



FEEDING VALUE OF *Daniellia oliveri* LEAF MEAL IN THE DIET OF CATFISH (*Clarias gariepinus*) JUVENILE

ABSTRACT

Growth performance as an integral part of wellness and increase of *Clarias gariepinus* juvenile. An eight-weeks feeding trial was conducted in ten (10) indoor plastic aquarium dimensions 1.1m by 1.4m² of 30-50 liter capacity. Seventy *Clarias gariepinus* juveniles were distributed to ten plastic aquaria where the fishes were stocked indoors. The objectives of this work is determine growth performance, proximate analysis of the feed included with

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Introduction

The feed industry is faced with enormous challenges not only regarding the availability of feed ingredients but also the ability to produce high-quality products cost-effectively (Chauynarong et al., 2009). Increased competition for available conventional feed and scarcity of food needs for research into the use of unconventional feedstuff with no competition with man, that could meet the nutritional needs of livestock and possibly substitute more expensive protein (groundnut cake and soybeans) and energy source (maize) in future (onyimonony and onukwufor, 2003).

Locally produced feed reduce the cost of production and hence cheaper means of meeting the protein requirement to improve food security and reduced the level of poverty, and locally available feedstuff are common in developing countries, thus inexpensive and locally available feedstuff are to be identified. The search for alternative protein sources is to be focused on by – products and materials which are not suitable for direct human consumption (Ali et al., 2008) the proportion of protein in fish diet is higher than those of other cultured animals, this makes fish meal very exorbitant. Study by Gabriel et al., (2007), have shown that the African catfish *Clarias gariepinus*, requires



Daneilla oliveri and the water quality parameter used to rear the fish. The ten indoor plastic aquariums were designed at 0%, 0.1%, 0.2%, and 0.3% with replicate labels T₀, T₁, T₂, and T₃. *Daniellia oliveri* leaf meal was included in the diet at 0%, 0.1%, 0.2%, and 0.3% respectively. Diet 0% without the inclusion of *Daniellia oliveri* leaf meal serves as a control. All were made 40-55%cp. The *Clarias gariepinus* Juveniles had an initial body weight of 5.3g, and the fish were allotted a diet of 5% of their body weight per day.

Keywords: *Daniella oliveri*, Leaf Meal, *Clarias gariepinus* and juvenile

about 40% crude protein in their diet and best result have been achieved with crude protein value ranging from 35-50% for all African catfish

Daniellia oliveri is a low-growing, deciduous tree with a flat-topped spreading, dense crown, usually growing 9-25 meters. The cylindrical bole which can be straight or twisted can be 150-200cm in diameter, un-branched for the first 8-10 meters, un-buttressed but with root flutes at the base, the largest tree of the wooded savannah of Sudan-guinea, it is harvested from the wild for its timber, gum and medicinal properties. The edible leaves are sometimes sold in the local market and the timber is also traded (Achigan-Dako et al., 2009).

The leaves are used in the treatment of stomach trouble, diabetes, dysmenorrhea (menstrual pain), and hemorrhoids (Zezi and Yaro, 2007). Whilst the leaves are said to be abortifacient (causes miscarriage), the flush of new leaf growth is said to be used to prevent miscarriage (Burkil, 2004).

An aqueous extract of the powdered bark has been shown to have effective pain reduction properties and also to be antioxidant (Boye et al., 2013). The recurring problem of resistance of microorganisms to orthodox medicine has led to an increase in herbal products as sources of novel compounds to combat the emergence of newer diseases while preventing the resurgence of older ones (Akharaiyi and Boboye, 2010).

The statement of the problem

The major item in recurrent cost in fish production is feed, this item cost alone has progressively taken the large shares of the cost of production, so that total feed cost account for over 60 percent of total production cost (Lamai, 2011) among the prerequisite for successful fish farming is the availability of suitable artificial formulated feed from locally available and cheap ingredients that contain all the nutritional requirements of the fish culture (Ayinla, 2007).



