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Nutrient Utilization and Growth of Catfish (*Clarias gariepinus*) Fed Dietary Levels of Cassava Leaf Meal

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Abstract: Fingerlings of catfish (*Clarias aariepinus*) of average weight 0.87 g were collected from ARAC, Port Harcourt and used to assess the responses of feeding dietary levels of cassava leaf meal on nutrient utilization and growth of the fish. 35% isonitrogeneous diets of 0%, 10%, 20% and 30% dietary levels of cassava leaf meal were formulated. These were fed to the fingerlings randomly assigned to 4 treatments TCN (Control), TC_1 (10% CLM), TC_2 (20% CLM) and TC_3 (30% CLM) respectively in 3 replicates of 13 fingerlings each, using 12 plastic aquaria of 250 x 150 cm dimension. The fish were fed at 5% body weight twice daily within the experimental period of 8 weeks. Mortality range was between 20 and 24%, the least observed on the TCN (control) while TC_2 and TC_3 were the highest. Daily feed intake and protein intake were not significantly ($p>0.05$) different. The control (TCN) had the highest body weight gain, followed by TC_2, TC_3 and then TC_1. Specific growth rate, feed conversion ratio and protein efficiency ratio for the control (TCN) were significantly ($p<0.05$) better than other treatments. The dietary inclusion levels of cassava leaf meal therefore seem to have no strong nutritional attribute as feedstuff in the diet of *Clarias gariepinus* fingerlings.

Key words: Catfish, cassava leaf meal, fish

INTRODUCTION

Catfishes for example African Catfish (*Clarias gariepinus*) are known to be omnivorous in their food habits. Besides, they are hardy and tolerant to a wide range of environmental conditions (Anyanwu, 2005). These attributes have indicted the fish as highly and veraciously disposed to accepting unconventional dietary feeds very commonly.

Conventional fish feeds are usually very expensive because the traditional feedstuffs such as maize, groundnut cake, soyabean, fish meal etc. are directly competing for livestock and human consumption. Unconventional feedstuff sourcing (Stale and Harold, 2003; Madu *et al*., 2003), especially of plant origin is meant to explore and utilize other resources which are cheaper and less competitive. Leaf meals of most tropical plants for example cassava leaf meal (Adugna *et al*., 1997; Ayodeji, 2005; Olurin *et al*., 2006; Anyanwu, 2008) are available and cheap. Their nutritive content profile vis-à-vis availability and very low incidence of cost make these leaf meals seem economically attractive, viable and sustainable despite their ant nutritional content limitations. The objective of this study therefore was to determine the nutrient utilization and growth responses to *Clarias gariepinus* fed dietary levels of cassava leaf meal.

MATERIALS AND METHODS

The experiment was mounted in the Department of Agric. Science, Alvan Ikoku Federal College of Education Owerri farm house. 12 plastic aquaria (250 x 150 cm), covered with mosquito mesh screen to prevent fish from jumping out and possible predation were used.

Local cassava leaves were harvested from cassava plots at Orogwe in Owerri West Local Government Area of Imo State. The leaves were sun dried for three days until they became crispy while still retaining their green coloration. The dried leaves were milled into powered form using a hammer mill to produce the cassava leaf meal. The meal was used to make 35% isonitrogenous dietary levels of CLM - 0%, 10%, 20% and 30% for treatments TCN (control), TC_1, TC_2 and TC_3 respectively. Maize was used as the major source of energy in the diets, while Soyabean meal and fish meal were major sources of protein. These and other ingredients (Table 1) in their various proportions were finely ground and mixed in plastic bowl into dough form using hot water, with cassava starch as binding material. The mixture was then pelleted by passing it through a mixer of 2 mm die to produce 2 mm diameter size of pellets. These were then sundried to about 10% moisture content, packed in polythene bags and kept safely dry for use.

