INTERNATIONAL JOURNAL OF PLANT, ANIMAL AND ENVIRONMENTAL SCIENCES
IJPAES
VOLUME-2, ISSUE-3, JULY-SEPT-2012 ISSN 2231-4490

Coden : IJPAES www.ijpaes.com

Received: 25th June-2012 *Revised: 29th June-2012* *Accepted: 01st July-2012*

Research article

REPLACEMENT OF MAIZE USING COWPEA (*Vigna unguiculata*) HULL MEAL IN PRACTICAL FEEDS OF AFRICAN CATFISH (*Clarias gariepinus*) FRY

A. E. Falaye[1], A. Omoike, [2*]and O. B., Olasebikan[1]

[1]University of Ibadan, Department of Wildlife and Fisheries Management, Ibadan, Nigeria.
[2]Bells University of Technology, Department of Biological Sciences, P.M.B.1015, Ota, Nigeria
*Corresponding author Email: dromoike@yahoo.com

ABSTRACT: A 56-day feeding trial was conducted to test the effect of partial replacement of maize meal by cowpea hull meal in the diet for fry of the African catfish, *Clarias gariepinus*. Five isonitrogenous rations containing replacement of 0 (control), 25%, 50%, 75% or 100 % maize meal by cowpea hull meal were fed to three replicate groups of *C. gariepinus* fingerlings (4.05 g). Growth performance and nutrient utilization of the fish were evaluated based on weight gain, protein intake, gross protein efficiency ratio, specific growth ratio, hematology, and carcass analysis. Average weight gains of the fingerlings fed the 100% cowpea hull meal replacement were highest (2.78g) followed by 50% (2.74g) compared to fish fed 75%, control and 25% cowpea hull meal inclusion of maize meal (2.71g, 2.09g and 1.97g, respectively). The feed conversion ratio (1.02-1.15) was low among the fish fed between 50% to 100% than the control and 25% fish fed replacement diet. The specific growth rate, protein intake, protein efficiency ratio, gross feed conversion efficiency, feed efficiency, mean feed intake, survival rate, and percentage weight gain significantly increased (p<0.05) as the level of dietary cowpea hull meal increased. It was concluded that the replacement of maize meal by cowpea hull meal diet within 50% to 100% level enhances growth performance of *C. gariepinus* fry
Key words: maize, *Clarias gariepinus*, cowpea hull meal, diets, hematology, replacement

INTRODUCTION

Aquaculture has the potential to become a sustainable practice that can supplement capture fisheries and significantly contribute to feeding the world's growing population [1] Many fish scientists have identify feed as a major hindrance to aquaculture growth in Nigeria.

Fish nutrition is the most expensive component of intensive aquaculture, representing over 50% of the total operating costs [2]**.** The feeding and nutrition of fish requires that feed ingredients which are potential nutrient carriers need to be supplied in adequate amount and in a definite proportion to ensure the supply of balanced nutrients; common ingredients such as soybean meal, groundnut cake, maize and cotton seed meal are in short supply in the tropics and often not available for sustainable animal production, hence there is an increase high cost of these ingredients [3] besides the competition for these same ingredients as easily reached food by the Nigerian populace. Its therefore apparently necessary to research into the underutilized materials that could substitute these expensive ingredients.

Maize is a popular energy source in fish feed, it is also popular as human and livestock feed, its also used for different purposes, such as pap, corn flour, corn flakes etc. The demand is greater than the supply, which necessitate its total replacement in fish feed.

Cowpea hull is usually removed from beans after soaking during the process of making bean cake (Akara) moin moin, bean meal and bean soup (gbegiri-yoruba). It has a crude protein content of about 15% and being a waste product makes it to be relatively cheap and readily available.

The African catfish, *Clarias gariepinus,* is a commercially important cultured species in Africa. This study was designed to determine the level of cowpea hull meal that could be used to replace maize meal in practical diets for *C. gariepinus* fingerlings.

MATERIALS AND METHODS

Experimental procedure and Fish. A total number of 150 fingerlings of *C. gariepinus* were procured from University of Ibadan, Department of Wildlife and Fisheries Management fish farm. They were acclimatized in the Wildlife and Fisheries Department Laboratory for one week during which they were fed with 40% crude protein 0.3mm commercial diet (coppens feed®) They were starved for 24 hours before the commencement of the feeding trial. Ten fish (AV. Wt., 4.5g) were allotted per dietary treatment, with three replicates per treatment.

