PERFORMANCE OF *HETEROCLARIAS* (*H. BIDORSALIS X C. GARIEPINUS*) FED 5% DIETARY LEVEL OF LEAF MEALS.

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ABSTRACT

The experiment was carried out to determine the effect of 5% dietary levels of *Alchornia cordifolia, Carica papaya, Ipomea batatas and Microdesmis puberula* leaf meals on the growth and nutrient utilization of *Heteroclarias* (*H. bidorsalis x C. gariepinus*) post fingerlings. 35% isonitrogenous dietary levels of 0%, 5%ACLM, 5%CPLM%, 5%IBLM and 5%MPLM were formulated. These were fed to 225 post fingerlings of *Heteroclarias*, randomly assigned to 5 treatments – TCN, TA_5, TC_5, TI_5 and TM_5 in 3 replicates of 15 post fingerlings each using 15 plastic aquaria (250 x 150cm). The fish were fed twice daily at 5% body weight within the experimental period of 56days. Growth and nutrient utilization of the experimental fish were determined. The specific growth rate, protein efficiency ratio, and feed conversion ratio of the control were significantly ($p<0.05$) better than those of other dietary treatments of leaf meals. This was followed by the 5% dietary levels of IBLM, MPLM and then CPLM. 5%ACLM dietary treatment performed least. The daily protein intake was similar for all the treatments. The results of the experiment revealed that 5%IBLM and 5%MPLM dietary treatments had significant nutritional attributes as feedstuff in the diets of post fingerlings of *Heteroclarias* and performed better than 5%CPLM dietary treatment. 5%ACLM dietary treatment was of least performance.

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INTRODUCTION

Non-conventional feed resources for example leaf meals are advantageous mainly for their non-competitive posture in terms of human consumption. The prices of these resources most often are relatively low and most times, command no cost values at all. Their potentials as the most viable and economic sources of feedstuff for fish feed manufacture according to Madu *et al,* (2003) cannot be over-emphasized. They are available and do not compete with human consumption, hence their optimum utilization may seem more economically viable, attractive and sustainable. Bedsides, their lower crude protein composition, physical form, palatability and stability during storage, high tinder levels and other organic compounds including anti-nutritional factors like tannin, phytin and HCN (Lakpini *et al*, 1997; Stale *et al*, 2003; Okoye, 2003) present the nutritional problems that are generally not encountered with sources of animals origin. The objective of this study therefore was to determine the effects of 5% dietary levels of *Alchornia cordifolia, Carica papaya, Ipomea batatas* and *Microdesmis puberula* leaf meals on growth and nutrient utilization of catfish hybrid (*Heterobranchus bidorsalis x Clarias gariepinus*).

Materials and Methods

A total of 15 plastic aquaria (250 x 150 cm), covered with mosquito mesh nylon screen to prevent fish from jumping out and possible predation were mounted in the fisheries house of the livestock pilot consult farm in Owerri, Imo state. The experimental 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. Five 35% crude protein Isonitrogenous diets of 0%LM, 5%ACLM, 5%CPLM, 5%IBLM, and 5%MPLM were produced for TCN, TA_5, TC_5, TI_5, and TM_5 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), 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.

Table 1: Experimental diets using 5% levels of ACLM, CPLM, IBLM and MPLM

Ingredients	TCN (0%)	5% Dietary Leaf Meals			
		ACLM	CPLM	IBLM	MPLM
Maize	30.60	25.50	28.80	27.80	26.80
Fish meal	19.00	19.00	19.00	19.00	19.00
Soya bean meal	45.00	44.10	41.80	42.80	43.80
Dietary leaf meals	0.00	5.00	5.00	5.00	5.00
Cassava starch	2.00	2.00	2.00	2.00	2.00
Palm oil	1.00	1.00	1.00	1.00	1.00
Bone meal	1.00	1.00	1.00	1.00	1.00
Lysine	0.20	0.20	0.20	0.20	0.20
Methionine	0.20	0.20	0.20	0.20	0.20
Vit/min premix	0.50	0.50	0.50	0.50	0.50
Common salt	0.50	0.50	0.50	0.50	0.50
	100.00	100.00	100.00	100.00	100.00

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 through a mincer of 2 mm die to produce 2 mm 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 the catfish hybrid collected from the African Regional Aquaculture Centre (ARAC) fish farm, Port Harcourt were stocked in an experimental tank for acclimatization. The fish were acclimated for 7 days during which they were fed with the control diet containing 35% crude protein, and of zero leaf meal twice daily, 08.00 – 09.00hr and 17.00 – 18.00hr.

At the end of the acclimatization period, the 225 post fingerlings were completely randomized in 3 replicates of 15 post fingerlings per replicate for the 5 treatments – TCN (Control), TA_5, TC_5, TI_5 and TM_5. 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 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^{o}c; immersed 5 cm deep on the water surface. The pH and dissolved oxygen readings were taken using pH and oxygen meters, respectively (Table 2).

Table 2: Physico-chemical properties of the experimental water.

