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Effects of Cassava Leaf Meal on Growth Performance and Nutrient Utilization of African Catfish in the Semi-Arid Zone of Nigeria

[1]Hassan M.,[2]Wakil U.B, A.I [3]Gamawa
[1and2] Department of Fisheries, University of Maiduguri, Borno State, Nigeria
[3]Department of Agric. Education, Umar Suleiman College of Education Gashua, Yobe State, Nigeria

ABSTRACT

A 52 day feeding trial was conducted to evaluate the possibility of utilising cassava leaf meal as a plant protein source in the diet of African catfish (Clarias gariepinus). Four iso-nitrogenous diets were formulated to contain Cassava leaf meal at 0, 10, 20 and 30% respectively. Total of 120 fingerlings of C. gariepinus were randomly stocked at 10/tank with replications and assigned a particular diet. At the end of the trial, growth performance and nutrient utilization showed decreasing trend to Cassava leaf meal levels in the diet. The group fed diet containing 10 and 20% CLM were not significantly different with the control diet. Diet containing 30% CLM recorded the lowest values (1.57g and 3.93g) Specific growth rate (SGR) and weight gain (WG) respectively. However, condition factor (K) and percentage survival rate were not significantly affected by the treatments. The study further revealed that the use of CLM at levels up to 20% could be used for the formulation of C. gariepinus diet without affecting growth and nutrient utilization.

Key Words: *Clarias Gariepinus, Growth Performance, Nutrient Utilization and Cassava Leaf Meal*

1. INTRODUCTION

Over the last 30 years, aquaculture has been growing faster worldwide than any other animal production sector (Francesco, *et al.*, 2004 and FAO 2007). However, in Nigeria the growth of the industry has been militated by high cost of feed and other production inputs which make its development very slow compared to livestock and poultry farming. High cost of fish feed was observed as one of the problems hampering aqua cultural development which account for at least 60% of the total cost of production (Gabriel *et al.*, 2007). This has brought about the search for local protein feed stuffs that are cheap and high in quality as alternative protein feed ingredient for fish culture.

Presently fish nutritionists are constantly searching for cheaper protein sources from plant and animal-based ingredients that will maximize fish growth and increase production within the shortest possible time. A number of plants and animal based ingredient are continued to be investigated for their potential in replacing fish meal. Many studies have been conducted using various sources of leaf meal protein. Ng and Wee, (1989) worked on the inclusion of cassava leaf meal in pelleted feed for Nile Tilapia; Bichi and Ahmed (2010) on Cassava leaf meal in *C. gariepinus* diet and Hassan *et al.* (2015) on Neem seed cake in *C. gariepinus* diet.

African Catfish (*Clarias gariepinus*) is one of the important Aquaculture candidates in Nigeria owing to their attributes such as omnivorous, hardy and tolerant to a wide range of environmental conditions as reported by Anyanwu (2005). In Nigeria larger population of fish farmers are involved in the production of this important specie for its high market value. It fetches a higher price than tilapia as it can be sold live at the market and therefore, has a market value two to three times that of tilapia (Emokaro, 2010).

Cassava (*Manihot esculenta*) is a staple food in the tropics and its leaves also serve as forage for animals due to its palatability and high protein content (Ravidran, 1991). It is one of the most drought-tolerant crops, capable of growing on marginal soils. Nigeria is one of the world's largest producers of cassava. It currently produces over 14m tonnes annually, representing about 25% of sub-saharan Africa's output, In some parts of Nigeria, where cassava is highly cultivated, the leaves are allowed to decay on the farmlands after harvest. These wasted cassava leaves on farmlands has been recommended for incorporation into fish feed by Falaye (1992). Cassava leaves have been used to replace soybean meal in conventional diets for pigs and gave good results if ensiled or dried (Bui Huy Nhuphuc *et al.*, 2000). In a related studies Cassava leaves has been used to feed rabbits as they compare favourably with alfalfa meal and *Aspilia africana*, which is common forage fed to rabbits in Africa (Samkol *et al.*, 2008).

With recent competition and hike in price of most feed stuff like maize, sorghum, soybean, groundnut cake and fish meal as a result of insurgency which affected their cultivation in the North Eastern part of Nigeria the used of Cassava leave meal in formulating fish feed would greatly assist towards reducing competition for these basic ingredients and enhance fish production.

2. MATERIALS AND METHODS

2.1. Study area

The study was carried out at the demonstration and research farm of the department of fisheries, University of Maiduguri (10^0 43N and 0^0 14N, longitude 10^0 15E and 13^0 17E).

2.2. Source of feed ingredients

The ingredients used in the formulation of the experimental diet include; Cassava leaf meal, soybean meal, fish meal, and maize which were purchase from the market in Maiduguri and ground using hammer mill. Vitamin and minerals Premix, methionine, lysine and vegetable oil were obtained from a feed store in Bama road Maiduguri.