The experimental fish were stocked in fifteen 20 litre circular plastic tanks, filled to 15 litre water, in a static renewal system. Water quality in the fish tank was monitored biweekly for temperature, dissolved oxygen, pH.

Experimental diets. The Cowpea (*Vigna unguiculata*) hull was collected from a reputable restaurant named Baba Klazz (University of Ibadan, Campus) Ibadan, Nigeria. The Cowpea hull was rinsed, sundried for few weeks and then grinded to a fine meal (Powdery Form) at Kasmak feed mill, at Ibadan Nigeria. (See table 1 for the proximate composition of the milled Cowpea hull). The experimental diets consisted of five isonitrogenous diets (36% crude protein) formulation in which the cowpea hull was used to replace Maize at 0, 25, 50, 75 and 100% by weight representing CD, TD_1, TD_2, TD_3, and TD_4 respectively (Table 2). The ingredients used were Fishmeal, Soybean meal, Groundnut cake, Wheat offal, Cowpea hull, Maize, Vitamin premix, mineral premix, palm oil and salt. The gross ingredients were grinded to powdery form, thoroughly mixed in a bowl to form a homogenous mixture starch was later added as a binding agent and moistened before being fed into a pellet mill and the pellet were extracted under pressure through a 0.3mm mm die. The pellets produced were sundried, labeled and packed in air tight bags to prevent contamination. Feeding. The fish were fed daily at the rate of 5% biomass for 56 days. The diets were administered twice daily in equal portions at 0900-1000 and 1700-1800hrs. The daily rations were adjusted accordingly after each biweekly weighing.

Calculation of growth and nutrient utilization parameters were as follows: Specific growth rate, SGR (%/day) = $(\log W_2 - \log W_1) / (T_2 - T_1)$, where W_1 is the weight at time T_1 and W_2 is the weight at time T_2. Feed Conversion Ratio (FCR) = total dry feed fed (g)/ total wet weight gain (g); Protein efficiency ratio PER = wet weight gain (g)/ amount of protein fed (g); Mean Weight Gain (MWG/Day) = Mean weight gain/ Numbers of days. Percentage Weight Gain (PWG) Mean weight gain/Final time – Initial time × 100; Gross Feed Conversion Efficiency (GFCE) = 1/FCR × 100 Protein Intake (PI) = Total feed consumed × percentage protein/100

Hematological and Blood Biochemistry Test: Blood sample of the experimental fish was collected using a 1.0ml syringe from the caudal vessels, Ethylene Diamine Tetra-acetic Acid (EDTA) was added to a vacutainer tubes before adding the collected blood to prevent clotting, carried out at the Pathology Department of Veterinary Medicine, University of Ibadan, Ibadan, Nigeria. To determine Packed cell Volume (PCV) Haemoglobin concentration (Hb), Red Blood Cell (RBC) Erythrocytes count (Er), White Blood Cell Count (WBC) Platelet, Leukocyte counts, Mean corpuscular Volume (MCV) Mean corpuscular haemoglobin Concentration (MCHC) and the Mean Corpuscular Haemoglobin (MCH) all were done based on the procedure of the unified methods for haematology examination of fish to evaluate the haematological profile

Analytical Methods. The proximate analysis of experimental diets; also that of the Cowpea hull meal and composite sample of fish carcass at the start of the feeding trial and at the end of the experiment were carried out by using methods described by [4]. Water quality analyses of dissolved oxygen, pH ammonia, nitrate and temperature in each of the treatments were determined using the method described by [5].

Statistical Analysis. Results of weight gain, specific growth rate, feed conversion ratio, protein intake, gross efficiency of food conversion, daily protein intake, protein efficiency ratio and percentage survival were pooled for each treatment computed and analyzed statistically using the statistical Package for the Social Sciences (SPSS) version 15.0. Means were compared by subjecting data to one way analysis of variance (ANOVA) to test the significance ($P<0.05$) testing that the level of Cowpea hull inclusion has effect on the growth of fish.

RESULTS

The processed Cowpea hull meal was rich both in protein, crude fat and fibre contents; it's adequate for inclusion in fish fed either as partial or complete replacement of maize meal. The study showed that the experimental fish were more healthy and active with lesser mortality than the control treatment.

The crude protein in the experimental diet and the experimental fish with 75% and 100% cowpea hull meal inclusion had more protein, crude fat and fiber than other treatments and control (Table 1).

