

Chemical Composition of Varying Inclusion Levels of Air-Dried Cassava Leaf Meal on the Growth Performance of African Catfish as Additive

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ABSTRACT

The effect of processed Cassava (*Manihot esculenta*) leaf as feed supplement was investigated on the growth performance of *Clarias gariepinus* (mean body weight, 268.20g). Five isonitrogenous diets (35% CP) were formulated as T1 (CONTROL) and T2 (0.02g CLM), T3 (0.04g CLM), T4 (0.06g CLM) and T5 (0.08g CLM) containing varying inclusion levels of air-dried cassava leaf meal (CLM). One hundred and Five (105) matured juvenile African catfish were procured from a reputable source in Ogbomoso and were divided into five groups of treatments. The fish were stocked at the rate of seven per tank (120 litres) and replicated three times. The fish were fed to satiation (*ad libitum*) twice daily (8:00 hours and 16:00 hours) for twelve (12) weeks and the growth were monitored and recorded every two weeks. At the end of the feeding trials, Data on weight gain and feed intake were recorded during feeding trial period. Hence, weight gain (WG), mean weight gain (MWG), percentage weight gain (PWG), specific growth rate (SGR), average feed intake (AFI), feed conversion ratio (FCR), protein intake (PI), protein efficiency ratio (PER) was calculated and were subjected to one way analysis of variance (ANOVA) using Completely Randomized Design (CRD). The result of this study found that the highest inclusion level (0.08g) of cassava leaf meal (CLM) in catfish diets resulted in the best growth performance result.

Keywords: Cassava leaf meal, Growth performance, feed intake

INTRODUCTION

Nigeria's fish supply come from both domestic and imported sources. Artisanal fisheries from coastal and brackish waterways, as well as interior lakes, dams, and rivers, aquaculture and industrial marine fishing, account for the majority of local production (Nwuba et al., 2023). By 2050, worldwide demand for fish and other aquatic foods is predicted to double (Naylor et al., 2021), driven by population and economic development, globalization, urbanization in developing nations, and dietary trends in affluent countries (FAO, 2020). The population of Nigeria is on the rise and there is a corresponding demand for fish consumption (Gabriel et al., 2007). Nigeria, like most third world countries, is not able to meet her animal protein requirement of meat, fish and their respective products.

Aquaculture is rapidly expanding across the world, with the potential to provide significant protein for human consumption (Issa et al., 2022). It plays a key part in the Nigerian economy, as it does in the economies of other African nations, in terms of job creation and income generating (Mulokozi et al., 2020). Aquaculture contributes to 46.8 percent of total global fish production. The most common fish species farmed in Nigeria are catfish and tilapia (Nwuba et al., 2023).

Catfish of the family Claridae comprise the most commonly cultivated fish in Nigeria. The growth of aquaculture in Nigeria now is largely being boosted by a steady rise in catfish culture. Although, inadequate availability of seed for stocking and feed used to be major problems. However, tremendous progress is now being made. The quest to increase the culture of the fish so as to meet its ever-increasing demand has made it crucial to develop essential diets either in supplementary forms in ponds or as whole feed in tanks (Olukunle, 2006).

Feed is one of the major inputs in aquaculture production and fish feed technology has become one of the least development sectors of aquaculture particularly in Africa and other developing countries of the world (Gabriel et al., 2007; Patrick, 2022). However, high cost of fish feed ingredients is recognized as one of the problems hindering aquaculture development in Nigeria (Gabriel et al., 2007; Patrick, 2022).

To address the high cost of feed militating against profitable fish farming practices and competition for protein sources such as soya-bean, alternate sources and supply are necessary. Leaves of most tropical plants for example ipomea batatas leaf meal (Olaniyi et al., 2010); Taro leaf meal (Olaniyi, 2010); pawpaw leaf meal (Olaniyi and Salau, 2013); mulberry leaf (Olaniyi et al., 2016) and *Ocimum gratissimum* leaf meal; *Telfaria occidentalis* leaf meal; *Azadirachta indica* leaf meal (Anyanwu et al., 2015) are available and inexpensive.

Cassava roots and leaves are readily available and have also been found to support the growth of different fish species such as *Oreochromis niloticus* (Tilapia), *Mystus cavasinus* (Catfish). Cassava leaves are renowned for their substantial protein content, making them a significant source of essential amino acids. Studies such as (Khang et al., 2013) highlight protein levels ranging from 20% to 30% on a dry weight basis, underlining the potential of cassava leaves as a protein supplement in diets for both humans and animals.

MATERIALS AND METHODS

Experimental Site

The experiment was conducted at the fishery unit of the Teaching and Research Farm, Ladoke Akintola University of Technology (LAUTECH), Ogbomoso Oyo State, Nigeria.

Collection and Processing of *Manihot esculenta*

Cassava (*Manihot esculenta*) leaves were plucked from cassava plantation Lautech teaching and research farm, ogbomoso, Oyo state, Nigeria. The leaves were air-dried and grounded into fine particles using mortar and pestle and then stored in an air tight container prior to use to avoid mould.