One hundred and fifty - six fingerlings of *Clarias gariepinus* of average weight 0.87 g, obtained from the African Regional Aquacultural Centre (ARAC), Port Harcourt were used for the study. The fish were acclimatized for 7 days using the 0% (control) CLM diet of 35% CP and fed twice daily at 08.30-09.30 hr and 17.30-18.30 hr. The fingerlings were completely randomized in 3 replicates of 13 fingerlings per replicate

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Table 1: Gross composition of dietary experimental feeds

Ingredients	TCN (0% CLM)	TC_1 (10% CLM)	TC_2 (20% CLM)	TC_3 (30% CLM)
Cassava leaf meal	-	10.00	20.00	30.00
Maize	34.10	25.20	16.60	7.90
Fish meal	20.00	20.00	20.00	20.00
Soybean	41.10	39.90	38.50	37.20
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
Vit/Min. premix	0.50	0.50	0.50	0.50
Common salt	0.50	0.50	0.50	0.50
Bone meal	0.50	0.50	0.50	0.50
Total	100.00	100.00	100.00	100.00

Table 2: Chemical composition of the diets

Parameters	TCN (0% CLM)	TC_1 (10% CLM)	TC_2 (20% CLM)	TC_3 (30% CLM)
Crude protein (%)	34.99	35.00	35.02	34.98
Ash (%)	7.44	7.89	8.32	8.75
Ether extract (%)	14.48	14.43	14.36	14.31
Crude fiber (%)	2.86	3.73	4.60	5.49
NFE (%)	33.40	30.56	28.17	25.60
M. Energy (kcal/g)	2710.00	2430.00	2150.00	1870.00

Table 3: Limnological parameters (Mean values)

Parameters	TCN	TC_1	TC_2	TC_3	Mean±SE
Temp (°C)	26.20±0.34	25.90±0.20	26.10±0.28	26.20±0.32	26.10±0.06
pH	6.40±0.08	6.50±0.07	6.30±0.06	6.40±0.09	6.40±0.03
Do (mg/l)	4.60±0.07	4.20±0.07	4.60±0.06	4.40±0.06	4.45±0.08

for the 4 treatments - TCN (control), TC_1, TC_2 and TC_3. The initial weight of fish in the aquaria were taken and recorded. Feeding commenced an hour after weighing exercise and the fish fed at 5% of their body weight twice daily, morning (08.30-09.30 hr) and evening (17.30-18.30 hr). 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 56 days of culture. Temperature was determined using mercury in glass thermometer calibrated from 0-100°C; immersed 5 cm deep on the water surface. The pH and dissolved oxygen readings were taken using pH and oxygen meters respectively.

The proximate analysis of the 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. Growth and nutrient utilization index were calculated according to Brown (1957) and AOAC (1990). Data were subjected to Analysis of Variance (ANOVA) as described by Steel and Torrie (1980). Test of significance was by Duncan Multiple Range Test (DMRT) at 95% confidence level, using Statistical Package for Social Sciences (SPSS) for windows (version 7.5).

RESULTS

The gross composition of the experimental diets, as well as proximate compositions are presented in Table 1 and 2 respectively. The mean values for the water condition of the experimental aquaria were 26.19±0.06%, 6.40±0.03 and 4.50±0.06 mg for temperature, pH and dissolved oxygen respectively (Table 3). The nutrient utilization and growth of *Clarias gariepinus* fed dietary levels of cassava leaf meal are shown in Table 4. The initial body weight, final body weight and increase in body weight of the experimental fish ranged from 0.82-0.92 g, 2.66-5.46 g and 1.78-4.60 g respectively, with the control achieving the highest increase in body weight (4.60 g) within the experimental period of 56 days. Mortality ranged from 20-24% and was least in the control treatment. Daily feed intake and daily protein intake for the treatments were not significantly ($p>0.05$) different. The specific growth rate, protein efficiency ratio and feed conversion ratio values of 2.96%/d, 1.24 and 2.81 respectively for the control (TCN) were significantly ($p<0.05$) better than the rest of the treatments - TC_1, TC_2 and TC_3.

