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GROWTH AND NUTRIENT UTILIZATION RESPONSES OF HETEROCLARIAS (*HETEROBRANCHUS BIDORSALIS X CLARIAS GARIEPINUS*) FED DIETARY LEVELS OF *IPOMEA BATATAS* LEAF MEAL

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Abstract: The growth and nutrient utilization responses of Heteroclarias (hybrid catfish) post fingerlings of *H. bidorsalis x C. gariepinus* fed 35% iso nitrogenous dietary levels of 0%(TI_1), 5%(TI_2), 10%(TI_3), 15%(TI_4) and 20%(TI_5) *Ipomea batatas* leaf meal were determined in a 3 replicate experiment that lasted for 8 weeks. 15 post-harvest fingerlings, measuring 11.35 ±0.10g in mean weight were randomly assigned to each treatment. 15 plastic aquaria, 250 x 150cm in dimension were used for the trial. The fish were fed twice daily at 5% body weight and growth response monitored. The daily protein intake did not show significant differences among the treatments ($p>0.05$). The specific growth rate and protein efficiency ratio of the control were significantly ($p<0.05$) higher than the dietary treatments of *Ipomea batatas*. The feed conversion ratio of the control was significantly ($p<0.05$) superior to only TI_3 (10%IBLM). Although higher levels of *Ipomea batatas* leaf meal up to 20% dietary inclusion showed improved responses, the overall performance of the experimental fish was significantly ($p<0.05$) higher for the control, than all the leaf meal dietary treatments.

Key words: *Ipomea batatas* leaf meal; Heteroclarias; Growth and Nutrient Utilization Responses.

INTRODUCTION

Unconventional feedstuffs are mostly carbohydrate based and are usually the cheapest sources of energy for cultured fish. Many fish species appear to be able to utilize simple carbohydrates more effectively than complex starches. Catfishes and carps are known to utilize high levels of dietary carbohydrates (Okoye, 2003). *Ipomea batatas* leaves have been very useful in feeding rabbits, and most researchers like Oyenuga, (1978) and Anyanwu, (2008) found it useful as feedstuff for poultry and other livestock, due to its measurable high level of crude protein (24.65-26.70%) and other essential food nutrients (Table 1).

Table 1: Chemical composition of *Ipomea batatas* leaf meal.

Dry matter (%)	-	11.05[b]
Crude protein (%)	24.65 [a]	26.70 [b]
Ash (%)	11.47 [a]	13.00 [b]
Crude fiber (%)	9.10 [a]	11.60 [b]
Ether extract (%)	3.58 [a]	4.25 [b]
Nitrogen free extract (%)	51.20 [a]	33.40 [b]

[a]Oyenuga (1978), [b]Anyanwu (2008).

Alternative feedstuff sourcing has been necessitated as a result of the high cost of feeds and indeed the much competition between man and other animals for concentrate feeds, to the point that makes highly intensive feeding uneconomical for farm animals, and even fish (Esonu, 2006; Madu *et al.*, 2003; Thapa *et al.*, 1997). There is therefore the need to exploit the potentials of *Ipomea batatas* leaf meal as feed ingredient in the diet of hybrid catfish (*Heterobranchus bidorsalis x Clarias gariepinus*) post fingerlings, aimed at determining the effects of the leaf meal on nutrient utilization and growth of the fish.

MATERIALS AND METHODS

The experiment was carried out in a farm's fisheries house of 8 x 6m² situated in Owerri, Imo State. A total of 15 plastic aquaria (250cm x 150cm), covered with mosquito mesh nylon screen to prevent fish from jumping out and possible predation were used. The *Ipomea batatas* leaves were harvested from bushes at the outskirt of the Owerri capital territory, along Owerri/Onitsha Road, Imo State.

These were spread under the sun and dried for three days until they became crispy while still retaining the green colouration. The dry leaves were milled, using a hammer mill to produce to leaf meal.

5 (five) 35%CP Isonitrogenous diets at inclusion levels of 0%, 5%, 10%, 15%, and 20% of the leaf meal for TI_1 TI_2, TI_3, TI_4, and TI_5 respectively were formulated. Maize was used as the major source of energy in the diets, while soyabean meal and fish meal as major sources of protein (Table 2), besides, the use of lysine and methionine at 0.2% levels of inclusion. 1% bone meal was 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% level of inclusion as a binding material.

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Table 2: Experimental Diets using *Ipomea batatas* leaf meal (IBLM); Dietary levels of IBLM

Ingredients	0%	5%	10%	15%	20%
Maize	30.6	27.8	25.0	22.2	19.5
Fish meal	19.0	19.0	19.0	19.0	19.0
Soyabean meal	45.0	42.8	40.6	38.4	36.1.
Ipomea leaf meal	0.0	5.0	10.0	15.0	20.0
Cassava starch	2.0	2.0	2.0	2.0	2.0
Palm oil	1.0	1.0	1.0	1.0	1.0
Bone meal	1.0	1.0	1.0	1.0	1.0
Lysine	0.2	0.2	0.2	0.2	0.2
Methionine	0.2	0.2	0.2	0.2	0.2
Vit./min premix	0.5	0.5	0.5	0.5	0.5
Common salt	0.5	0.5	0.5	0.5	0.5
	100.00	100.00	100.00	100.00	100.00

The feedstuffs were finely ground and mixed up into a dough form in a plastic bowl using hot water. The mixture was then pelleted by passing through a mincer of 2mm die to produce 2mm diameter size of the pellets. The pellets were then sundried to about 10% moisture content, packed in polythene bags and kept safely dry for use.

