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Effects of *Ocimum gratissimum* Leaf Meal on Carcass Composition and Quality of *Clarias gariepinus*

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Abstract: The carcass composition and product quality of *Clarias gaiepinus* fed dietary levels of 0%, 5%, 10% and 15%, *Ocimum gratissimum* Leaf Meal (OGLM) was investigated. The 36% isonitrogenous diets were fed to the post fingerlings, randomly assigned to four treatments-control (T_{zn}), 5% (T_0), 10% (T_{02}), 15% (T_{03}) in three replicates of 15 post fingerlings each using twelve plastic aquaria of 250 x 150 cm dimension. The fish were fed at 5% body weight twice daily within the experimental period of 56 days. Significant differences were recorded in carcass composition, with fish on T_{zn} and T_{01} diets having higher values in crude protein and ash content. Fish on T_{02} and T_{03} diets were higher in moisture content, lipids and nitrogen extract. Fish on T_{zn} diet were significantly superior ($p<0.05$) in quality to fish on T_{01}, T_{02} and T_{03} (for raw fresh fish). However when cooked, the fish on T_{zn} and T_{03} were not significantly different ($p>0.05$). The results of this study showed that up to 15% dietary inclusion level of OGLM could support optimal carcass composition of *Clarias gariepinus* without grossly affecting the quality of the fish.

Key words: *Clarias gaiepinus*, protein sources, aqua feeds

INTRODUCTION

The search for alternative protein sources in aqua feeds is increasing and has gained increasing significance as traditional ingredients are becoming costly and less available (Ali *et al*., 2003; Erdal *et al*., 2004; Adewolu, 2008). Accordingly, considerable attention has been given to the replacement of fish meal with leaf meal protein sources such as duckweed (Hassan and Edwards, 1992; Leng, *et al*., 1995; Erdal *et al*., 2004). Similarly, alfalfa meal (Ali *et al*., 2003) and potato leaf meal (Adewolu, 2008). *Ocimum gratissimum* is a popular herb which is cultivated for culinary purposes. The crude protein, crude fibre, ash, lipids and energy levels of its leaf meal varies from 9.19-17.94%, 4.88-9.04%, 5.68-6.88%, 1.06-4.90% and 357.68-373.26 (mg/cal) respectively (Edeoga *et al*., 2006).
Clarias gariepinus however is known for its omnivorous food habit and is an economically important food fish in Nigeria for table, due to its high premium quality, market potentials and acceptability among others (Babalola and Apata, 2006; Ibrahim *et al*., 2007; Wikipeadia, 2008). The objective of this study therefore was to determine the carcass composition and product quality of *Clarias gariepinus* fed dietary levels of *Ocimum gratissimum* Leaf Meal (OGLM).

MATERIALS AND METHODS

The fish meal and other feed stuff used were purchased at fidelity feed mill in Ikenegbu, Owerri, Imo State of Nigeria. *Ocimum gratissimum* leaves were harvested mainly from bushes and gardens around Owerri. The leaves were sun dried for three days until they became crispy while still retaining their green coloration. The dried leaves were milled, using a hammer mill to produce the leaf meal. Four isonitrogenous diets of 36% cp were formulated at 0%., 5%,10% and 15% dietary inclusion levels of *Ocimum gratissimum* Leaf Meal (OGLM) designated T_{zn}, T_{01}, T_{02} and T_{03} respectively. Maize was used as major source of energy in the diets, while soyabean, fish meal and blood meal as major sources of protein, besides the use of lysine and methioine at 0.2% levels of inclusion. Vitamin premix and salt were used at 0.5% while bone meal was at 1% inclusion level all as main sources of vitamins and minerals. Cassava starch was used at 2% level of inclusion as a binding agent. The feedstuffs were finely ground and mixed up into a dough form. The mixture was then pelleted by passing it through a mincer of 2 mm diameter to produce 2 mm diameter size of the pellets. The pellets were then sun dried to about 10% moisture content, packed in polythene bags and kept safely dry for use. Over one hundred and eighty post fingerlings were collected from African Regional Aquaculture Centre (ARAC) Port Harcourt and stocked in an experimental tank for acclimatization. The fish were acclimated for 7 days during which they were fed with the control diet containing 36% crude protein. After acclimation, samples were collected, dried and the initial carcass composition of the fish was determined. Exactly180 postifingerlings were therefore completely randomized in 3 replicates of 15 per replicate for the 4 treatments. The fish were fed at 5% of their body weight

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twice daily, morning (08.000-09.00) and evening (17.00-18.00). 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 for 56 days of culture. Temperature was determined using mercury in glass thermometer calibrated 0-100°C, pH and dissolved oxygen reading were taken using pH and O_2 meters respectively.