Experimental Fish

A total of two hundred (200) juvenile African catfish were procured from a reputable fish farm in Ogbomoso. The fishes were acclimatized for the period of two weeks after which, one hundred and five (105) juvenile African catfish (268.20g) were randomly selected and divided into five (5) dietary treatments. The fish were stocked at the rate of 7 juveniles (3male: 4females) per tank (120L) and replicated three times. The fish were fed to satiation twice daily.

Experimental Diets.

Feed ingredients such as maize, wheat offal, groundnut cake, fish meal, soybean meal, oyster shell, bone meal, methionine and lysine were obtained from a reputable feed mill in Ogbomoso. Five diets with varying inclusion level of cassava leaf meal were formulated, Diet 1(0g), Diet 2(0.02g), Diet 3(0.04g), Diet 4 (0.06g) and Diet 5(0.08g) per 100g of feed.

Experimental Procedure.

After acclimatization period, one hundred and five (105) African Catfish Fingerlings were randomly

selected and divided into five (5) treatments. The fish were stock at the rate of ten (7) per tank (120L). They were fed to satiation twice daily in the morning (8:00 AM) and evening (4:00PM).

Data Collection

Growth Performance

Using a weighing scale, the difference in fish weight was recorded and feed intake data were as well collected. The data was collected fortnightly throughout the experimental period which lasted for duration of 12weeks. From the data, the mean weight gain (MWG), percentage weight gain (PWG), specific growth rate (SGR), feed conversion ratio (FCR), protein intake (PI) and protein efficiency ratio (PER) parameters were calculated.

Table 1: Gross Composition of Experimental Diets

Ingredients	T1 (Contr ol)	T2 (0.02gCLM/10 0gDiet)	T3 (0.04gCLM/100 gDiet)	T4 (0.06gCLM/100 gDiet)	T5 (0.08gCLM/100 gDiet)
Maize	20.60	20.60	20.60	20.60	20.60
W/O	10.30	10.30	10.30	10.30	10.30
GNC	22.20	22.20	22.20	22.20	22.20
Soybean C	33.30	33.30	33.30	33.30	33.30
Fish Meal	11.10	11.10	11.10	11.10	11.10
Bone Meal	0.50	0.50	0.50	0.50	0.50
Oyster Shell	0.50	0.50	0.50	0.50	0.50
Lysine	0.50	0.50	0.50	0.50	0.50
V/Premix	0.50	0.50	0.50	0.50	0.50
Honey	0.50	0.50	0.50	0.50	0.50
CLM	–	0.02	0.04	0.06	0.08
Quantity	100	100.02	100.04	100.06	100.08
%CP	35	35	35	35	35

CP – Crude protein, CLM – Cassava Leaf Meal

Chemical Analysis

At the beginning and the end of the feeding trial, proximate composition of Cassava leaf (test ingredient) and experimental diets were determined according to the methods of AOAC (2002)

Statistical analysis

All data collected were subjected to one-way analysis of variance (ANOVA) using a completely Randomized Design (CRD) and means was separated by Duncan's Multiple Range Test (Duncan's 2020) using the same computer package.

RESULT AND DISCUSSION

Proximate Composition of Test Ingredient

The proximate composition of the test ingredient (Cassava Leaf) meal is presented in table 4.1. The crude protein, dry matter, crude fiber, ash content, nitrogen free extract and ether extract were as follows: 22.93%, 83.23%, 3.49%, 2.32%, 45.22%, 9.27% respectively.

Table 2: The Proximate Composition of the Test Ingredient (Cassava Leaf) Meal

Parameters	Crude protein	Dry matter	Crude fiber	Ash content	Nitrogen free extract	Ether extract
Values	22.93%	83.23%	3.49%	2.32%	45.22%	9.27%

Growth Performance and Nutrient Utilization of Matured African Catfish (*Clarias gariepinus*) Fed Cassava (*Manihot esculenta*) Leaf Meal as Additives

The results of the growth performance and nutrient utilization of African catfish fed varying levels of cassava leaf meal as additives are presented in table 4.3 All parameters such as Final Mean Weight (FMW), Mean Weight Gain (MWG), Percentage Weight Gain (PWG), Specific Growth Rate (SGR), Average Feed Intake (AFI), Feed Conversion Ratio (FCR), Protein Intake (PI) and Protein Efficiency Ratio (PER) observed for the growth and nutrient utilization of African catfish fed different levels of cassava leaf meal as additives were significantly ($P < 0.05$) different in all the values across the treatments.

