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Carcass Composition and Product Quality of Clarias Gariepinus Fed 5% Dietary Levels of Leaf Meals

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Abstract: The carcass composition and product quality of Clarias gariepinus fed dietary levels of 0% leaf meal, 5% levels of Ocimum gratissimum leaf meal (OGLM), Telfaria ocidentalis leaf meal (TOLM) and Azadirachta indica leaf meal (AILM) were investigated. Four 36% isonitrogenous diets of these leaf meal levels respectively, were formulated and fed to the post fingerlings, randomly assigned to the four treatments- control (Tzn), 5%OGLM (To), 5%TOLM (Tt) and 5%AILM (Ta) in three replicates of 15 post fingerlings each, using twelve plastic aquaria of 250 x 150cm dimension. The fish were fed at 5% body weight twice daily within the experimental period of 56 days. There were significant differences ($P<0.05$) in carcass composition, with fish on To diet having higher crude protein value, but least in crude fiber. Fish on diets Tzn, To and Tt were higher in moisture and ash contents, while those on diet Ta had higher lipid and nitrogen free extract contents. There were no significant differences ($P>0.05$) in the quality of fresh raw samples, whereas those of cooked fish samples were slightly different. The result of this study showed that 5% dietary levels of OGLM, TOLM and AILM could support optimal carcass composition of Clarias gariepinus without deleterious effect on the fish quality.

Key words: Clarias gariepinus, carcass composition, product quality, Leaf meal.

I. INTRODUCTION

The water percentage of fish is a good indicator of the relative energy, protein, and lipid content. There is an inverse relationship between moisture content of fish and lipids, protein contents and energy density of fish. The live weight of majority of fish usually consists of about 70-80% of water, 20-30% of protein, and 2-12% of lipids. However these values vary considerably within and between species, and also with size, sexual condition, feeding, time of the year, pond depth, and physical activity. The distribution of these nutrient compositions among the various organs and tissues of the body may also show considerable differences (Ali, et al 2005; Cox and Hartman, 2005). Sensory evaluation of fish quality is a scientific discipline used to evoke measure, analyze, and interpret reactions to the characteristics of fish as perceived through the senses of sight, smell, taste, touch and hearing (Huss, 1995). Scientifically, the process can be divided into three steps: detection of the stimulus with the human sense organs; evaluation and interpretation by a mental process; and then the response of the assessor to the stimuli.

The alarming high cost of conventional feed ingredients has therefore necessitated the search for unconventional fish feed ingredients, for example leaf meals, in order to reduce the feed cost (Adewolu, 2008). The objective of this study was to compare the body composition and product quality of Clarias gariepinus fed 5% dietary inclusion levels of Ocimum gratissimum leaf meal (OGLM), Telfaria ocidentalis leaf meal (TOLM) and Azadirachta indica leaf meal (AILM).

II. MATERIALS AND METHODS

The fish meal and other feedstuff used were procured from Fidelity Agro-resource depot in Owerri, Imo State of Nigeria. Ocimum gratissimum, Telfaria ocidentalis and Azadirachta indica 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 leave meals. Four is onitrogenous diets of 36% crude protein were formulated (Tables 1 and 2) designated Tzn, To, Tt and Ta, for control (0%), 5%OGLM, 5%TOLM and 5%AILM respectively.

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***Table 1**: Composition of Experimental Diets Using OGLM, TOLM, and AILM.*

Ingredients (5%)	**Tzn (0%)**	**To (5%)**	**Tt (5%)**	**Ta**
Maize	34.50	29.90	30.90	30.80
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	33.70	33.80
Leaf meals	0.00	5.00	5.00	5.00
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
Total	100	100	100	100

***Table 2:** Chemical composition of experimental diets*

Parameters	**Tzn (0%)**	**To (5%)**	**Tt (5%)**	**Ta (5%)**
Crude protein (%)	35.99	35.99	36.02	36.00
Crude fiber (%)	2.59	3.11	4.42	3.24
Lipids (%)	13.06	12.91	13.60	17.09
Ash (%)	7.12	7.56	7.52	7.66
ME (Kcal/Kg)	3,220	3,045	3,077	3,052