The ban on the use of antibiotics in an animal is believed to be associated with an increased incidence of foodborne disease in humans. *Daniellia oliveri* produce liquid deoresin which consists of large but ++++++varying amounts of volatile resinous substance and small quantities of acid (Gilbert, 2000) of antibiotics for therapeutic purposes in animals (Casewell et al., 2003, Spellbergs et al., 2013)

Justification of the work

Many farmers either cannot afford or do not have access to commercial formulated feeds and hence are forced to use farm-made feeds. For economic reasons, over 90 percent of the feeds used by fish farmers in sub-Saharan Africa are wet or dry feeds made on the farm or by small-scale feed producers (Hecht, 2007).

Due to the ban on the use of antibiotics in animal feeds, many scientists have searched for an alternative to antibiotics through the utilization of the extract of some medicinal plants (Alcicek et al., 2003). However, this present study intends to investigate the supplementation of *Daniellia oliveri* leaf meal in the feed of African Catfish (*Clarias gariepinus*)

General objective

The aim of the study is to assess the growth performance of *Clarias gariepinus* juveniles fed with a graded level of *Daniellia oliveri* leaf meal at a proportion of 0.1%, 0.2% and 0.3% respectively.

Specific objectives

The following growth parameters will be taken;

1. Standard length (cm) = $L_2 - L_1$
Where L_2 = Final standard length
 L_1 = Initial standard length
 - (a) Feed Conversion Ratio (FCR)
 - (b) Protein Efficiency Ratio (PER)
 - (c) Survival Rate
 - (d) Specific Growth Rate (SGR)
 - (e) Mean Growth Rate (MGR)
2. To determine the Cost-Benefit Analysis

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 - (e) Mean Growth Rate (MGR)
2. To determine the Cost-Benefit Analysis
3. To Monitor the Water quality; P^H , , Dissolved Oxygen (D.O), Water Hardness, Alkalinity, and Ammonia
4. Proximate Analysis of the feed

Material and Methods

An indoor system of fish farming was applied to assess the efficacy of *Daniellia oliveri* leaf meal in the diet of African catfish (*clarias gariepinus*) juvenile to determine the growth performance using the necessary materials needed such as ruler (calibrated in mm), thermometer, P^H meter, scooping net, weighing balance, and indoor tanks.

Experimental site

The experiment was carried out at the Fishery unit of the Faculty of Agriculture, University of Abuja Permanent Site, Gwagwalada FCT-Abuja Nigeria. The study area is located between latitude 8° 57' 15" North and Longitude 7° 04' 28" East, University of Abuja, along airport road Gwagwalada Abuja Nigeria (Google Map).

The wet season in Gwagwalada is oppressive and overcast, the dry season is humid and partly cloudy, and it is hot year-round. Over the year, the temperature typically varies from 63°F to 95°F and is rarely below 57°F or above 102°F.

Gwagwalada is one of the six (6) local government areas of the Federal Capital

The territory of Nigeria, together with Abaji, kuje, Bwari, Abuja Municipal Local Government Area, and kwali. The FCT also includes the City of Abuja. Gwagwalada is also the name of the main town in the Area Council, which has an area of 1,043km² and a population of 157,770 at the 2006 census.



Ten plastic tanks (aquarium) were used and three replicates were obtained ($3 \times 3 = 9$ with one control = 10 plastic tanks) at the site.

Experimental design and Data collection

A total number of 70 *Clarias gariepinus* juveniles were collected from Agricultural Development Programme in Gwagwalada Area Council, Federal Capital Territory (FCT) Abuja, Nigeria. These fishes were transported in a well-aerated bucket with well-oxygenated water to the Faculty of Agriculture fishery unit of the University of Abuja. The Seventy (70) juveniles were then stocked in an indoor tank and their growth rate were observed and analyzed by random selection. The fish were fed for 8 weeks at the rate of 5% of their body weight per day, shared between morning (7 am to 8 am) and evening (5 pm to 6 pm) while the water of all treatments was changed manually at the end of every week. The quantity of feed given was calculated thus;

Quantity of Feed (g) = Total weight of Fish $\times$ 5/100

Length and weight measurements of the juveniles were taken at the start of the experiment using a meter rule and sensitive weighing balance. At weekly intervals, the fishes in each tank were weighed and the average length and weight of the fishes in each tank were measured. Water PH and temperature records were taken daily with a PH meter and laboratory mercury thermometer (0 - 100 °C) respectively. Daily mortalities of fish in the tanks were recorded as described by Agbon et al. (2012).

