature, 6.30 – 6.50 for Ph and 4.20 – 4.60mg/l for DO_2.

Table 3: Water Quality Assessment

Treatments	Mean Temp. (^{o}C)	Mean pH	Mean DO(mg/l)
T_{zo}(0%)	26.20	6.40	4.60
TO_1(5%)	25.90	6.50	4.20
TO_2(10%)	26.10	6.40	4.60
TO_3(15%)	26.00	6.30	4.40

The result of the experiment showed increase in body weight of the experimental fish (Table 4), 1.53g, 0.97g, 1.02g and 1.29g for treatments T_{zo}(0%), TO_1(5%), TO_2(10%) and TO_3(15%) respectively.

Table 4: Growth and Nutrient Utilization of *Clarias gariepinus* fed dietary levels of *Ocimum Gratissimum* leaf meal

	Dietary Levels of OGLM				
Parameters	**T_{zo}(0%)**	**TO_1(5%)**	**TO_2(10%)**	**TO_3(15%)**	*** SEM**
Final weight/fish (g)	2.67	2.09	2.14	2.42	0.12
Initial weight/fish (g)	1.14	1.12	1.12	1.13	0.004
Weight gain/fish (g)	1.53	0.97	1.02	1.29	0.11
Mortality (%)	14.00	26.00	26.00	40.00	4.60
Daily feed intake/fish (g)	0.08^a	0.08^a	0.08^a	0.08^a	0.00
Daily Protein intake/fish (g)	0.03^a	0.03^a	0.03^a	0.03^a	0.00
Specific Growth Rate (%/day)	1.53^a	1.12^c	1.23^c	1.36^b	0.07
Protein Efficiency Ratio	0.91^a	0.58^b	0.61^b	0.78^b	0.06
Feed Conversion Ratio	2.90^a	4.00^d	3.65^c	3.32^b	0.20
Production Protein Value	0.60^a	0.37^a	0.39^a	0.48^a	0.04

Means with similar superscript are not significantly different (P>0.05).
** Standard error of pooled means.*

The daily feed intake and protein intake for the treatments were not significantly (P>0.05) different. There was a corresponding decrease in weight of fish with increase in OGLM dietary levels and decreasing energy level of the diets when compared with the control treatment. The specific growth rate of the fish ranged between 0.97 – 1.53%/dy and were significantly (P<0.05) different, T_{zo} higher than other treatments. This was followed by TO_3 (15%), and then TO_2 (10%) and TO_1 (5%) which were the least. The protein efficiency ratio and feed conversion ratio of the control treatments were significantly (P<0.05) superior to the rest of the treatments. This was followed by TO_3 (15%) while TO_1(5%) was the poorest. The protein efficiency ratio for the control (0.91) was significantly (P<0.05) higher than the rest of the treatments. The Feed Conversion Ratio for the treatments were significantly (P<0.05) different, the control treatment superior to the rest, followed by TO_3 (15%) and then treatments TO_2 (10%) and TO_3 (5%).

Mortality however was highest for TO_3 (15%), while that of the control (0%) was least. The productive protein value (0.37 – 0.60) of the fish were not significantly (P>0.05) different.

Discussion

The chemical composition of the experimental diets for crude protein were similar (36%CP) for the 0% (control), 5%, 10% and 15% dietary inclusion levels of *Ocimum gratissimum* leaf meal (Tables 1 and 2). The 15% OGLM diet had the highest crude fibre and ash content, followed by the 10% and 5% OGLM, while the control diet had the least. The ether extract and energy content of the diets decreased with increase in OGLM dietary inclusion levels, with the 0% (control) diet as highest, while the 15% diet was the least. Besides, the proximate values for the OGLM test feedstuff are in agreement with the reports of Edeoga, *et al*, (2006). The decrease in energy level of the diets with increase in dietary levels of OGLM is an indication of the low energy level of the leaf meal. Edeoga *et al*, (2006) reported proximate values of 8.48%, 11.81%, 6.87% and 4.90% for crude fibre, crude protein, ash and lipid respectively, and also energy level of 363.10kcal, which is comparatively lower than those of dietary seed meal sources. OGLM contains 12 – 18% crude protein and had been reported to contain antinutritional substances, particularly safrole which can inhibit digestion of cell walls in ruminants because of their antimicrobial activity, thereby decreasing productivity. The mean values for the water conditions of the experimental aquaria (Table 3) fall within the optimal requirements for normal fish production (Jhingran and Pullin, 1985; Anyanwu, 2005; Ochang *et al*, 2007).

