Growth performance and blood profile of African cat fish fed sweet potato (*Ipomoea batatas*) leaf meal

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ABSTRACT: Two hundred and twenty five *Clarias gariepinus* were fed with five diets of 40% crude protein containing 0, 10, 20 30 and 40% SPLM respectively for 14weeks. The mean weight gain, total feed intake and total protein intake for diet 4(30% SPLM) was significantly higher ($P<0.05$). Diet 4 showed better feed conversion ratio and protein efficiency ratio were significantly affected ($P <0.05$) .The haematological values were not significantly ($P>0.05$) differents . Therefore, this study showed that Sweet potato leaf meal has good potential as a protein source in diet of *Clarias gariepinus* up to 30% level without compromising growth.

Key words: clarias gariepinus, performance, haematology, replacement value, ipomoea batatas

INTRODUCTION

Fish serves as a source of food and income for most people in the developing countries particularly Africa (FAO, 1996). Nutritionally, fish is equivalent to meat in protein with a good amino acid profile, high essential mineral element and low saturated fatty acid (Idoniboye – obu and Ayinla, 1988).

However, prices of animal protein ingredients for fish feeds have been on the increase in Nigeria. This has resulted in the increasing cost of fish production and consequently increase in the cost of fish products. Therefore one of the problems facing aquaculture industry is the high cost of fish feed, hence fish nutritionist all over the world are constantly searching for the dietary protein source in which fish will maximize growth and increase production within the shortest possible time and at the lowest cost (Adewolu, 2008). Various unconventional feed resources have been used especially from plant origin either as energy or protein feedstuffs.

Leaf meal is one of the cheapest source of protein that may reduce the cost of fish feed. Sweet potato (*Ipomoea batatas*) is a dicotyledonous plant which belongs to the family *Convolvulaceae* (Austin, 1988). It is an herbaceous creeping plant with smooth, lightly moderate green leaves sometimes with a considerable amount of purple pigmentation especially along its veins (Longe, 1986).

Sweet potato grows best at an average temperature of 24^{o}C (75^{o}F) with abundant sunshine and warm nights. Annual rainfall of 750-1000mm is considered most suitable with a minimum of 500mm in the growing season (Austin, 1988). It is cultivated in over 100 nations and ranks fifth among the most important food crops in the tropical areas (An, 2004). According to Hong (2003), sweet potato is a major tropical crop with a short and fast growth cycle.

The young leaves of sweet potato serve as good vegetable source for man. Its wide use as vegetable is however hampered by the fact that it is considered a poor man's vegetable and the fact that it had always been used traditionally as folder and browse for domestic animals (Oyenuga, 1968). Sweet Potato leaves has 4.90% Crude fat; 24.85% Crude protein; 51.95% Carbohydrate; 7.20 % Crude fiber; Caloric value 351.30 ME kcal / g. (Antia *et al*,2006)

Leaves of sweet potato (*Ipomoea batatas*) have high crude protein (CP) content ranging from 25% to 29% in DM (Hong *et al*, 2003), with high amino acid score. Asides from its nutritive values, sweet potato leaves can be harvested many times throughout the year (Hong *et al*, 2003) thereby making the leaf meal to be abundant.

Hence this study was carried out to determine the effect of sweet potato *(Ipomoea batatas)* leaf meal (SPLM) on the growth performance and blood profile of African catfish (*Clarias gariepinus).*

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MATERIALS AND METHODS

The experiment was carried out in the fishery unit of the Teaching and Research Farm, Ladoke Akintola University of Technology, Ogbomoso.

Collection and Processing of Sweet Potato Leaf Meal: The sweet potato (*Ipomoea batatas)* leaves were collected and sundried for minimum of 8 hours per day for a week under intensive sunlight until it became crispy to touch after which they were milled.

Formulation of experimental diets: Five diets with different replacement levels of Sweetpotatoa leaf meal (SPLM): 0, 10, 20, 30, and 40% SPLM were formulated to be isonitrogenuous (40% crude protein). Apart from sweet potato leaves, other ingredients were obtained from a local supplier. The ingredients were mixed thoroughly with oil, processed into a paste by adding hot water and pelleted through a metal plae with a die of 2.0mm. The resulting pellets were air-dried after which they were broken up and sieved through graded sieves to obtain pellets with an average diameter of 543μ.