Feed and Supplement Preparation

Daniellia oliveri was collected from the faculty of Agriculture Teaching and Research Farm, dried, and grinded into a powdered form, while the maize, groundnut cake, soya bean, fishmeal, and maize offal were purchased from

Gwagwalada market and brought to the Fishery unit of the Faculty of Agriculture, University of Abuja, for feed formulation. The *Daniellia oliveri* (supplemented into the feed at 0.1%, 0.2%, and 0.3% respectively), maize, groundnut cake, soya bean, fishmeal, and maize offal were collected and homogenized before application in Treatment 1, 2, and 3 respectively while having no percentage of *Daniellia oliveri* in the control.

Experimental diet

Four experimental diets were formulated using Maize, Groundnut cake, Fishmeal, and Soya bean, which were grinded homogenously. Vitamin premixes were used as a source of minerals and vitamins in the feed. The control (T_0) feed had no inclusion level of *Daniellia oliveri*, while treatment 1, 2 and 3 feeds had an inclusion level of *Daniellia oliveri* at 0.1%, 0.2%, and 0.3% respectively.



Below are the compositions of the experimental diet to be used;

Table1: COMPOSITION OF THE EXPERIMENTAL DIET (kg/100kg) OF *Danielliaoliveri* INCLUSION LEVELS (%)

Ingredients (%)	Control	Treatment 1	Treatment 2	Treatment 3
Maize offal	10	10	10	10
Maize	15	15	15	15
Groundnut cake	25	25	25	25
Soybean meal	19.5	19.5	19.5	19.5
Fishmeal	30	30	30	30
<i>Daniellia oliveri</i>	0	0.1	0.2	0.3
Premix	0.5	0.4	0.3	0.2
Crude protein	50.11	52.41	48.67	50.33
Energy (ME) Kcal/g	2285.5	2300.5	2423.5	2440.7
Ether extract	8.33	5.19	4.42	4.11
Crude fiber	1.24	1.30	1.28	1.40

Measuring of Growth Parameter

The initial live weights of the fish were recorded at the commencement of the experiment. Weekly weight gained and the average length of the fish were recorded. Daily water temperature reading was taken in the morning and evening. The following parameters were monitored during the study and further analyzed; P^H, water quality, Dissolved Oxygen (D.O), Water Hardness, Alkalinity, and Ammonia, while the cost of implication was calculated as follows;

$$\text{Feed conversion Ratio (FCR)} = \frac{\text{Total feed given (kg)}}{\text{Weight gain (kg)}} \times 100$$

$$\begin{aligned} \text{Standard length} &= \text{Final length (cm)} - \text{Initial length (cm)} \\ &= L_2 - L_1 \end{aligned}$$

Where L₁= Initial standard length

L₂= Final standard length

Mortality rate = $\frac{\text{Total No. of fishes stocked} - \text{Total No. of live fishes remaining in the aquarium}}{\text{Total No. of fishes stocked}} \times 100$



$$\text{Protein Efficiency Ratio (PER)} = \frac{W_2 - W_1}{P}$$

$$\text{Where } P (\text{Protein intake}) = \frac{\% \text{ Protein}}{\text{diet}} \times \text{Total feed consumed} \times 100$$