Two hundred and twenty-five post fingerlings of *Hetero clarias* collected from the African Regional Aquaculture Centre (ARAC) fish farm at Alum, Port Harcourt were stocked in an experimental tank for acclimatization. The fish were acclimatized for 7 days during which they were fed with the control diet containing 35% crude protein and of zero *Ipomea batatas* leaf meal twice daily, 08.00-09.00h and 17.00-18.00h. At the end of the acclimatization, 15 post fingerlings of the hybrid fish were randomly assigned to each treatment and replicated three times in a 3 × 5 (15 experimental units) completely randomized experimental design (CRD). Thus a total of 15 plastic aquaria and 225 post-harvest fingerlings were used in the trial. The initial weight of fish in each aquarium was taken and recorded. Feeding commenced an hour after weighing exercise and the fish fed at 5% of their body weight twice daily, morning (08.00-09.00) and evening (17.00-18.00h).

Subsequently, body weight measurements were taken biweekly, and ration fed, adjusted according to fish weight gain. The water in the aquaria was regularly monitored for the physico-chemical properties, and was renewed completely every other day during the experimental period that lasted 56 days. Temperature was determined using mercury in glass thermometer calibrated from 0-100°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 for the moisture, ash, lipid, crude protein, crude fibre and nitrogen free extract, using the A.O.A.C (1990) methods and Kekeocha (2001). Growth and nutrient utilization index were calculated according to Brown (1957) and A.O.A.C. (1990) methods.

Statistical Method

Experimental results were subjected to a one-way analysis of variance (ANOVA) as described by Steel and Torrie (1980). CRD (Yij) = *M* + Ti + Eij (i = 1……..20, j = 1……..5);

where Yij = value of independent observations
M = unknown population variable
Ti = Treatment effect
Eij = Error term (experimental error).

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 proximate composition for the *Ipomea batatas* leaf meal were 26.70%, 13.00%, 4.25%, 11.60%, 33.40% and 11.05% for crude protein, ash, lipids, crude fibre, nitrogen free extract and dry matter respectively. Water quality condition in the experimental aquaria of mean values 26.07 ± 0.01°C, 6.62 ± 0.07 and 4.94 ± 0.07mg/l for temperature, pH and dissolved oxygen (DO2) respectively, showed little variations throughout the experimental duration (Table 3).

Table 3: Physico-chemical characteristics of the water.

Variable Parameters	TI_1	TI_2	TI_3	TI_4	TI_5	Mean
Temperature (°C)	26.05	26.05	26.10	26.12	26.1	26.07±0.01
pH	6.50	6.80	6.68	6.70	6.40	6.62±0.07
DO2 (mg/l)	5.15	5.05	4.90	4.80	4.78	4.94±0.07

The dietary feeds chemical compositions are shown in table 4. The energy level of the diets decreased with increased levels of leaf meal. Growth and nutrient utilization responses of hybrid catfish (*H. bidorsalis x C. gariepinus*) fed varied levels of *Ipomea batatas* leaf meal is shown in table 5. The initial body weight, final body weight and increase in body weight of the fish for the treatments ranged from 10.50g – 12.36g, 19.12g-29.24g, and 6.76g-18.48g respectively, with the control (TI_1) achieving the highest increase in body weight (18.48g) and TI_3 (6.76g), the least within the experimental period of 56days.

The specific growth rate value of 1.81g/d for control (TI_1) was significantly ($p<0.05$) higher than the rest of the treatments. This was followed by TI_5 (1.47g/d), TI_4 (1.33g/d), TI_2 (1.10g/d) and then TI_3 (0.72g/d), which was the least. These were, however, significantly ($p<0.05$) different from each other, except for TI_2 and TI_4 that were not different ($p>0.05$). The

daily protein intake did not show any significant differences among the treatments (p>0.05). The protein efficiency ratio of 1.23 for control (TI_1) was however significantly (p<0.05) higher than other treatments. This was followed by TI_5 (0.95), TI_4 (0.86), TI_3 (0.70) and TI_2 (0.50). The feed conversion ratio of TI_1 (3.19), TI_2 (6.13), TI_4 (4.12) and TI_5 (3.74) were significantly (p<0.05) superior to TI_3 (9.32).

Table 4: Chemical composition of the dietary feeds

Parameters	0%	5%	10%	15%	20%
Crude protein (%)	34.98	35	35.07	34.97	34.95
Crude fibre (%)	2.93	3.16	3.57	3.75	4.04
Ether Extract (%)	7.35	7.47	8.05	8.54	8.9
Ash (%)	13.7	13.06	13.13	12.13	11.66
ME (Kcal/kg)	*3244.74*	*3200*	*3155.2*	*3110.5*	*3066*

Table 5: Nutrient Utilization and Growth Responses of Catfish hybrid (*Heterobranchus* bidorsalis x *Clarias gariepinus*) fingerlings fed varied levels of *I. batatas* leaf meals.