DISCUSSION

The mean values for the water condition of the experimental aquaria (26.10±06°C, 6.40±0.03 and 4.50±0.06 mg/l for temperature, pH and dissolved oxygen respectively) fall within the optimal requirements for fish production (Anyanwu, 2003; Ochang *et al*., 2007). The chemical composition of cassava leaf meal as reported by Ayodeji (2005) showed very high level of crude fiber and low energy level, a feature that is very common with leaf meals. The metabolizable energy

Table 4: Nutrient utilization and growth of *Clarias gariepinus* fed dietary levels of cassava leaf meal

Parameters	TCN (Control)	TC_1 (10% CLM)	TC_2 (20% CLM)	TC_3 (30% CLM)	SEM
Initial weight (g)	0.86	0.89	0.82	0.92	0.02
Final weight (g)	5.46	2.66	3.01	2.85	0.57
Increase in body weight (g)	4.60	1.78	2.19	1.93	0.57
Mortality (%)	20.00	23.00	24.00	24.00	0.82
Daily feed intake (g)	0.20^{NS}	0.20^{NS}	0.20^{NS}	0.20^{NS}	0.00
Daily protein intake (g)	0.04^{NS}	0.03^{NS}	0.04^{NS}	0.40^{NS}	0.00
Specific growth rate (%/Day)	2.96^{a}	1.65^{b}	1.94^{b}	1.76^{b}	0.05
Protein Efficiency Ratio (PER)	1.24^{a}	0.75^{b}	0.99^{b}	0.99^{b}	0.08
Feed Conversion Ratio (FCR)	2.81^{a}	5.16^{b}	5.76^{b}	4.40^{b}	0.55

Within each row, figures differently subscripted are significantly ($p<0.05$) different

value of the diets decreased with increased levels of the leaf meal (Table 2), indicating the low energy status of CLM.

The result of this experiment revealed a much higher body weight gain of the fish on control diet (TCN) than the rest of the treatments. The specific growth rate of the fish on TCN was significantly ($p<0.05$) higher than other treatment. This might be an indication that the nutrients were best converted to flesh by the fish on the control (0% CLM) dietary treatment. This followed similar trend with Anyanwu *et al*. (2009) using Microdesmis leaf meal diets on hybrid catfish (*Hetrobranchus bidorsalis x Clarias gariepinus*). There was however no significant differences in body weight gain and specific growth rate of African catfish, *Clarias gariepinus* fed varying inclusion level of *Leucaena leucocephala* leafmeal (Amisah *et al*., 2009). *Leucaena leucocephala* is known to be a leguminous tree and this may have resulted to the higher performance potential of its leaf meal than Cassava leaf meal which tree is non leguminous.

There was also no significant ($p>0.05$) differences among Tilapia zilli fingerlings fed varied dietary levels of *Ipomea batatas* leaf meal up to 15% inclusion level (Adewolu, 2008), whereas up to 20% were significantly ($p<0.05$) different. The trend in the SGR, PER and FCR of the experimental fish (Table 4) might be an indication of their relative responses to the varied dietary inclusion levels of the test feedstuff, Cassava leaf meal. The protein efficiency ratios of 0.75-1.24 observed in this study compared favourably with the 0.78-1.13 and 0.53-1.23 reported by Erfanullah and Jafri (1998) and Anyanwu *et al*. (2009) respectively, in dietary trials using catfish fingerlings. The Feed Conversion Ratios (FCR) of 2.81-5.76 observed in this study compared well with the 4.95-6.39 and 3.19-8.07 reported by Amisah *et al*. (2009) and Anyanwu *et al*. (2009) respectively on growth and nutrient utilization studies in catfish fingerlings fed dietary levels of leaf meals. With higher values of FCR, there seemed to be a decrease in the SGR of the fish and the overall performance of the experimental fish. The control group therefore revealed a better performance ($p<0.05$) than other groups. Varying nutrient levels however have been noted to influence growth responses in catfish (Olurin *et al*., 2006; Babalola and Apata, 2006).

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