W_2 = Final weight

W_1 = Initial weight

Mean Growth Rate (MGR)

$$\text{MGR} = \frac{W_2 - W_1}{0.5(W_1 + W_2)t} \times 100$$

Where; t = Period of the experiment in days

W_1 = Initial weight

W_2 = Final weight

$$\text{Survival Rate} = \frac{\text{Total number of fish at harvest}}{\text{Number of fish stocked}} \times 100$$

$$\text{Specific Growth Rate (SGR)} = \frac{W_2 - W_1}{T} \times \frac{100}{1}$$

Where W_2 = Final weight of fish

W_1 = Initial weight of fish

T = Period of experiment in days

Cost-Benefit Analysis

The cost of the feed per kilogram of the diet and the cost of feed per kilogram of the body weight gain were determined by using the price of ingredients at the time of purchase. To estimate the economic value of the fish diet supplemented with *Daniellia oliveri*

$$\text{Cost-Benefit Analysis} = \frac{\text{Financial cost of feed (N)}}{\text{Body Weight (g)}}$$

Statistical Analysis:

Duncan's multiple range test of the same analytical tools was used for the analysis of the same set of experiments as well as mean between the treatments was determined using Turkey-HSD at a 95% degree of confidence using the SPSS 15 statistical analysis package.



DISCUSSION

Four experimental diets were formulated, grinded into powder, and pelleted. *Daniellia oliveri* leaf was grinded and included in the catfish (*Clarias gariepinus*) feed at 0%, 0.1%, 0.2%, and 0.3% respectively.

The juvenile had an initial body weight of 5.3g and their body weight. After 8 weeks of the experiment under review, the following growth parameters were taken:

Fishes in control have better adaptation and tend to grow faster than any other fish fed at different *Daniellia oliveri* leaf meal levels, Followed by those fed with 0.1% *Daniellia oliveri* leaf meal replacement level, followed by 0.2% *Daniellia oliveri* leaf meal replacement inclusion level and finally 0.3% *Daniellia oliveri* leaf meal replacement level respectively. However, fishes in the first treatment (T₁) have better adaptation and better response to the feed at a 0.1% inclusion level than any other fish in the remaining aquarium, followed by T₃ and subsequently T₂.

But in terms of survival rate T₁ and T₃ have the highest survival rate in every other aquarium.

Control had 6 mortalities

T₁ had 4 mortalities

T₂ had 6 mortalities

T₃ had 2 mortalities

These mortalities were discovered during the last phase of the first month, while in the second month, only two mortalities were discovered in treatment one (T₁: one mortality) and treatment two (T₂: one mortality).

TABLE 2: Level of *Daniellia oliveri* leaf meal

Growth parameters	Control 0%	T ₁ (0.1%)	T ₂ (0.2%)	T ₃ (0.3%)	SEM
Initial body weight	4.39 ^{bc}	5.26 ^a	4.92 ^{bc}	4.42 ^d	0.06
Final body weight	20.40 ^d	21.57 ^d	23.94 ^a	26.00 ^c	0.06
Body weight gains	16.01 ^d	16.31 ^c	19.02 ^b	21.58 ^a	0.06
Percentage (%)					
Body weight gain	30.22 ^d	30.02 ^d	34.97 ^a	40.83 ^{bc}	0.06
Initial length (cm)	6.40 ^{bc}	6.57 ^{bc}	6.00 ^{bc}	7.00 ^a	0.06
Final body length (cm)	18.17 ^{bc}	18.57 ^{bc}	18.99 ^{bc}	7.00 ^a	0.06
Increased body length (cm)	11.77 ^d	12.57 ^c	13.00 ^b	14.07 ^a	0.06
Feed conversion ratio	16.45 ^a	13.78 ^b	13.28 ^c	6.36 ^d	0.06
Survival Rate (%)	71.43 ^c	80.95 ^b	71.43 ^{cd}	90.47 ^a	0.06
Mortality Rate (%)	28.57 ^a	19.04 ^b	28.57 ^a	9.52 ^d	0.06
Mean growth rate	2.15 ^{bc}	2.03 ^d	2.19 ^{bc}	2.36 ^a	0.06
Protein efficiency ratio	0.33 ^d	0.36 ^c	0.41 ^b	0.46 ^a	0.06



SEM= Standard error of the mean

NS= Means in the same row are non-significant different differences ($P > 0.05$) a,b,c,d= means with different superscript differs significantly at ($P < 0.05$).