Parameters	5% Dietary Leaf meals treatments					
	TCN (0%)	**TA_5**	**TC_5**	**TI_5**	**TM_5**	**SEM**
Temperature (^{O}C)	26.05	26.10	26.04	26.06	26.10	0.01
PH	6.50	6.30	6.70	6.80	6.75	0.08
Dissolved oxygen (mg/l)	5.15	4.08	5.05	5.05	4.85	0.17

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 (1990) methods and Kekeocha (2001). Growth and nutrient utilization index were calculated according to Brown (1957) and A.O.A.C. (1990) methods. Experimental results 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).

RESULT

The compositions of the leaf meals are shown in table 3. The dry matter compositions were 8.75%. 9.65%, 11.05% and 10.70% for *Alchornia cordifolia, Carica papaya*, *Ipomea batatas* and *Microdesmis puberula* leaf meals, respectively. The crude protein (%DM) were 19.02%, 28.08%, 26.70% and 19.32%; the ash values were 4.50%, 11.80%, 13% and 8%; the ether extract values were 6.30%, 6.30%, 4.25% and 4.60%; the crude fibre values were 14.30%, 11.80%, 11.60% and 17.35% while the nitrogen free extract values were 47.13%, 32.37%, 33.40% and 40.03%, respectively. The proximate composition of the experimental diets revealed that they were isonitrogenous, but not isocaloric (Table 4). There were however slight variations in other nutrient components.

Table 3: Proximate composition of test leaf meals

Leaf meals	% Crude protein	% Ash	% Ether extract	% Crude Fibre	% Nitrogen free extract	% Dry matter
Alchornia cordifolia leaf meal	19.02	4.50	6.30	14.30	47.13	8.75
Carica papaya leaf meal	28.08	11.80	6.30	11.80	32.37	9.25
Ipomea batatas leaf meal	26.70	13.00	4.25	11.60	33.40	11.05
Microdesmis puberula leaf meal	19.32	8.00	4.60	17.35	40.03	10.70

Table 4: Chemical composition of the experimental diets

Parameters	5% Dietary Leaf meals				
	0%	ACLM	CPLM	IBLM	MPLM
Crude protein (%)	34.98	35.08	35.04	35.00	35.02
Crude fibre (%)	2.93	3.56	3.54	3.16	3.98
Ether extract (%)	7.35	7.43	7.18	7.47	7.90
Ash (%)	13.70	13.44	13.33	13.06	13.44
ME (kcal/kg)	3244.74	3206.74	3187.89	3199.95	3119.84

The growth and nutrient utilization of *Heteroclarias* (*Heterobranchus bidorsalis x Clarias gariepinus*) post fingerlings fed 5% dietary levels of *A. cordifolia, C. papaya, I. batatas* and *M. puberula* leaf meals are summarized in table 5. The initial body weight, final body weight and increase in body weight for the treatments ranged from 10.14g – 11.90g, 16.63g – 29.24g and 4.73g – 18.48g respectively, with the control (TCN) having the highest increase in body weight (18.48) and TC_5 (7.06) having the least in the experimental period of 56days. The specific growth rate of 1.81g/d for TCN was significantly ($p<0.05$) higher than the other treatments. In the same vein, TI_5 (1.01gld) and TM_5 (1.23g/d) were similar to TC_5 (1.04g/d), but significantly ($p<0.05$) higher than TA_5 (0.64g/d). There was however no significant ($p<0.05$) difference between TC_5 and TA_5 ($p<0.05$).

The daily protein intakes of the fish for the treatments were not significantly ($p<0.05$) different. The protein efficiency ratio of TCN (1.23) was significantly ($p<0.05$) higher than other treatments. Similarly, TC_5 (0.68), TI_5 (0.70) and TM_5 (0.73) were also significantly ($p<0.05$) higher than TA_5 (0.38), which was the least. The feed conversion ratios of 3.19, 6.92, 6.13 and 4.79 for TCN, TC_5, TI_5, and TM_5 respectively were all similar, but significantly ($p<0.05$) superior to TA_5 (19.09). Fish mortality however ranged from 4.44 – 11.11% and was highest for TC_5 (11.11%), while TA_5 (4.44%) was the lowest.

Table 5: Growth and Nutrient utilization responses of heteroclarias (Heterobranchus bidorsalis X clarias gariepinus fingerlings fed 5% dietary levels of the experimental leaf meals.