Maize was used as the major source of energy in the diets, while soybean, fish meal and blood meal as major sources of protein, besides the use of lysine and methionine at 0.2% levels of inclusion. Vitamin premix and salt were used at 0.5%, bone meal at 1% inclusion level, all as main sources of vitamins and minerals, while cassava starch was used at 2% as binding agent. The feedstuffs were finely ground and mixed up in a dough form. The mixture was then pelleted by passing it through a minxer of 2mm diameter to produce 2mm 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 seven days during which they were fed with the control diet containing 36% crude protein. After acclimation, exactly 180 post fingerlings were completely randomized in 3 replicates of 15 each, and assigned to the 4 treatments – Tzn, To, Tt and Ta at recorded initial weights. The fish were fed at 5% of their body weight twice daily, morning (08.00-09.00) 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 0-100oC, pH and dissolved oxygen readings were taken using pH and oxygen meters respectively. Proximate analysis of the test feedstuff, diets and biweekly fish samples were carried out to determine the moisture content, ash, lipid, crude protein, crude fibre and nitrogen free extract using the Association of Official Analytical Chemists AOAC (1990) procedure and kekeocha (2001) method, employing the micro-Kjeldahl method for crude protein (CP), Soxhlet extraction method for ether

extract (E.E), Weende method for crude fibre and dry combustion for ash. The gross energy of the sample was assayed using adiabatic oxygen bomb calorimetric technique.

The organoleptic assessments of both fresh raw and cooked samples of fish were also carried out. 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 point assessment score chart (Anyanwu, 2005). Average score of less than or equal to 3.5 indicated freshness (of good quality), while mean scores above 3.5 indicated poor quality. Data collected 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).

III. RESULTS

The gross compositions of the experimental diets, as well as proximate composition are presented in Table 1 and 2. Proximate composition for OGLM were 18.50%, 11.19%, 13.00%, 3.41% and 13.22% for moisture content, ash, crude fibre, fat and crude protein respectively. TOLM were 21.50%, 10.00%, 24.90%, 6.75% and 29.13% respectively, and 21.95%, 9.52%, 16.00%, 2.48% and 20.37% for AILM. Water quality conditions in the experimental aquaria showed little variation throughout the duration of the experiment (Table 3).

Table 3: *Water quality parameters of culture aquaria during feeding trail*

Treatment	Temp (oC)	Mean Temp (mg/l)	pH Range	Mean pH	DO (mg/l)	MeanDO(mg/l)
Tzn (0%)	24-28	26.2	6.0-6.8	6.4	3.5-5.5	4.6
To (5%)	24-28	26.0	6.1-6.7	6.5	3.2-5.0	4.2
Tt (5%)	24-28	25.9	6.2-6.9	6.3	3.2-5.1	4.6
Ta (5%)	24-28	26.1	6.0-6.9	6.4	3.3-5.5	4.4

Carcass composition of fish in the feeding trial was summarized in table 4 and reveals moisture content of Tzn (control), To and Tt not significantly different (P >0.05) but significantly superior to Ta.

Table 4*: Body composition of C. gariepinus fed 5% Leaf Meals*

Parameters	**Treatments**				
	Initial	Tzn(0%)	TO (5%)	TT (5%)	TA(5%)
Moisture content (%)	12.72	10.96^{a}	10.80^{a}	10.68^{a}	10.23^{b}
Crude Protein (%)	60.23	66.12^{b}	67.44^{a}	66.13^{b}	66.56^{b}
Lipids (%)	6.24	5.24^{c}	6.39^{b}	6.76^{b}	7.63^{a}
Ash (%)	10.75	12.97^{a}	13.00^{a}	12.95^{a}	8.78^{b}
Crude Fibre (%)	0.70	1.01^{b}	0.43^{d}	1.06^{a}	0.79^{c}
Nitrogen Extract (%)	9.36	3.71^{b}	2.09^{c}	2.44^{c}	6.02^{a}

The crude protein level was highest in To and was not significantly different for other treatments. Lipids was least in Tzn but was significantly highest for Ta. The carcass ash content of the treatments were not significantly different (P>0.05) in Tzn, To and Tt, except Ta which was least in ash and crude fibre contents while Tt was highest for crude fibre.

Result for product quality of fish at the end of the feeding trial was summarized in Table 5.