INTERPRETATION OF THE GROWTH PARAMETERS (TABLE 4.1)

There was a significant ($P < 0.05$) difference in the experimental diets based on the observed body weight gain. The catfish juvenile fed 0.3% and 0.2% *Daniellia oliveri* leaf meal has the highest ($P > 0.05$) body weight gain 21.58g and 19.02g.

The weight started increasing from 0%, 0.1%, and 0.3% inclusion levels with values of 16.01, 16.31, 19.02g, and 21.58 respectively. The *Clarias gariepinus* juvenile fed with the 0% (control) and 0.1% *Daniellia oliveri* leaf meal diet gave the lowest weight gain values 16.01 and 16.31 respectively.

There was a significant ($P < 0.05$) difference in the experimental diet based on the weight gain obtained, the catfish juvenile fed diet 0.3% *Daniellia oliveri* leaf meal has the highest specific growth rate of 1.22 ($P > 0.05$) comparable to the catfish juvenile fed diet 0.2% *Daniellia oliveri* leaf meal inclusion level with specific growth rate at 1.20. The catfish juvenile fed 0% (control) *Daniellia oliveri* leaf meal has the lowest growth rate of 1.06.

There was no significant ($P > 0.05$) difference in the treatment on the observed feed intake by the *Clarias gariepinus* juvenile since they were fed at the same level of feed given at the value of 5g respectively.

There was a significant ($P < 0.05$) difference in the experimental diet based on the observed increased body weight. The catfish juvenile fed diet at 0.3% *Daniellia oliveri* leaf meal has the highest ($P < 0.05$) increase in body length of 14.07cm. The catfish juvenile fed diet at 0.2% *Daniellia oliveri* leaf meal was next with an increased body length of 13.00 cm, while the catfish juvenile fed diet at 0% (control) and 0.1% *Daniellia oliveri* leaf meal had the lowest ($P < 0.05$) increased body length of 11.77cm and 12.57cm respectively.

There was a significant ($P < 0.05$) difference in the experimental diet based on the observed feed conversion ratio. The catfish juvenile fed at 0%(control) inclusion level of *Daniellia oliveri* leaf meal has the highest feed conversion ratio of 16.45, while the catfish juvenile fed diet 0.3% *Daniellia oliveri* leaf meal has the lowest feed conversion ratio at ($P > 0.05$) of 6.36 as compared respectively.

The Protein Efficiency Ratio (PER) of the mean are non-significant ($P > 0.05$) differences in the row between 0%, 0.1, 0.2%, and 0.3% respectively. The highest was obtained at 0.3% with a value of 0.46, while the lowest was at 0% with a value of 0.33.

There was a significant ($P < 0.05$) difference in *Daniellia oliveri* leaf meal inclusion on the mean growth rate (MGR) obtained. The lower mean growth rate obtained on *Clarias gariepinus* fed at 0% (control) and 0.1% with the values of 2.15% and 2.03% which was



comparable to the mean growth rate obtained at 0.2% and 0.3% with the values of 2.19% and 2.36% respectively. The *Clarias gariepinus* juvenile fed at 0.3% *Daniellia oliveri* leaf meal diet had the highest growth rate of 2.36%.

TABLE 3. Physiochemical analysis of water

Physiochemical

Parameters	0%	0.1%	0.2%	0.3%	SEM
Main Temperature (c°)	29.1 ^a	29.1 ^a	29.1 ^a	29.1 ^a	0.06
PH Range	6.70 ^{bc}	6.74 ^{bc}	6.25 ^d	6.78 ^a	0.06
Dissolved Oxygen (mg/l)	6.93 ^b	6.07 ^{bc}	6.73 ^c	7.13 ^a	0.06
Total Hardness (mg/l)	1.46 ^a	1.26 ^{bc}	1.08 ^d	1.22 ^{bc}	0.06
Alkalinity (mg/l)	89.25 ^a	86.66 ^b	76.99 ^d	82.38 ^c	0.06
Ammonia (mg/l)	0.39 ^a	0.43 ^a	0.44 ^a	0.55 ^a	0.06

KEYS: a, b, c, d = means with different superscripts differ significantly like (P < 0.05).

