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THE EFFECT OF CASSAVA LEAF MEAL ON THE GROWTH PERFORMANCE OF AFRICAN CATFISH

(*Clarias gariepinus*)

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Target Audience: Nutritionists, existing fish farmers, potential fish farmers, researchers, feed mill operators.

ABSTRACT

The effect of substituting groundnut cake (GNC) with cassava leaf meal (CLM) as a dietary protein source for the African Catfish (Clarias gariepinus) was investigated. Histopathological studies of the liver and kidney of catfish were also carried out to determine the pathological effects. Four test diets containing sun-dried cassava leaf meal replacing 0, 25, 50, 75 and 100% GNC were fed to duplicate groups of catfish in circular plastic tanks (0.018m³). Growth depression and reduced nutrient utilization efficiency occurred with increasing dietary levels of CLM ($P < 0.05$). Histopathological examination of catfish liver revealed a degeneration of the hepatocytes as the dietary level of CLM increased. There was no mortality and the fish were morphologically normal.

Key words: Nutritive value, cassava leaf meal, catfish, performance, histopathology.

DESCRIPTION OF PROBLEM

The problems faced by the aquaculture industry in developing countries include the lack of fish feed which appears to be the most crucial. Fish feeds are expensive and scarce hence the demand is met largely by importation of many feed ingredients such as fish meal to compound the finished feeds (1). Ezenwa (2) noted that the cost of feeds constitutes a disincentive to small scale fish farming in Nigeria. Numerous feedstuffs available in Nigeria have potentials as ingredients in fish feed formulation. However, there is a need to consider and assess their economic and nutritional values and availability in substantial quantities before their utilization can be regarded as adequate.

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Leaf meal derived from cassava (*Manihot esculenta)* is a potential low-cost protein source for aquaculture. The average protein content of dry cassava leaf is 25% (4) which is high value for a non-leguminous plant. However, there appears to be no previous reference on the use of cassava leaf meal as a protean source of fish. Such information is important in the assessment of the replacement value of cassava leaf meal for conventional protein feeds like soybean meal and groundnut cake (GNC), which are scarce and usually too expensive for the local fish farmer. This study therefore, explored the possibility of incorporating cassava leaves into the diet of *Clarias gariepinus.*

MATERIALS AND METHODS

Experimental procedures

Fish meal, groundnut cake (GNC) and cassava leaf meal (CLM) were used as dietary protein in this study while cassava root meal was used as energy source. Whole cassava leaves collected from harvested cassava plants, were sun-dried on a concrete slab for 6 days and ground in a hammaer mill. Five diets were formulated to contain varying replacement levels of CLM (0%, 25%, 50%, 75% and 100%) for GNC. The diets were isonitrogenous (35% crude protein) except for diet 5 which contained 30% crude protein (Table 1.). Milled feed ingredients were weighed and the components were thoroughly mixed and moistened with hot water. The mix was pelleted manually using a pelleting machine and feeding trial was conducted in ten indoor circular and aerated plastic tanks ($0.018m^3$) in the Fisheries Laboratory, University of Ibadan, The five treatments were replicated twice.

Table 1: Gross composition of Experimental Rations (% Dry - Weight)

Ingredients	DIET				
	0% 1	25% 2	50% 3	75% 3	100% 5
Fish meal	20.00	20.00	20.00	20.00	20.00
Groundnut cake	48.26	41.00	31.51	27.92	-
Cassava leaf Meal (CLM)	-	13.67	31.51	36.81	65.97
Cassava Root Meal	20.99	14.58	6.23	4.48	3.28
Bone Meal	1.50	1.50	1.50	1.50	1.50
Oyster Shell	2.00	2.00	2.00	2.00	2.00
Vitamin Premix	2.00	2.00	2.00	2.00	2.00
Oil	5.00	5.00	5.00	5.00	5.00
Salt	0.25	0.25	0.25	0.25	0.25
Determined chemical composition (% dry matter)					
Crude Protein (N x 6.25)	36.67	36.06	35.66	35.33	31.15
Crude Lipid	7.82	7.69	6.71	5.34	4.29
Crude Fibre	2.58	6.41	9.31	11.87	16.19
Ash	16.59	14.30	11.66	9.01	4.82
NFE	31.79	30.86	32.06	32.40	39.34