Table 1. Gross compositions of the experimental diets

Ingredient	Diet 1(0%)	Diet 2(10%)	Diet 3(20%)	Diet 4(30%)	Diet 5(40%)
Yellow maize	24.45	23.45	21.95	20.45	19.45
Rice bran	12.23	11.73	10.73	9.23	7.23
GNC	14.48	14.58	16.08	17.58	19.08
Blood meal	7.29	8.79	9.79	11.29	12.79
Fish meal	36.45	32.80	29.16	25.51	21.87
SPLM	-	3.65	7.29	10.94	14.58
Oyster shell	1.50	1.50	1.50	1.50	1.50
Bone meal	1.50	1.50	1.50	1.50	1.50
Mineral premix	1.00	1.00	1.00	1.00	1.00
Lysine	0.50	0.50	0.50	0.50	0.50
Vegetable Oil	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100
% CP	40.00	39.71	39.58	39.81	39.77

GNC- Groundnut cake; SPLM- Sweet Potato Leaf Meal; CP- Crude Protein

Experimental Animal, procedure and management : 225 *C. gariepinus* fingerlings of an average weight of 7.35g ± 0.2g were acclimatized for 2 weeks and distributed into 15 tanks, each containing 15 fingerlings. The five dietary treatments were replicated three times. 15 fingerlings were sacrificed before and at the end of the feeding trial, to determine the initial and final carcass composition at the end of the feeding trial. The fingerlings were fed twice daily, in the morning (0.900hours) and evening (17.00hours), at a rate of 3% body weight per day in two equal feedings and the feeding regime was adjusted with respect to body weight fortnightly. The fingerlings were weighed every two weeks, a prophylactic treatment of acriflavin ($3mgL^{-1}$) sigma chemical was administered after each weighing to reduce bacteriological infestation caused by handling . The experiment lasted 12 weeks.

Data collection :The parameters measured were, Mean Weight Gain (MWG): Final mean weight (g) - Initial mean weight (g).

Average Daily Weight Gain (ADWG) = Mean weight gain (g) / length of feeding trial (days)

Percentage Weight Gain (PWG): Mean weight gain (g) x 100 / Initial mean weight

Protein Efficiency Ratio (PER) : Net weight gain (g) / Amount of protein fed (g)

Chemical analysis :The proximate analysis of sweet potato leaf, diets and the fish carcass were done , using the procedure outlined by AOAC (1990).

Blood Sample Collection: Blood samples for haematological analysis were collected at the end of the feeding trial from the caudal peduncle of both the test and control fish with a sharp blade. The blood samples were dispensed into tubes containing Ethylene Di -amine Tetra Acetate (EDTA).The following haematological parameters were assessed : Erythrocyte count (RBC), Leucocyte count , Heamoglobin (Hb), Packed cells volume (PCV), Mean corpuscular volume (MCV), Mean corpuscular haemoglobin concentration (MCHC) Mean corpuscular haemoglobin (MCH) and Total blood protein.

Statistical analysis : The data collected were subjected to One Way Analysis of Variance (ANOVA) using the general liner model of SAS, (1999). Means were separated by Duncan's Multiple Range Test (Duncan, 1955) of the same computer package.

RESULTS AND DISCISSIONS

The results of the proximate analysis of the sweet potato leaf meal is presented in Table 2. Sweet potato leaf meal has a crude protein level of 24.85%, crude fat 4.90%, Crude fibre 7.20%, total ash 11.10% and Nitrogen Free Extract 44.16%.

The performance characteristics of *Clarias gariepinus* fed diets containing varying levels of sweet Potato meal is presented in the Table 3. The final mean weight shows that there is increase in size of the fish in all the dietary treatments. The MWG across the dietary treatment were significantly different ($P<0.05$). Highest MWG values of 9.66g and 9.49g were recorded by diets 1 and 4 respectively while fish fed diets 2, 3 and 5 had the least MWG values.