The mean weight gain, feed efficiency, protein intake and specific growth rate were higher in T2, T3 and T4 than the control and T1. (Table 2) There were no observed deleterious effects of diets on the fish in any treatment as revealed in the blood hematology and the fish Biochemistry. Meanwhile, the water quality remained stable throughout the experimental period. The mortality level showed that T2 and T3 had the highest survival rate against CT with 50% between the first four weeks only.

Highest protein intake was observed in the T4 but there was no significant difference between the protein intake level at ($p<0.05$). The T4 with 100% of cowpea hull meal replacement for maize had the best FCR and other indicators of diet adequacy.

Table 1 Proximate composition of the experimental diets

Parameter	**Test Diets**				
Ingredients	CD	TD1	TD2	TD3	TD4
Crude Protein	37.42	35.98	36.21	38.15	40.10
Crude Fibre	4.22	5.43	5.40	5.58	5.87
Crude Fat	4.38	4.96	5.23	5.44	6.56
Crude Ash	15.67	15.84	16.00	15.96	16.20
Moisture	9.96	9.79	9.88	9.93	9.89
Nitrogen Free Extract	28.35	28.00	27.28	24.94	21.83

Table 2 Proximate composition of the experimental fish before and after the feeding trial

Parameter	**Initial**	**CT**	**T1**	**T2**	**T3**	**T4**
Crude protein	41.34	52.04	50.15	53.37	58.09	58.71
Crude fibre	0.21	1.13	1.21	1.09	1.24	1.17
Crude fat	4.70	6.21	5.92	7.21	8.05	6.11
Crude ash	10.50	12.81	12.69	13.09	13.46	12.85
Moisture (%)	2.11	3.77	3.69	3.82	3.76	3.59

Table 3 Hematological composition of *Clarias gariepinus* fed with various inclusion level of cowpea hull meal

	TRtS (%)	PCV (gm%)	Hb ($x10^{12/1}$)	RBC ($x10^{9/1}$)	WBC (x10.9/1)	PLATELETS (FI)	MCV (%)	MCHm (%)	MCHC.Lym (%)	NEUT (%)
INITIAL	21	6.9	6.84	7.4	06	32	10	32	58	41
CT	28	9.2	8.62	10.7	08	32	10	32	72	27
T1	31	10.2	9.86	12.4	08	31	10	32	70	30
T2	33	10.9	10.64	18.0	10	31	10	32	65	34
T3	25	8.2	8.84	6.4	06	28	09	32	73	26
T4	42	13.9	12.66	28.4	12	33	10	33	65	35

Table 4 Plasma biochemistry of C*larias* gariepinus fed with various inclusion of cowpea hull meal

TREATMENTS	TOTAL PROTEIN	ALBUMIN	GLOBULIN	K+	NA+	SGOT	SGPT	Glucose
INITIAL	4.2	1.0	3.2	25	40	32	45	42
CT	4.8	1.2	3.6	30	56	36	58	60
T1	5.0	1.1	3.9	32	60	38	65	76
T2	5.2	2.0	3.2	35	68	40	72	80
T3	4.4	1.3	3.1	28	52	34	56	58
T4	5.6	2.1	3.5	38	74	46	86	92

Table 5 Growths and nutrient utilization of experimental fish

Parameters	CT	T1	T2	T3	T4
Experimental Period (Days)	56	56	56	56	56
Number of Fish per Treatment	10	10	10	10	10
Mean Initial Weight	4.03b±0.02	4.06a±0.02	4.06a±0.01	4.05a±0.03	4.05a±0.02
Mean Final Weight	6.12c±0.28	6.03d±0.08	6.80a±0.34	6.76b±0.12	6.83a±0.10
Mean Weight Gain	2.09c±0.04	1.97c±0.02	2.74b±0.04	2.71b±0.02	2.78a±0.05
Percentage Weight Gain (%)	51.82b±7.11	48.38c±3.06	67.20a±8.01	66.80a±3.08	68.76a±4.62
Mean feed intake/Week	2.24c±0.31	2.28c±0.15	2.90a±0.02	2.79a±0.12	2.58b±0.02
Feed efficiency	0.93b±0.05	0.86b±0.08	1.08a±0.13	1.08a±0.04	1.08a±0.05
Food Conversion Ratio	1.07b±0.49	1.15a±0.86	1.05a±0.99	1.02a±0.26	1.06a±0.34
Gross Feed Conversion Efficiency	11.65b±0.06	10.79c±1.01	13.52a±1.67	13.50a±0.47	13.46a±0.6
Protein Efficiency Ratio	0.32b±0.02	0.30b±0.03	0.37a±0.04	0.37a±0.01	0.37a±0.01
Protein Intake Rate	6.47c±0.89	6.58c±0.45	7.28b±0.05	7.22b±0.36	7.45a±0.06
Specific Growth Rate	0.74c±0.08	0.70c±0.03	0.92b±0.08	0.91b±0.03	0.94a±0.05
Survival Rate (%)	50	70	90	90	90