Catfish fingerlings (mean weight 1.38 + 0.024g) were purchased from a commercial fish farm, acclimatized in the plastic tanks for one week and distributed randomly between the tanks at the rate of 10 catfish/tank. At the start of the feeding trial ten fish were sacrificed, weighed, oven-dried and kept in sealed polyethylene bags for subsequent analyses. The catfish were weighed individually at the beginning and at the end of the feeding trial, but fish were batch-weighed at weekly intervals using a sensitive Acculab weighing balance. All fish were fed *ad libitum* for 12 weeks.

Analytical Procedures

Triplicate samples of experimental diets, cassava leaf meal and catfish tissues were analysed for proximate composition by the AOAC method (5). Water temperature, dissolved oxygen, pH and total alkalinity were also measured (5). Growth performance and feed utilization of the fish were estimated based on indices such as specific growth rate (SGR), protein efficiency ratio (PER), food conversion ratio, gross food conversion efficiency, protein intake (PI), and total feed intake (6).

Histopathological examinations were carried out by the Erlictis Hematoxylin-coxin technique. Statistical comparisons were made using analysis of variance (ANOVA) test to determine if differences existed among treatment means. Mean differences between treatments were tested at 95% binomial confidence level, ($P < 0.05$), using Fisher's Least Significance Difference Test (7).

RESULTS AND DISCUSSION

Growth response by catfish fed CLM - based diets is shown in Table 2. Results obtained show that an increase in CLM in the diets gave a depression of growth and feed conversion efficiency. Progressive depressions in mean final weight, weight gain and specific growth rate were observed with increasing levels of cassava leaf meal. The best growth for all treatments was observed in catfish fed 25% CLM - based diet which gained significantly ($P < 0.05$) higher weight than those on 75% and 100% CLM - based diets. These results are at variance with those of previous studies (8,9) which reported no significant difference in the growth performance of Nile tilapia fed soaked and sun-dried CLM although a significant reduction in growth response occurred with each increase of CLM level in the diet. The difference between these results and that obtained in the present study probably has to do with the soaking treatment of cassava leaf before sun-drying and milling in the previous studies. Soaking feed stuffs in water prior to their use as animal or fish feed has been found to be very effective in removing certain anti-nutritional factors from the feeds and enhancing their nutritive value (10). However, other studies in agreement with the results of this study, reported significant growth depressions in rabbit, chicken and quail when diets containing unprocessed cassava leaf meal, were fed (11,12).

Table 2: Growth Response of Claria gariepinus Fed Different Levels of Cassava Lea' Meal (CLM) for 12 Weeks

Growth Parameters	Dietary Treatments					
	1	2	3	4	5	SEM+
Mean Initial Weight (g)	1.36	1.41	1.39	1.37	1.37	0.04
Mean final weight (g)	2.72[a]	2.53[a]	2.26[ab]	2.07[b]	1.75[b]	0.08
Mean percentage weight gain (g)	1.36[a]	1.12[a]	0.87[ab]	0.71[b]	0.38[c]	0.09
Specific growth rate (% per day)	0.83	0.70	0.58	0.50	0.29	0.02
Food conversion ratio	4.17[c]	34.82[c]	6.06[b]	7.02[b]	11.84[a]	01.40
Gross Food Conversion Efficiency (%)	23.98[a]	20.75[a]	16.50[b]	14.25[b]	8.45[c]	4.00
Protein Efficiency Ratio	0.65[a]	0.57[a]	0.46[a]	0.40[a]	0.27[c]	0.03

abc - values in the same row with similar superscripts are not significantly different (P > 0.05)