INTERPRETATION OF PHYSIOCHEMICAL PARAMETERS (TABLE 4.2)

The result of the physiochemical analysis of water is that there was no significant (P > 0.05) the difference in the temperature value of 29.1°C from 0% (control) diet to 0.3% *Daniellia Oliveri* leaf meal inclusion of the diet. The diets have the same temperature value of 29.1°C.

The *Clarias gariepinus* fed with 0.1% and 0.3% *Daniellia oliveri* leaf meal seems to have the highest PH with the value 6.78 while the lowest was recorded or obtained in T₂ of 0.2% inclusion of *Daniellia oliveri* leaf meal with value 6.25.

There was a significant (P < 0.05) difference in the dissolved oxygen (D. O) obtained at 0.3% with a value of 7.13mg/l, while the lowest was measured at 0.1% with a value of 6.07mg/l.

There was a significant (P < 0.05) difference based on the total hardness of water. *Clarias gariepinus* fed with 0% (control) *Daniellia Oliveri* leaf meal has the highest value of 1.46mg/l, while the lowest was measured at 10% with a value of 1.08mg/l.

There was a significant (P < 0.05) difference based on the alkalinity (mg/l) obtained. The highest alkalinity was obtained at 0% control with a value of 89.25mg/l, while the lowest was measured at 0.2% with a value of 76.99mg/l.

There was no significant (P > 0.05) difference based on the level of ammonia NH₃ (mg/l) was obtained at 0.3% with the value 0.55mg/l, while the lowest NH₃ (mg/l) was measured at 0% (control) with the value of 0.39mg/l.



Experiment Discussion

The catfish *Clarias gariepinus* juvenile can be accessed based on the size of the initial weight of the experimental fish of 5g is in line with or agrees with the recommendation of Isyagi *et al.* (2009). This can be accessed based on the weight gain of the experimental fish, this weight gain increases as the percentage of *Daniellia oliveri* increases from 0% to 0.3% with the values of 16.01g, 16.31g, 19.02g and 21.58g respectively.

Oxygen depletion in water leads to poor feeding of fish starvation, reduces growth and causes more fish mortality, either directly or indirectly (Bhatnagar and Garb, 2000). So therefore, dissolving oxygen level in water at between 6 and 7-13mg/l is suitable for fish production, because according to Bhatnagar and Singh (2010) and Bhatnagar *et al.* (2010) D. O (Dissolved oxygen) level >5mg/l is essential to support good fish production.

The P^H level of experimental waterfalls between 6.25 and 7.78 shows a high survival rate is in line with Omotoyin (2007) which shows that the ideal P^H is between 6.5 and 9.0, as described in the figure below:

Figure 1.0: Suitable P^H range for food fish culture:

DEATH	Desired range for fish production	DEATH
0-4	6.5-9.0	11-14

The alkaline level of water is suitable between 66 and 100mg/l. According to Omotoyin (2007) alkalinity between 75 to 200mg/l but not less than 200mg/l but not less than 20mg/l is ideal in an aquaculture pond. The total ammonia nitrogen level in the experiment shows between 0.4 and 0.6mg/l is good as well as suitable for fish production indicating the good colour of the water is recommended in Omotoyin (2007) between 0.3-2mg/l which stated that, the higher the P^H level in the water, the more the accumulation of total ammonia nitrogen.

In the present investigation based on the growth performance of the experimental juvenile from the beginning to the end of the study, there was a significant ($P < 0.05$) difference in the growth performance of juveniles fed with different levels of inclusion at 0% control to 0.3% *Daniellia oliveri* leaf meal diet respectively.