DISCUSSION

TD_4 has showed that the complete replacement of maize with cowpea hull meal is nutritionally most adequate than partial inclusion levels.

The proximate analysis of the experimental fish revealed an increase in the proximate composition of all the treatments from their initial value. This is an indication that all the fermented diets were nutritionally adequate for practical feeding of *Claris gariepinus* fish.

The growth performance of these fish during the experiment indicates that all the formulated diets are nutritionally adequate. However, the value were low compared to 8.13g obtained as reported by [6] that fed with various inclusion level of leucaena leucocephala. The mean weight gain of the fish of T1 (25%) gave the slowest growth performance, which may be attributed to the poor acceptability of the TD_1 by the fish. The food conversion ratio recorded in this study is adequate and is comparable to that of [7] when fish meal was substituted by blood meal in the diet of *Clarias gariepinus* but, contrary to the study of the replacement of fishmeal by processed poultry offal by [8] which showed the decrease in growth performance as the poultry offal inclusion increases.

Blood hematology showed that the physiological condition of the experimental fish is adequate to withstand the effect of environmental factors and stress that could cause low growth performance. Because there was no reduction in the value of WBC count, because the reduction in value of WBC count leads to the release of epinephrine during stress causing a decrease of leucocytes count resulting to the weakening of immune system.

Based on the result of this study the substitution of maize with cowpea hull in the diet of *clarias_gariepinus* at various inclusion level of 0%, 25%, 50%, 75%, and 100% revealed that the fish fed with TD_4 containing 100% cowpea inclusion level gave the best growth performance and nutrient utilization in terms of mean weight gain (MWG), specific growth rate (SGR), food conversion ratio (FCR) and protein efficiency ratio (PER). The poorest performance result was by TD1 with 25% cowpea hull inclusion level. TD4 equally showed that it had the best blood hematology indicator.

It is therefore recommended that cowpea hull could be used as total substitution for maize in the diet of *Clasrias gariepinus* as it enhances rapid growth, sound health, and economic profitability.

REFERENCES

[1] Kathryn W, Brendan O, and Zdravka T., 2004. At crossroads: Will Aquaculture fulfill the promise of the blue revolution. A Sea Web Aquaculture clearing house report. Pp 1-17.

[2] Falaye A.E., 1988. Nutrient Utilization of cocoa husk in the diet of tilapia (Oreochromis niloticus). Ph.D Thesis, University of Ibadan.

[3] Tacon A.G. J. and Akinyana D.M., 1993. Feed ingredients for crustacean. Akinyana (ed) (1993), The Crustacean Nutrition World Aqua Society.

[4] A O.A.C, 1995. Official Methods for Analysis of AOAC International Vol.1, Arlington V.A USA.[5] Boyd C.E., 1979. Water Quality Management for Pond Fish Culture . Developments in Aquaculture and Fisheries Science, Elsevier Science Publication, Amsterdam. 560pp.

[6] Amishar., S. Oteng, M.A and Ofori, J.K., 2009. Growth Performance of the African Catfish, Clarias gariepinus, fed varying inclusion level of leucaena Leucophala leaf meal. Journal of Applied Sciences Environmental Management. Vol.13 (1), Pp.21-26

[7] Agbegi O.T., Otubusin S.O, and Ogunleye F.O., 2009. Effect of different levels of substitution of fishmeal with bloodmeal in pelted feeds on Catfish, Clarias gariepinus (Buchell,1882) culture in net cages. European journal of scientific Research. Vol.31(1). Pp 6-10.

[8] Falaye A.E., A. Omoike, E.K. Ajani, and Kolawole O.T., 2010. The Israeli Journal of Aquaculture – Bamidgeh, IIC.63.2011.542, http://www.siamb.org.il