Proximate analysis of the test feed stuff and diets were carried out to determine the moisture content, ash, lipid, crude protein, crude fibre and nitrogen free extract using the AOAC (1990) and Kekeocha (2001) methods. Proximate analysis of fish samples was done bi weekly. Two fish were pooled together from each replicate and were dried in an electric oven at 105°C for 24 h. After which they were ground and proximate composition determined. Moisture content was determined by difference in weight of samples before oven drying and the final constant weight after drying and the crude protein was determined using Kyeldahl methods (AOAC, 1990); crude lipid was determined by extraction with petroleum spirit for 4 h on a soxhlet apparatus, ash was determined from weighed moisture free sample in a porcelain crucible placed in a muffle furnace at 600°C for 6 h; crude fibre was determined by weende method.

At the end of the 56 days, product quality of the fish was determined by carrying out an organoleptic assessment of both raw fresh and cooked sample of the fish. Five well trained literate adults selected for their interest and sensorial capabilities of memorizing stimuli or discriminating intensities were used for the assessment (Ochang *et al.*, 2007). 13 Characters (skin pigmentation, skin mucus, eye trait, eye shape, gill trait, gills odour, flesh rigidity, abdominal wall rigidity, state of peritoneum, adherence of back bone, colour of flesh surrounding back bone, odour of flesh and flavour of flesh were assessed using a 6 score assessment score chart (Anyanwu, 2005).

Average scores of less than or equal to 3.5 indicated freshness (of good quality), while mean scores above 3.5 indicated poor quality.

Data for both carcass composition and product quality were subjected to Analysis of Variance (ANOVA) as described by steel and Torrie (1980). Test of significance was by Duncan multiple Range Test at 95 confidence level using Statistical Package for Social Sciences (SPSS) for windows (version 7.5).

RESULTS

The gross compositions of the experimental diets, as well as proximate composition are presented in Table 1 and 2. Proximate composition for *O. gratissum* leaf meal were 18.50%, 11.19%, 13.00%, 3.41% and 13.22% for moisture content, ash, crude fibre, fat and crude protein respectively. Water quality conditions in the experimental aquaria showed little variation throughout the duration of the experiment (Table 3).

Carcass composition of fish at the end of the feeding trial was summarized n Table 4. Moisture content of treatments T_{02} and T_{03} were not significantly different

Table 1: Ingredient and proximate composition of experimental diets using dietary levels of OGLM

Ingredients	T_{zn} (0%)	T_{01} (5%)	T_{02} (10%)	T_{03} (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
Soya bean meal	35.10	34.70	34.30	33.90
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
Vitamin premix	0.50	0.50	0.50	0.50
Common salt	0.50	0.50	0.50	0.50

Table 2: Chemical composition of experimental diets

Perameters	T_{zn} (0%)	T_{01} (5%)	T_{02} (10%)	T_{03} (15%)
Crude protein (%)	35.990	35.990	35.991	35.993
Crude fibre (%)	2.594	3.112	3.631	4.127
Ash (%)	7.117	12.905	12.746	12.463
ME (kcal/kg)	3,221	3,045	2,881	2,695

Table 3: Water quality parameters of culture aquaria during feeding trials of *Clarias gariepinus* fed diets with OGLM

Treatment	Temperature (1°C)	Mean Temp	pHRange	MeanpH	Dissolved oxygen (DO_2)	Mean DO
T_{zn} (0%)	24-28	26.2	6.0-6.8	6.4	3.5-5.5	4.6
T_{01} (5%)	24-28	25.9	6.1-6.7	6.5	3.2-5.0	4.2
T_{02} (10%)	24-28	26.1	6.2-6.9	6.4	3.2-5.1	4.6
T_{03} (15%)	24-28	26.0	6.0-6.9	6.3	3.3-5.5	4.4

Table 4: Carcass composition of *C. gariepinus* fed dietary levels of OGLM

		Dietary levels of OGLM			
Parameters	Initial	T_{zn} (0%)	T_{01} (5%)	T_{02} (10%)	T_{03} (15%)
Moisture content (%)	12.72	10.96[b]	10.80[b]	11.50[a]	11.75[a]
Crude protein (%)	60.23	66.12[a]	67.44[a]	64.46[b]	63.00[b]
Lipids (%)	6.24	5.24[c]	6.32[b]	6.72[b]	7.64[a]
Crude fibre	0.70	1.01[a]	0.43[c]	0.68[b]	0.69[b]
Nitrogen extract (%)	9.36	3.73[b]	2.07[b]	5.12[b]	5.89[a]

Table 5: Organoleptic assessment of *Clarias gariepinus* fed dietary levels of OGLM