The result shows better improvement in the utilization of *Daniellia oliveri* leaf meal of the juvenile fed diet containing a graded level of *Daniellia oliveri* leaf meal at 0.3% which has 40.83% (body weight gain) had the best growth performance followed by 0.2% *Daniellia oliveri* leaf meal.



Table 4: PROXIMATE ANALYSIS OF THE EXPERIMENTAL DIET PARAMETERS:

Parameters

(%)	<i>Daniellia oliveri</i> replacement level (%)				SEM
	0%	0.1%	0.2%	0.3%	
Moisture Content	16.70 ^d	12.08 ^{bc}	12.44 ^a	12.00 ^{bc}	0.06
Crude protein	50.11 ^{bc}	52.41 ^a	48.67 ^d	50.33 ^{bc}	0.06
Crude fiber	1.24 ^d	1.30 ^{bc}	1.28 ^{bc}	1.40 ^a	0.06
Ash (%)	12.45 ^b	12.33 ^c	11.72 ^d	13.13 ^a	0.06
Ether extract (%)	8.33 ^a	5.19 ^b	4.42 ^{bc}	4.11 ^{bc}	0.06
Gross energy (Kcal/Kg)	2285.5 ^d	2300.8 ^c	2423.5 ^b	2440.7 ^a	0.06

Key: Values with the same superscript across the row are not significantly different ($p > 0.05$).

INTERPRETATION OF THE PROXIMATE ANALYSIS OF THE EXPERIMENTAL DIET (TABLE 4.3)

The result of the proximate analysis of the experimental diet containing *Daniellia oliveri* leaf meal at different inclusion levels of the diet shows that there was a significant ($P < 0.05$) difference in the percentage moisture content. The highest percentage of moisture was obtained at 0.2% with a value of 12.44% while the lowest percentage of moisture was obtained at 0% control with a value of 11.37%.

There was a significant ($P < 0.05$) difference based on the percentage of crude protein. The highest percentage of crude protein was obtained at 0.1% *Daniellia oliveri* leaf meal with a value of 52.41% while the lowest ($P < 0.05$) percentage of crude protein was obtained at 0.2% *Daniellia oliveri* leaf meal with the value of 48.67%.

There was a significant ($P < 0.05$) difference in the ash content obtained. The *Clarias gariepinus* fed at 0.3% had the highest value of ash content with a value of 13.

There was a significant ($P < 0.05$) difference based on the observed ether extract obtained in the diet. The highest percentage of ether extract was obtained at 0% control with a value of 8.33% while the lowest ($P < 0.05$) percentage of ether extract was obtained at 0.3% *Daniellia oliveri* leaf meal with a value of 4.11%.

Table 5: VITAMIN COMPOSITION OF *Daniellia oliveri* LEAF MEAL

Vitamin	Composition (mg/100g)
Ascorbic acid	34.09
β -carotene	811.3
Niacin	1.16
Thiamine	1.21
Riboflavin	1.02
Folic acid	2.77



TABLE 6: CATFISH PREMIX COMPOSITION

Composition	Value for each kg
L- Lysine	2.000 GM
DL-Methionine	2.000 GM
Vitamin A	1.000 MIU
Vitamin D ₃	0.200 MIU
Vitamin E	5.000 MIU
Vitamin K ₃	1.000 GM
Vitamin B ₂	1.000GM
Vitamin B ₆	1.000 GM
Niacin	10.000 GM
Calcium D	
Pantothenate	3.000 GM
Folic acid	0.800 GM
Biotin	0.040 GM
Copper sulphate	1.200 GM
Manganese	6.000 GM
Cobalt sulphate	0.004 GM
Sodium selenite	0.040 GM
Choline chloride	5.000 GM

Conclusion:

The African catfish (*Clarias gariepinus*) has an excellent digestive capacity to utilize whatsoever kind of feed ingredient of any nutritive value that has been added to the feed at different inclusion levels.