There was no significant ($P>0.05$) difference in the feed intake values of diets 2, 3 and 5. Diet 4 had the highest total feed intake (2.06g) while diet 2 recorded the lowest total feed intake (1.81g). This was also observed in the total protein intake value of all the dietary treatments. Least value ($P< 0.05$) of FCR was recorded in diet 1 (0.2) and diet 2 had the highest value (0.26). In all the diets, the values were significantly ($P < 0.05$) different however FCR recorded for diets 4 and 5 are similar. PER values were significantly ($P<0.05$) different among the treatments. Diet 2 had the lowest PER value of (0.10) while diet 3 had the highest value (0.95). The SGR values are significantly ($P< 0.05$) affected in all the treatments. Fish fed with diets 1 and 4 had the highest values of 0.99 and 0.985% respectively while diet 2 had the least value of 0.86%.

The results of carcass composition of *Clarias gariepinus* fingerlings before the commencement of the experiment and at the end the experiment are presented in the Table 4. The crude protein content value of diet 3 is the highest (65.69%) while diet 1 had the least (60.66%) . However, the carcass composition of fish before the feeding trials (Initial) had lower crude fat and NFE contents than the final composition of the fish carcass.

The results of the haematological analysis of *Clarias gariepinus* at the end of the experiment are shown in Table 5. Significant ($P<0.05$) differences were observed in the values of mean corpuscular volume (MCV) and white blood cells (WBC). The RBC, Hb, PCV, MCHC and total protein are not significantly ($P>0.05$) affected in all the treatments. Despite this, diets 1,4 and 5 were numerically higher than diets 2 and 3.

Table 2. Proximate composition and energy of sweet potato (*Ipomoea batatas)* leaves

Parameters	% Dry Matter
Moisture content	82.21
Ash content	11.10
Crude fat	4.90
Crude protein	24.85
Crude fiber	7.20
Carbohydrate	51.95
Caloric value, Kcal	351.30

When the alternative sources of feedstuff such as plant proteins are used in fish diets, one of the common problems is the acceptability by fish and this has to do with the palatability of the diet (Rodriguez *et al*, 1996). The potential of the feedstuff such as leaf meal in fish diet can be evaluated on the basis of its chemical composition. The proximate composition of the Sweet Potato Leaf Meal used in this experiment revealed that the CP content was 24.85%, crude fibre 7.20% and total ash 11.10%. These values are lower than the values reported by Woolfe (1992) and An (2004) but higher than the values reported by Adewolu, (2008) for SPLM. These differences may be due to varietal differences and changes in environmental conditions such as soil type, harvesting time, processing and preservation methods.

Table 3. Performance characteristics of *Clarias gariepinus* fingerlings fed various inclusion levels of sweet potato leaf meal.

	Diets					
Parameters	1(0%)	2(10%)	3(20%)	4(30%)	5(40%)	SEM
Initial weight, g	7.49	7.01	7.26	7.30	7.16	0.04
Final weight, g	17.15[a]	14.44[b]	15.21[b]	16.79[b]	15.35[b]	0.24
MWG, g	9.66[a]	7.44[b]	7.95[b]	9.49[a]	8.19[b]	0.21
ADWG, g/d	0.99[a]	0.76[b]	0.81[b]	0.97[a]	0.84[b]	0.00
PWG, %	128.96[a]	105.52[b]	109.43[b]	129.67[a]	114.20[b]	2.59
SGR, %/d	0.99[a]	0.86[b]	0.91[b]	0.985[a]	0.92[b]	0.01
TFI , g	2.04[a]	1.81[b]	1.81[b]	2.06[a]	1.90[b]	0.24
FCR	0.21[c]	0.26[a]	0.24[b]	0.22[bc]	0.23[bc]	0.00
TPI	0.82[a]	0.72[b]	0.75[b]	0.82[a]	0.76[b]	0.01
PER	0.85[b]	0.10[c]	0.95[a]	0.87[b]	0.94[a]	0.02

[abc] Means in the same row with the same superscripts are not different (P>0.05)

Table 4. Carcass composition (% dry weight basis) of experimental fish samples at the beginning and at the end of the feeding trial.