	Scores of independent assessors						
Treatment	1	2	3	4	5	Means	SEM
For raw fresh fish							
T_{zn} (0%)	1.07	1.31	1.38	1.61	1.46	1.37[a]	0.09
T_{01} (5%)	1.69	1.92	1.62	1.38	1.62	1.68[a]	0.15
T_{02} (10%)	1.85	2.23	1.38	1.62	1.31	1.68[b]	0.15
T_{03} (15%)	1.85	2.77	1.35	1.23	1.23	1.69[b]	0.26
For cooked fish							
T_{zn} (0%)	2.15	2.30	2.46	2.85	2.77	2.51[a]	0.12
T_{01} (5%)	3.00	2.92	2.31	2.77	2.62	2.72[ab]	0.11
T_{02} (10%)	3.15	3.15	2.52	2.69	2.62	2.76[a]	0.12
T_{03} (15%)	2.92	2.31	2.23	2.46	2.54	2.49[a]	0.11

($p>0.05$) but were significantly higher than those of T_{zn} and T_{01}. Crude protein for treatment T_{zn} and T_{01} were not significantly ($p<0.05$) higher than treatment T_{02} and T_{03}. Lipids were significantly highest for treatment T_{03}, while T_{zn} was the least. Ash content for treatments T_{zn} and T_{01} were not significantly different ($p>0.05$) but were significantly higher ($p<0.05$) than those of T_{02} and T_{03}. The control treatment (T_{zn}) was significantly highest in crude fibre, while T_{01} was the least.

Result for product quality (Table 5) showed significant differences ($p<0.05$). Assessment on raw fresh basis showed no significant differences ($p>0.05$) in fish fed T_{01}, T_{02} and T_{03}. fish fed T_{zn} were however significantly superior ($p<0.05$).

On cooked basis, fish fed T_{zn} and T_{03} were not significantly different ($p>0.05$) but were significantly superior ($p<0.05$) to those fed T_{01} and T_{02}. Organolleptic mean scores for fish fed all the diets were below 3.5 (the bench mark). Hence all fish produced were of good quality.

DISCUSSION

The proximate composition of OGLM-18.50%, 11.19%, 13.00%, 3.4% and 13.22% for moisture content, Ash crude fibre, fat and crude protein respectively was in consonance with the report of Edeoga *et al*. (2006). The metabolizable energy levels of the diets decreased with increased levels of the leaf meal (Table 2). This was an indication of low energy status of the leaf meal as is common with most leaf meals. The mean values for the water quality parameters obtained are within the optimum requirement for normal physiological state of the fish. The observed range values of 25.9-26.2°C, 6.3-65 and 4.2-4.6 mg/l (Table 3) fall within the optimal production levels for temperature, pH and dissolved oxygen respectively (Anyanwu, 2005).

Carcass composition was significantly affected by intake of OGLM (Table 4). Moisture content increased with increase in leaf meal inclusion levels and was least in the fish on T_{zn}. This agreed with the findings to Ali *et al.* (2003). This could be attributed to corresponding decrease in the energy level of diets. Fanullah and Jafri (1998) reported a strong inverse relationship between moisture content of fish and the energy level of their diets. Lipids also increased with increase in leaf meal inclusion level and were highest in fish fed T_{03} (15%). This is similar to the findings of Erdal *et al.* (2004). This could be attributed to the lipid content of the diets. Ibrahim and Mehmet (2002) suspected a negative correlation between gross lipid content of diet and lipid content of fish. The ash content of fish fed T_{zn}, T_{01} and T_{02} were not significantly different ($p>0.05$). It was however least in fish fed T_{03}. Crude fibre was highest in T_{zn}. This could be attributed to low ash and crude fibre content of the leaf meal, as was also observed by Erdal *et al.* (2004). Crude protein of fish decreased with increase in leaf meal inclusion and recorded highest in fish fed T_{01} and least in fish fed T_{03}. This is an indication that upto 5% inclusion level best enhanced the crude protein content of *C. gariepinus*.

The organoleptic assessment of fish samples showed significant differences in the product quality (Table 5). For fish assessed on fresh condition, those fed the control diet were significantly superior ($p<0.05$) to those fed other dietary levels of OGLM. This could be linked to the effect of the leaf meal on body composition of the fish. Accordingly, Robb *et al.* (2002) reported that sensory quality of fish is determined by its body composition. For cooked samples however, fish fed control diet and T_{03} were not significantly different ($p>0.05$) but were significantly superior ($p<0.05$) to fish fed T_{01} and T_{02} diets. The cooking appeared to have improved the quality of fish fed diets with OGLM inclusion levels. The experimental mean values of all treatments for the cooked and raw fresh samples showed that the quality of *C. gariepinus* was not grossly affected since none was up to 3.5. In conclusion therefor, the result of the present study indicated that 15% dietary inclusion level of OGLM could be used in the diet for *Clarias gariepinus*. This is recommended since upto 15% inclusion level still produced fish of good quality, without also compromising the carcass composition.

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