The highest FMW, MWG, PWG and SGR (409.05g, 140.85g, 52.52g and 0.22g) were obtained in treatment 5 respectively while the least values of FMW, MWG, PWG and SGR (370.59g, 102.39g, 38.18g and 0.17g) were recorded in treatment 3. The AFI (258.53g) recorded the highest value with treatment 2 while, the lowest value of AFI (235.72g) was recorded with treatment 3. However, the highest value of FCR (2.30) was found with treatment 3 while the least value for FCR (1.76) was recorded in treatment 5. The highest PI (90.49) value was observed in treatment 2 while the least value of PI (82.50) was recorded in treatment 3. The highest value of PER (1.62) was revealed in Treatment 5 while the least PER (1.24) value was obtained in treatment 3. Although, treatments 2 and 4 (1.38) and (1.37) were not significantly different ($P > 0.05$).

Table 3: Growth Performance and Nutrient Utilization of (*Clarias gariepinus*) Fed Varying Levels of Cassava (*Manihot esculenta*) Leaf Meal

Parameters	T1(Control)	T2(0.02g)	T3(0.04g)	T4(0.06g)	T5(0.08g)	SEM
IMW(g)	268.20	268.20	268.20	268.20	268.20	0.56
FMW(g)	400.08 ^b	393.34 ^c	370.59 ^e	384.96 ^d	409.05 ^a	3.92
MWG(g)	131.88 ^b	125.14 ^c	102.39 ^e	116.76 ^d	140.85 ^a	3.57
PWG (%)	49.17 ^b	46.66 ^c	38.18 ^e	43.53 ^d	52.52 ^a	1.27
SGR (%)	0.21 ^b	0.19 ^c	0.17 ^d	0.19 ^c	0.22 ^a	0.00
AFI (g)	251.65 ^b	258.53 ^a	235.72 ^e	244.10 ^d	247.97 ^c	5.68
FCR	1.91 ^c	2.07 ^b	2.30 ^a	2.09 ^b	1.76 ^d	0.05
PI(g)	88.08 ^b	90.49 ^a	82.50 ^e	85.43 ^d	86.79 ^c	1.99
PER	1.49 ^b	1.38 ^c	1.24 ^d	1.37 ^c	1.62 ^a	0.00

a, b and c means in the same row with the same superscript are not significantly different ($p>0.05$). IMW- initial mean weight, FMW- final mean weight, MWG- mean weight gain, PWG- percentage weight gain, SGR- specific growth rate, AFI-average feed intake, FCR-feed conversion ratio, PI- protein intake and PER- protein efficiency ratio

DISCUSSION

Positive change in weight gain described in all treatments signified that the fish reacted positively to all diets. This is in line with the findings of (Olaniyi et al., 2010) that weight gain and specific growth rate were the most substantial criteria used in assessing the diets performance

The result of this experiment revealed a much higher mean weight gain (MWG), percentage weight gain (PWG) and specific growth rate (SGR) in diet 5 than the rest of the diets, hence, signifying the fish's ability to transform feed into energy/body weight. The PWG AND SGR in this present study is lower compared to the report of (Anyanwu et al., 2012) this might be as a result of difference in inclusion level. The MW range obtained in this study is higher than the findings of (Olude and Akinduti, 2023) who fed *Oreochromis niloticus* diets containing fermented cassava leaf meal. Although, PWG and SGR in this study is lower compared to this author. The difference may be due to the difference in processing methods. Also, the MW and PWG range obtained in this study is higher with the findings of (Falaye et al. 1999). Although, SGR in this study is lower compared to this author. The difference may be due to the replacement of groundnut cake with cassava leaf meal by this author. The MW and SGR in this study are lower but PWG is higher compared to the report of (Bichi et al. 2010). The difference might be as a result of replacement of maize with cassava leaf meal by this author. The feed conversion ratio (FCR) of 1.76-2.30 observed in this study is lower compared to 4.95-6.39 and 3.19-8.07 reported by (Amisah et al., 2009) and (Anyanwu et al., 2012) respectively but higher to (1.33-1.47) reported by (Olude and Akinduti, 2023). The best conversion efficiency was obtained in treatment 5 thus, it can be deduced that treatment 5 convert more of the feed offered into flesh hence, the weight gain of the fish increased. Protein intake (PI) was best observed with treatment 2 fish fed (0.02g) inclusion level of cassava leaf meal. Protein contents of the diets effectively improved growth and energy source of the fish. The protein efficiency ratios (PER) of 1.24-1.62 observed in this study is lower compared to the report by (Falaye et al., 1999; Bichi et al., 2010; Anyanwu et al., 2012; Odo et al., 2016 and Olude and Akinduti, 2023). All the experimental diets were accepted by *Clarias gariepinus*. This might be attributed to the good processing techniques which involved drying that might have reduced the antinutrient of cassava leaves and increases its palatability.

CONCLUSION AND RECOMMENDATION

From the results obtained from these experiments, the study revealed that CASSAVA LEAF MEAL diet can be tolerated by African catfish. Treatment 5 performed better than the control and other treatments in terms of final mean weight, mean weight gain, percentage weight gain, specific growth rate and protein efficiency ratio thereby reducing the cost of production of Catfish in Nigeria. This results also suggests that up to 0.08g/100g level of cassava leaves could be best added as the optimum requirement for catfish (*Clarias gariepinus*) growth performance

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