2.3. Processing of Cassava leaf meal

Cassava (*Manihot esculanta*) leaf meal was prepared by soaking the leaves for 3 days and sun-dried for 7 days to reduce the presence of cyanogenic glycosides (Bichi and Ahmad, 2010). The dried leaves were ground into fine powder to obtain the cassava leaf meal (CLM) which was used to formulate the feed.

2.4. Experimental design

Twelve plastic bowls of fifty litre capacity were used for the experiment. Water level was maintained at 25 litres. One hundred and twenty (120) fingerlings of *Claris gariepinus* were purchased from a private fish farm in Maiduguri, Borno State, Nigeria. The fish were acclimatised for 3 days (Okoye and Sule, 2001), and fed with control diet at 5% of their body weight twice daily at 8.00-9.00am and 5.00-6.00pm (Madu *et al.*, (2001).

A complete randomized design (CRD) was adopted with three replicates at 10 fish per tank. Prior to the commencement of the experiment the fish were individually weighed and measured to ascertain their initial weight and initial length respectively. Thereafter, fish were starved for 24 hours in order to empty their stomach and prepare their appetite for the new feed. Subsequently, fish were batch weighed and standard length measurements were taken after every two weeks (fortnightly) and the rations fed were adjusted according to the fish weight gain respectively. The experiment lasted 52 days.

2.5. Diet Preparation and formulation

Four iso-nitrogenous diets (35% crude protein) were formulated as presented in Table1. The dried cassava leaf meal were incorporated in the diets at different levels and labelled D1(Control), D2(10%), D3(20%) and D4 (30%). The ingredients were mixed together manually before the addition of vitamin and mineral premix. Warm water (60^oc) was added to the pre-mixed ingredients and homogenized until a dough-like paste was formed. The dough was pelleted manually using hand operated pelleting machine. Oil was added to the pellets and sun dried to a constant weight and kept in air tight containers. The feeds formulated were analysed for proximate composition according to the procedure in A.O.A.C (2000).

Table1: Gross and Proximate Composition of Experimental Diets

Ingredients	D1 (0%)	D2 (10%)	D3 (20%)	D4 (30%)
CLM	0.00	3.09	7.40	8.98
SBM	37.62	27.86	29.60	20.97
Fish meal	37.62	37.62	37.62	37.62
Maize	9.75	13.12	10.18	13.70
WB	9.75	13.12	10.18	13.70
Premix	1.50	1.50	1.50	1.50
Lysine	1.00	1.00	1.00	1.00
Methionine	1.00	1.00	1.00	1.00
Salt	0.50	0.50	0.50	0.50
Starch	0.50	0.50	0.50	0.50
Oil	0.50	0.50	0.50	0.50
Total	100	100	100	100
Proximate Composition				
Dry matter	97.00	96.00	96.00	97.00
Protein	35.18	35.21	35.14	34.89
Fibre	8.90	10.40	8.44	7.93
Fat	8.22	7.34	8.32	8.12
Ash	2.87	4.53	3.46	2.76

2.6. Measurement of Growth Parameters

Growth performance and nutrient utilization of fish were determined following the methods of Jimoh and Aroyehun (2011). Final averaged weight, survival rate, Specific Growth Rate (SGR), Feed Conversion Ratio (FCR) and Protein Efficiency Ratio (PER), Net Protein Utilization(NPU) responses were calculated as:

i. Weight gain (g) = W_2 (Mean final weight) – W_1 (Mean initial weight)

ii. Specific growth rate (SGR) = $\frac{\text{Ln}W_2 \text{ (Mean final weight)} - \text{Ln}W_1 \text{ (Mean initial weight)}}{\text{Experimental periods (days)}} \times 100$

Where Ln = Base of Natural log.

iii. Survival rate(%) = $\frac{\text{Number of fish harvested}}{\text{Number of fish stocked}} \times 100$

iv. Condition factor(K or C) = $\frac{W}{L^3} \times 100$

v. Feed conversion ratio (FCR) = $\frac{\text{Weight of the dry feed dispensed (g)}}{}$

Live weight gain of fish (g).

vi. Protein efficiency ratio (PER) = Weight gain (g) / Protein intake (g)

2.7. Water quality parameters

Water quality parameters were monitored throughout the feeding trial. Water temperature (^{0}C) and pH were measured with Mercury in glass thermometer and digital pH meter respectively.

2.8. Statistical analysis of data

Data were analysed to compare the means using One-way analysis of variance (ANOVA) at P<0.05. Significant differences between treatment means were ranked using Duncan's multiple range tests.

3. RESULTS AND DISCUSSION

In the present study, there was a general increase in weight gain in all treatments, thus indicating that the fish were able to convert feed protein to extra muscles. Weight gain and specific growth rate are usually considered as the most important measurement of productivity of diets (Hossain *et al.,* 1995; Omotoyin and Faturoti, 2000). The performance of the experimental fish with regards to the growth and nutrient utilization parameters is presented in Table2. The mean initial weight ranged from 2.63±0.17g to 2.80±0.14g (P<0.05), which ensured homogeneity of fingerlings at the onset of the feeding trial. Mean final weight ranged from 6.75±0.36 (Diet3) to 10.89±0.25 (Diet1) was significantly different (P>0.05) among the experimental diets and control (Table2). The result of this experiment revealed a much higher body weight gain of fish on control diet (0%) than the rest of the treatments.