Table 5(A): *Organoleptic Assessment Scores for Fresh Fish*

Treatment	**Independent Observations**					**Means**	**SEM**
	1	2	3	4	5		
Tzn (0%)	1.07	1.31	1.38	1.61	1.46	1.37^{NS}	0.09
TO (5%)	1.69	1.92	1.62	1.38	1.62	1.65^{NS}	0.08
TA (5%)	1.54	2.00	1.54	1.62	1.62	1.66^{NS}	0.08
TT (5%)	1.46	1.69	1.96	1.69	1.31	1.63^{NS}	0.10

Table 5(B): *Organoleptic Assessment Scores for cooked Fish*

Treatment	**Independent Observations**					**Means**	**SEM**
	1	**2**	**3**	**4**	**5**		
Tzn (0%)	2.15	2.30	2.46	2.85	2.77	2.51a	0.12
TO (5%)	3.00	2.92	2.31	2.77	2.62	2.72ab	0.11
TA (5%)	3.15	2.54	2.62	3.08	2.69	2.81ab	0.11
TT (5%)	3.46	3.00	2.69	2.31	2.85	2.86b	0.17

Assessment on fresh raw basis showed no significant ($p>0.05$) differences in fish fed leaf meals. On cooked basis, the control (Tzn) was significantly superior ($p<0.05$) to other treatments. To and Ta were not significantly different ($p> 0.05$) to Tt. Organoleptic mean score for all treatment were below 3.5 (the bench mark). Hence all the fish produced were of good quality.

IV. DISCUSSION

The proximate composition of OGLM (18.50%, 11.19%, 13.00%, 3.40% and 13.22%), TOLM (21.50%, 10.00%, 24.90%, 6.75% and 29.13%) and AILM (21.95%, 9.52%, 16.00%, 2.48%, and 20.37%) respectively for moisture content, ash, crude fibre, fat and crude protein did not vary much with the reports of Akorada, (1990) and Edeoga et al, (2006). Water quality parameters are within the optimum requirement for normal physiological state of the fish. The observed range values of 25.9-26.2oC, 6.3-6.5 and 4.2- 4.6 mg/l (Table 3) fall within the optimal production levels for temperature, pH and dissolved oxygen respectively (Anyanwu, 2005; Ochang et al 2007). Body composition of fish were significantly affected ($P < 0.05$) by treatments. This was not so in the results of Hasan, et al (1997) and Adewolu, (2008). Moisture content for the control diet (Tzn) and To were not significantly different but were significantly higher than Tt and Ta. Fanullah and Jafri (1998) reported strong inverse relationship between moisture content of fish and the energy level of their diets. This however was not observed in this study, as the diets with leaf meal inclusion did not produce fish with higher moisture content though they were of lower energy level. Crude protein was significantly higher for fish fed To but was not significantly different for other treatments. This may be attributed to the supposed balanced Essential Amino Acid (EAA) content of OGLM (Edeoga, 2006). Lipid content was least for fish fed the control diet (Tzn) but was significantly highest ($P<0.05$) in fish fed diet Ta. This agrees with the findings of Yilmaz et al (2004). Ibrahim and Mahmet (2002) had suspected a negetive correlation between gross lipid content of diet and lipid content of fish. Ash content was not significantly affected in fish fed Tzn, To and Tt but was significantly lower in fish fed Ta. This probably indicates a poor mineral composition of AILM. Edeoga et al, 2006 and Akorada, (1990) reported balanced mineral composition of Ocimum gratissimun and Telfairia ocidentalis leaves respectively. Crude fibre was highest in fish fed Tt and least in fish fed To. This trend is traceable to the crude fibre contents of the leaf meals. The organoleptic assessment of fresh raw fish samples showed no significant differences ($p>0.05$). This indicates a no negative effect on fish quality. Robb, et al (2002) reported a positive correlation between body composition and sensory quality, whereas Ochang, et al (2007) observed no significant differences in the sensory evaluation of fresh raw fish fed different diets. For cooked samples, fish fed the control (Tzn) was significantly superior ($p<0.05$) to fish fed other diets. Fish fed To and Ta were not significantly different but were significantly superior to fish fed Tt. These differences in quality may be attributed to the leaf meals effect on body composition of the fish. The mean scores for all samples were less than 3.5 indicative

of good quality. The result of the study showed that 5% dietary inclusion level of OGLM will produce fish of better quality and composition than TOLM and AILM. In conclusion, the three leaf meals compared at 5% inclusion level appear to have supported the body composition of C. gariepinus without grossly affecting quality when compared with the control diet. The use of any of these leaf meals at 5% inclusion level is therefore recommended when body composition and quality of C. gariepinus is considered.

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