The result of the experiment showed increase in body weight of the experimental fish (Table 4) – 1.53g, 0.97g, 1.02g and 1.29g for treatments T_{zo}(0%), TO_1(5%), TO_2(10%) and TO_3(15%) respectively.

The daily feed intake and protein intake for the treatments were not significantly (P>0.05) different. There was a corresponding decrease in weight of fish with increase in OGLM dietary levels and decreasing energy level of the diets when compared with the control treatment. Low energy in the ration means that protein may not be fully utilized to the fullest potentials (NRC,

1993; Bakke – Mckellep *et al*, 2007). The specific growth rate of the fish ranged between 0.97 – 1.53%/dy and were significantly (P<0.05) different, T_{zo} higher than other treatments. This was followed by TO_3 (15%), and then TO_2(10%) and TO_1(5%) which were the least. Nutrients seemed to be best converted into flesh by the fish on the 0% leaf meal dietary treatment, followed by that of the 15%, while the ones of 5% and 10% were least converted. Ali *et al*, (2003); Wing-Keong *et al,* (2004) and Sotolu and Adejumoh, (2008) reported varying nutrient levels to affect growth responses of fish. Fish fed cassava based diet had inferior growth response to the control of zero cassava peel (Oresegun and Alegbeleye, 2001; Anyanwu, *et al* 2012), while in their studies on tilapia using *alfalfa* as test feedstuff, Ali *et al*, (2003), reported a decrease in growth performance which was said to be linearly correlated with level of alfalfa meal in the diet. The trend in SGR of the experimental fish might be an indication of their relative responses to the varied dietary inclusion levels of *Ocimum gratissimum* leaf meal.

The protein efficiency ratio and feed conversion ratio of the control treatments were significantly (P<0.05) superior to the rest of the treatments. This was followed by TO_3(15%) while TO_1(5%) was the poorest. The protein efficiency ratio (0.58 – 0.91), feed conversion ratio (2.90 – 4.00) and SGR values observed in this study were in consonance with that reported by Erfanullah and Jafri (1998), Alegbeleye *et al*, (2001) and Ochang *et al*, (2007). With higher FCR values, there seemed to be decrease in the SGR of the fish. Mortality however was highest for TO_3 (15%), while that of the control (0%) was least. The productive protein value (0.37 – 0.60) of the fish were not significantly (P>0.05) different. The values were comparatively in agreement with the 0.05 – 0.55 value reported by Oyelese (2006) on catfish fed tilapia fishmeal. The control treatment generally revealed a better performance (P<0.05) than other treatments, which runs in consonance with Anyanwu *et al*, (2008) and (2013), who acknowledged that SGR, PER and FCR of post fingerlings fed control diet were significantly (P<0.05) higher than those fed on dietary levels of leaf meals.

The trend in the PPV of the experimental fish, with significant (P<0.05) improvement on the FCR at levels above 5%, as observed for the 10% and 15% OGLM dietary treatments is an indication of the good attributes of the leaf meal in supporting growth and nutrient utilization in fish. Besides its content of phenolic compounds which gives the leaf therapeutic or bactericidal

properties, it has a good content of minerals that are necessary for the repair of worn out cells, building of red blood cells and for body mechanism (Anyanwu, 2008; Edeoga *et al*, 2006; Floridata, 2008). OGLM therefore seems to have a seemingly measurable nutritive attributes to support growth and nutrients utilization, particularly at 15% level of inclusion.

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