Table2: Growth Performance and Nutrient utilization of Clarias gariepinus fed diets containing different levels of Cassava leaf meal

Growth Parameters	Graded Levels of Cassava Leaf Meal in the feeds (%)			
	0	10	20	30
Initial length (cm)	6.54±0.31^{b}	6.17±0.18^{a}	6.23±0.48^{ab}	6.13±0.14^{a}
Final length (cm)	9.70±0.40^{a}	8.57±0.79^{a}	8.97±0.33^{a}	8.53±0.35^{a}
Initial weight (g)	2.76±0.30^{a}	2.63±0.17^{a}	2.80±0.14^{a}	2.80±0.05^{a}
Final weight (g)	10.89±0.25^{a}	9.05±0.16^{a}	8.10±0.26^{a}	6.75±0.36^{b}
Weight gain (g)	8.13±1.49^{a}	6.42±0.25^{a}	5.35±0.27^{a}	3.93±0.24^{b}
Feed intake (g)	2.68±1.18^{b}	8.86±0.05^{ab}	10.29±0.22^{a}	8.38±0.10^{b}
Specific growth rate	2.42±0.35^{a}	2.21±0.13^{ab}	1.89±0.05^{ab}	1.57±0.05^{b}
Feed conversion ratio	1.61±0.18^{bc}	6.17±0.18^{a}	1.94±0.02^{ab}	2.08±0.17^{a}
Protein efficiency ratio	1.81±0.21^{ab}	8.57±0.79^{a}	1.81±0.21^{ab}	1.37±0.10^{b}
Survival rate	56.67±3.33^{a}	2.63±0.17^{a}	56.67±3.33^{a}	63.33±3.33^{a}
Condition factor (k)	1.19±0.02^{a}	1.39±0.24^{a}	1.14±0.1^{a}	1.11±0.15^{a}

Values are means ±SE, means with different superscript along a raw are significantly (P<0.05) different

This followed a similar trend with the work of Anyanwu *et al.* (2012) who reported that weight gained by *Clarias gariepinus* decreased with increased inclusion level of cassava leaf meal. However, Bichi and Ahmad (2010) obtained the greatest weight at 66.7% inclusion level of cassava leaf meal. The decrease in mean weight gain of fish at 30% inclusion was probably caused by reduced palatability of the diet.

Specific growth rate ranged from 1.57g - 2.42g in the control diet and treatment containing 30% inclusion of Cassava leaf meal respectively. This parameter was significantly affected by the treatment levels as indicated by decreasing trend observed from the result (Table1). These results compared favourably with 1.65 to 2.96 reported by Anyanwu et al. (2012). Other performance indices such as Percentage Survival rate and condition factor (K) which gives

information relating to the physiological status of the fish with regards to health and welfare during the feeding trial were not significantly (P> 0.05) affected by the treatments. Similar results were recorded by Thomas *et al.* (2003) and Bichi and Ahmad *(*2010).

Nutrient utilization of the experimental fish with regards to feed intake, protein efficiency ratio and food conversion ratio, indicates that mean feed intake of the experimental fish ranged from 8.38g to 12.68g. With the control and diet containing 10%CLM been the most accepted diets. This parameter was significantly ($p<0.05$) affected by the level of CLM inclusion in the diet as it showed a decreasing trend to CLM levels. This may be probably due to reduced palatability of the diet at certain levels in feed. Although, there was significant variation between the means and the control, these values are within range usually recommended for the culture of fish. In similar experiment higher values than those recorded in this study were reported by Anyanwu *et al.* (2009); Erfanullah and Jafri (1998) and Anyanwu *et al.* (2012). The effect can be apparently related to the protein efficiency ratio (PER) which ranged from 1.37±0.10 to 2.97±0.22. The PER was highest at 20% inclusion level and the control was not significantly different ($P>0.05$) with diet containing the highest level of CLM indicating efficient utilization of protein. Related values have been reported by Adejumo (2005). The mean values of the physicochemical parameters monitored during the feeding trial were 23^{o}c-25±06°C, 7.5-8.30±0.03 and 3.0-32mg/l for temperature, pH and Dissolved oxygen respectively although within the ranges required for fish production (Anyanwu, 2003 and Ochang *et al*., 2007), these values are very close to the extremes of the various requirements respectively. This may probably responsible for the relatively lower weight gains recorded in the current study as the study was coincidently carried out during the cold season in the study area.

4. CONCLUSION AND RECOMMENDATION

Based on the growth performance and nutrient utilization of the experimental fish in the present study, the use of Cassava Leaf Meal in the diets for African catfish at 20% replacement value did not affect the growth and nutrient utilization and may therefore reduce cost of production and enhance fish production. Higher levels of inclusion can be tried using other means of processing.

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