Variable parameters	TCN (0%)	5% Dietary Leaf Meal treatment				
		TA_5	TC_5	TI_5	TM_5	SEM
Initial weight (g)	10.76	11.90	10.14	10.61	10.50	0.13
Final weight (g)	29.24	16.63	17.20	21.29	20.93	1.01
Increase in body weight (g)	18.48	4.73	7.06	9.68	10.43	1.04
Feed intake (g/day)	0.82^{NS}	0.68^{NS}	0.65^{NS}	0.71^{NS}	0.77^{NS}	0.01
Specific growth rate (g/day)	1.81^{a}	0.64^{c}	1.04^{bc}	1.10^{b}	1.23^{b}	0.20
Daily protein intake (g)	0.29^{NS}	0.24^{NS}	0.23^{NS}	0.25^{NS}	0.27^{NS}	0.04
Protein efficiency ratio (PER)	1.23^{a}	0.38^{c}	0.38^{c}	0.70^{b}	0.73^{b}	0.14
Feed conversion ratio (FCR)	3.19^{a}	19.09^{b}	6.92^{a}	6.13^{a}	4.79^{a}	3.90
Mortality	8.88^{b}	4.44^{d}	11.11^{a}	8.88^{b}	6.66^{c}	1.01

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

DISCUSSION

The crude protein levels of *Alchornia cordifolia* and *Microdesmis puberula* leaf meals seemed to be closely similar, while the same was applicable for *Carica papaya* and *Ipomea batatas* leaf meals which recorded the highest levels of crude protein of 28.06% and 26.70% respectively. Their percentage ash was also highest, followed by that of *Microdesmis puberula* while *Alchornia cordifolia* leaf meal had the least ash level of 4.50%. The ether extract for *Alchornia cordifolia* and *Carica papaya* leaf meals were the same (6.30%), while those of *Ipomea batatas* and *Micordesmis puberula* seemed somehow similar, 4.25% and 4.60%, respectively. The crude fibre levels of the leaf meals were high, with *Microdesmis puberula* recording the highest (17.35%), followed closely by *Alchornia cordifolia*. The percentage crude fibre for *Carica papaya* and *Ipomea batatas* were closely the same. The proximate composition values of the leaf meals agree with result reported by Udedibie and Opara (1998), Udedibie (1989) and Esonu *et al* (2003) for *Alchornia cordifolia, Carica papaya, Ipomea batatas* and *Microdesmis puberula* leaf meals respectively. The crude fibre levels were high, a feature that is very common with leaf meals. These however were indications of the low energy status of the leaf meals.

The mean values for the water quality parameters obtained in the course of this study are within the optimum requirement for normal growth, nutrient utilization and physiological state of the fish. The range values of 26.0 – 26.10^{o}C, 6.30 – 6.80 and 4.08 – 5.15mg/l observed in this study fall within the optimal production levels of 20 – 30^{o}C, 6.5 – 9.0 and 4.0 – 5.60mg/l temperature, pH and dissolved oxygen respectively (Jhingran and Pullin, 1985, Anyanwu, 2005 and Ochang *et al*, 2007).

The result of this experiment as summarized in table 5 showed a significant growth rate of the experimental fish with the 0% leaf meal dietary treatment (TCN) being significantly ($p<0.05$) higher than the other treatments. This was followed by the 5% *Microdesmis puberula* (TM_5) and *Ipomea batatas* (TI_5) leaf meal dietary treatments, and then that of 5% *Carica papaya* leaf meal (TC_5), while the 5% *Alchornia cordifolia* leaf meal dietary treatment (TA_5) showed the least response. This was an indication that the nutrients were best converted to flesh by the fish on TCN, followed by TM_5, TI_5 and TC_5, while those of TA_5 were the least converted. The use of plant – derived materials such

as legume seeds, different types of oil seed cakes, leaf meals, concentrates and root tuber meals as fish feed ingredients however, is limited by the presence of a wide variety of anti-nutritional substances which have been observed to depress growth in catfish (Okoli *et al*, 2003; Adugna *et al*, 1997; Kaitho *et al*, 1998; and Thorne *et al*, 1999). The trend in the weight gain and SGR of the experimental fish might be an indication of their relative responses to the dietary inclusion levels of the leaf meals. The value of 0.38 – 1.23 observed for the protein efficiency ratio (PER) seemingly compared well with the range of 0.27 – 0.79 and 0.571 – 1.47 reported by Wing-Keong *et al* (2004) and Algbeleye *et al* (2001) respectively for varying levels of Jackbean meal.

The protein efficiency ratio (PER) for TCN was significantly higher ($p<0.05$) than those of the 5% leaf meal dietary treatments. The 5% *Microdesmis puberula, Ipomea batatas* and *Carica papaya* leaf meal dietary treatments (TM_5, TI_5 and TC_5) were significantly ($p<0.05$) higher than that of the 5% *Alchornia cordifolia* leaf meal dietary treatment (TA_5). The feed conversion ratio (FCR) of 3.20 for TCN was similar ($p>0.05$) to the values of 4.79, 6.13 and 6.92 for TM_5, TI_5 and TC_5, respectively.

These compared favourably with the range of 5.7 – 8.7 in a study on optimal dietary protein levels and conventional diets for juveniles of catfish by Madu and Akilo (2001). The higher feed conversion ratio (FCR) value observed for the 5% *Alchornia cordifolia* leaf meal dietary treatment (TA_5) is synonymous with the overall poor yield and performance of the fish on this feeding regime. This suggests that the 5% *Microdesmis puberula, Ipomea batatas* and *Carica papaya* leaf meal dietary treatments compared favourably with the 0% leaf meal dietary treatment (TCN) in achieving higher yield and overall performance of the fish.

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