Variable parameters	Dietary levels of *Ipomea batatas* leaf meal					
	T_1(0%)	TI_2(5%)	TI_3(10%)	TI_4(15%)	TI_5(20%)	SEM
Initial weight (g)	.76	11.61	12.36	11.53	10.50	0.10
Final weight (g)	29.24	21.29	19.12	23.51	23.76	0.75
Increase in body wt (g)	18.48	9.68	6.76	11.98	13.26	0.87
Feed Intake (g/day)	0.82^{NS}	0.82^{NS}	0.71^{NS}	0.80^{NS}	0.74^{NS}	0.01
Specific growth rate (%/day)	1.81^{a}	0.10^{c}	0.72^{d}	1.33^{bc}	1.47^{b}	0.15
Daily protein intake (g)	0.29^{NS}	0.29^{NS}	0.25^{NS}	0.28^{NS}	0.26^{NS}	0.04
Protein efficiency ratio (PER)	1.23^{a}	0.50^{d}	0.70^{cd}	0.86^{bc}	0.95^{b}	0.11
Mortality (%)	8.88^{a}	8.88^{a}	4.44^{b}	4.44^{b}	2.22^{c}	1.19
Feed conv. ratio (FCR)	3.19^{a}	6.13^{ab}	9.32^{b}	4.12^{a}	3.74^{a}	1.40

$^{a, b, c, d}$ Means within a row with different superscripts are significantly different (p< 0.05)

DISCUSSION

The proximate composition values of IBLM observed in this study are in line with the results reported by Oyenuga (1978). The metabolizable energy value of the diets decreased with increased levels of the leaf meal (Table 4), showing the low energy status of IBLM. The mean values for the water conditions of the experimental trials fall within the requirements for optimal fish production (Jingran and Pullin, 1985 and Ochang *et al.*, 2007). The result of this experiment showed much increase in body weight of the fish. The specific growth rate of the fish for control (TI_1) was significantly higher (p<0.05) than the other treatments. This was followed by TI_5 and TI_4. The 10% leaf meal inclusion (TI_3) had the least specific growth rate (p<0.05). This might be an indication that the nutrients were best converted to flesh by the fish on TI_1, receiving no leaf meal; followed by the 20% and then those on the 15%, while the ones of 10% leaf meal inclusion level were least converted to flesh. *Ipomea batatas* leaf is known to be highly nutritious, and may have accounted for the seemingly comparable performance of higher inclusion levels of the leaf meal with the control. This confirms that varying nutrient levels affect growth responses of fish (Ochang *et al.*, 2007; Wing-Keong *et al.*, 2004; Olurin *et al.*, 2006). *Ipomea batatas* leaves have been very useful in feeding rabbits (Oyenuga 1978), and also found useful as feedstuff for poultry and other livestock including fish, due to its measurable high level of crude protein and other essential food nutrients (Udedibie, 1989).

The trend in the specific growth rate of the fish might be an indication of their relative responses to the varied inclusion levels of the test feedstuffs, *Ipomea batatas* leaf meal.

The values of 0.50-1.23 reported for the protein efficiency ratio (PER) compare well with the range of 0.571-1.47 reported by Alegbeleye *et al.*, (2001) for varying levels of jackbean meal. The PER for the control treatment was significantly (p<0.05) higher than those of other treatments, while the 5% leaf meal dietary treatment had the least PER (p<0.05). The feed conversion ratios (FCR) of 3.19 –9.32 observed in this study compare slightly well with the range of between 5.6-8.7 in a study on optimal dietary protein levels and conventional diets for juveniles of Catfish by Madu and Akilo (2001) and Madu *et al.*, (2001). However, with higher values of FCR, there seemed to be corresponding decrease in the values for SGR of the fish and the overall performance of the fish. The feed conversion ratio for control was better (p<0.05) than the rest of the treatments. This however compared favorably with the 20% leaf meal dietary treatment, followed by the one of 15%, while that of 10% *Ipomea batatas* dietary treatment was the least. This is also an indication that higher inclusion levels of *Ipomea batatas* leaf meal were better than lower levels in achieving higher fish yield. Besides, the overall performance of the fish was significantly (p<0.05) highest for the control than all the leaf meal dietary treatments. These observations are in consonance with the reports of Opstvedt *et al.*, (2003) and Railly and Lochmann (2004) in feedings trials on catfish.

CONCLUSION

Beside the control diet that showed better overall performance, higher inclusion levels of *Ipomea batatas* leaf meal were measurably better than lower levels in achieving higher fish yield. Higher dietary inclusion levels of *Ipomea batatas* leaf meal up to 30% is therefore recommended, to fully explore and maximize the potentials of this leaf meal on hybrid catfish (*Heterobranchus bidorsalis × Clarias gariepinus*).

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