The deteriorating growth response observed with increasing levels of CLM, may have been caused by the poor digestibility of CLM due to high fibre content as well as declining dietary energy content of the high fibrous CLM - based diets. The significantly (P > 0.05) lower protein efficiency ratio (PER) of fish fed 50%, 75% and 100% CLM diets compared to others, attests to the fact that maximum utilisation of nutrients was not obtained at higher levels of CLM in the diet. The increasing level of fibre in the feeds with increase in CLM may have reduced the utilization efficiencies of the feed nutrients. A similar observation was made in the growth response of *Sarotherodon galilaeus* to diets containing varying levels of sorghum husk (13). It was observed that high fibre in the feed decreased nutrient utilization by hastening gastric emptying time (14, 15).

The proximate composition of catfish carcass at the beginning and end of the feeding trial is shown in Table 3. The carcass protein content of catfish was not significantly (P > 0.05) affected by dietary treatments except for fish fed 100% CLM diet which gave a reduction in body protein. An increase in the dietary CLM level resulted in a decrease in carcass fat content and an increase in carcass moisture and ash contents.

Table 3: Proximate Composition of Catfish Carcass at The Beginning and End of the 12 Week Feeding Trail (% Dry Weight)

Component	Dietary Treatments					
	Initial Fish	1	2	3	4	5
Moisture	6.31	5.39	6.49	6.41	6.59	7.02
Crude Protein	54.63	62.45	62.39	62.90	61.24	52.32
Crude Lipid	12.33	15.24	12.02	11.86	10.42	9.90
Ash	17.46	16.65	17.39	18.78	20.01	20.86

Histopathological examinations of catfish liver revealed a progressive degeneration of the hepatocytes with increasing dietary level of CLM (Table 4)

Fish fed diet containing 0% (Control diet) showed no hepatocyte degeneration but there was periportal cellular infiltration as dietary CLM increased in treatment, 3, 4, 5, and to a lesser extent in treatment 2. Congestion of the blood vessels was observed in treatment 2, 3 and 4 which led to distension of sinusoids in the fish. Eosinophils were seen around the liver blood vessels in all the treatments being highest in treatment 5 but with mild occurrence in the control treatment.

Table 4: The Effects of Different Levels of Cassava Leaf Meal on Liver of Clarias Gariepinus

Observation	Treatments				
	1	2	3	4	5
Hepatocytes	-	+	x	x	x
Congestion of the blood vessels	-	x	x	x	++
Distension of sinusoids	-	+	+	+	+
Cellular infiltration	-	+	+	+	+
Eosinophilia around the blood vessels	x	+	++	++	+++
Megalocytes	-	-	-	-	-
Fatty degeneration	-	-	-	-	-

- Not present
x Mildy present
\+ Present
++ Pronounced presence
+++ Highly pronounced presence

Symptoms of degeneration of the liver hepatocytes were probably due to the effect of residual cyanide in CLM fed to catfish, which resulted in an inflammatory response and congestion of the blood vessels. Inflammatory response is a basic protective response to tissue damage and the marginal toxic effect observed in fish fed 25% CLM compared with other treatments, indicates that CLM could be safely incorporated in *C. gariepinus* diet at this level of substitution for groundnut cake, without any significant adverse effect on the fish.

CONCLUSION AND APPLICATIONS

(1) The use of cassava leaf meal as a cheap source of protein in fish feed would reduce the cost of feeding fish in Nigeria and other developing countries where the conventional feed ingredients are scarce and expensive.

(2) Cassava leaf may also prove useful as a partial protein source at higher levels of inclusion in feeds for Clarias species, if the causes of the poor nutritive value of this protein supplement relative to groundnut cake can be ameliorated. Research on more effective processing treatments would therefore be required to eliminate any residual cyanide and enhance its nutritive value.

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