		Diets					
Parameters, %	Initial	1(0%)	2(10%)	3(20%)	4(30%)	5(40%)	SEM
Moisture content	4.12	4.11	3.88	4.63	3.76	4.45	0.13
Dry matter	95.88	95.89	96.12	95.37	96.24	95.55	0.13
Crude protein	62.34[ab]	60.66[b]	63.14[ab]	61.54[b]	65.69[a]	62.92[ab]	0.56
Crude fat	5.75	5.92	5.93	6.02	6.09	6.10	0.06
Crude fibre	1.89[a]	1.63[b]	1.72[a]	1.63[b]	1.48[c]	1.57[bc]	0.88
Total ash	14.60[a]	13.29[b]	13.56[b]	13.53[b]	14.23[a]	13.62[b]	0.15
Nitrogen free extract	11.30[b]	14.39[a]	11.76[b]	12.64[a]	8.84[c]	11.33[b]	1.05

[abc] Means in the same row with the same superscripts are not different (P> 0.05).
SEM - Standard Error of Mean

Table 5. Haematological parameters and total serum protein of *Clarias gariepinus* fingerlings fed various inclusion levels of sweet potato leaf meal.

	Diet					
Parameters	1(0%)	2(10%)	3(20%)	4(30%)	5(40%)	SEM
RBC, 10^6/µl	24.05	21.06	21.06	24.03	21.15	0.36
Hb, g/dl	10.01	8.55	8.59	10.01	9.85	1.35
PCV, %	37.02	35.67	35.66	37.05	36.98	3.91
MCV, fl	158.20[a]	145.50[b]	145.35[b]	113.95[c]	156.28[a]	4.73
MCHC, g/dl	27.00	25.22	25.55	27.20	26.98	5.14
WBC, 10^3/µl	43.45[a]	37.38[b]	37.38[b]	44.50[a]	43.49[a]	44.43
Total Protein, g/100ml	4.54	4.25	4.05	4.6n[a]	4.3	0.04

[abc] Means in the same row with the same superscripts are not different (P>0.05).

Although the nutritional quality of SPLM as determined by mean weight gain and specific growth rate were higher in fish fed diet 1 (control) and 4 (30% SPLM). This implies that SPLM can be included in the diet of *Clarias gareipinus* fingerlings up to 30% without any adverse effect on fish growth. Adewolu, (2008) reported the replacement level of 15% SPLM in the diet of *Tilapia zilli* as optimum. These two works have shown that leaf meal protein at low level of inclusion in fish diet were able to support growth.

The proximate carcass composition data of *Clarias gariepinus* fingerlings showed significant ($p<0.05$) differences in fish fed diets containing different levels of Sweet Potato Leaf Meal, these amount however increased more than the initial values. This observation is in accordance with the

report of Adewolu, (2008) and Ramachandran and Ray (2004). The body moisture were not significant ($p>0.05$) but there were significant ($p<0.05$) differences in the crude protein content in all the experimental groups. The crude Fat and Nitrogen Free Extract content increased in all the dietary treatments more than the initial value. Crude fibre and ash content values were also significantly ($p<0.05$) different.

The none significant differences in the value of RBC, Hb, PCV,MCHC across the treatment groups is an indication that the oxygen carrying capacity of the blood is not tampered with as a result of ingesting test ingredient . The values also portray its nutritional adequacy and good nourishment of the animals(church *et al*,1984). No sign of anaemic condition was observed in all the treatments. Hackbath *et al* (1983) reported that diets have very strong influence on haematological traits but the values obtained in this study falls within the recommended range of Wederneger and Yasutake (1997) and Adedeji *et al* (2000) for haematological parameters.Total serum protein values were also similar ($P>0.05$) indication that the proteins in the diets were well utilized.

CONCLUSION

From the results obtained, fish fed with diet 1 (control) had the best performance in terms of MWG, ADWG, SGR and PER followed closely by fish fed with diet 4 (30% inclusion level). Therefore, it can be concluded that fishmeal can be replaced with SPLM more than 30% in the diet of African catfish fingerlings. It is recommended that farmers should replace fishmeal with SPLM more than 30% so as to reduce cost and maximize profit.

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