Daniellia oliveri leaf meal as an ingredient in formulating the diet of *Clarias gariepinus* showed a significant ($P < 0.05$) improvement in feeding catfish (i.e)

Daniellia oliveri leaf meal can be included at 0.1% and 0.3% but performed best at 0.3% *Daniellia oliveri* leaf meal with remarkable feed intake, feed conversion efficiency, weight gain, specific growth rate, and higher survival rate that was similar or close to that of 0% control (To). Therefore, *Daniellia oliveri* leaf meal contains some medicinal properties that help to stabilize the health of catfish (*Clarias gariepinus*) and this leaf is abundant in the Northern part of Nigeria. *Daniellia oliveri* leaf is not scarce to find which makes it cost-effective and useful just as mentioned in the statement of the problem.

The analysis in Table 4.1 shows that there was a significant ($P < 0.5$) difference in the body weight gain and feed conversion ratio (FCR), this study shows that the higher the



inclusion level of *Daniellia oliveri* leaf meal, the better the performance of the experimental fish.

Recommendation:

On the inclusion of *Daniellia oliveri* leaf meal to the diet of catfish (*Clarias gariepinus*) juvenile, 0.2% and 0.3% *Daniellia oliveri* leaf meal in the diet is hereby recommended because there was a low feed conversation ratio on showing at 0.3% and 0.2% because the fish consumed less and gained much.

REFERENCES

- Achigan-Dako E. et al 2009 Traditional Vegetables in Benin. Publisher; Darwin initiative international foundation for science.
- Agbon, A. O., Omoniyi, I. T. and Teko, A. A. (2012). Acute toxicity of tobacco (*Nicotianatobaccum*) leaf dust on *Oreochromis niloticus* and haematological change resulting from sub-lethal exposure. *Journal of Aquatic Science*, 17(1), 5-8.
- Akharaiyi F.C and Boboye, B. (2010). Anti-bacteria and phytochemical evaluation of three medicinal plants. *Journal of Natural Product* 3:27-34
- Alcicek A., Botcurt M., Cabuk M. (2003). The effect of herbal essential oils organic acid or a probiotic on broiler performance. *S. J. Anim. Sci*: 2003: 34: 217-222. J
- Alcicek A., Botcurt M., Cabuk M. (2003). The effect of herbal essential oils organic acid or a probiotic on broiler performance. *S. J. Anim. Sci*: 2003: 34: 217-222. J
- Ali MDZ (2001). Dietary protein and energy interaction in African Catfish *Clarias gariepinus* (Burchell 1822). PhD-thesis, University of Sterling, Scotland, UK. 273pp.
- Ali MDZ (2001). Dietary protein and energy interaction in African Catfish *Clarias gariepinus* (Burchell 1822). PhD-thesis, University of Sterling, Scotland, UK. 273pp.
- Antinociceptive and antioxidant Activity of an Aqueous Root Bark Extract of *Danielliaoliveri* (Rolfe) Hutch And Dalz. *Resource*, 9: 35-41.
- Ayinla O.A (2007): Analysis of feeds and fertilizers for sustainable development in Nigeria. NIOMR Technical paper NO.83;pg13.
- Batnager, A. Kana, S. N., Garg S.T. Patra, B. V., Singh, G. and Barman, U. K., (2004), water quality management in aquaculture, in Course manual of a summer school on the development of sustainable aquaculture technology in fresh and saline waters, CCS Haryana Agricultural, Hisar India, app 203210.
- Batnargar, A. and Singh, G., (2010), culture fisheries in village ponds: a multilocation study pp 24: 31-37.
- Boye A.: Amoateng P.: Koffuor G.A, :Barku V. Y. A.: Bawa E.M.: 2013
- Burkil.M, (2004). The useful plants of West tropical Africa. Publisher: Kew: Royal Botanic Garden 1985-2004.
- Casewell, M., Friis, C., Macro E., McMullin, P., and Philips, I. (2003). The European ban on growth-promoting antibiotics and emerging consequences human and animal health. *J. Antimicrob. Chemother.* 52, 159-161. doi: 10. 1093/jac/dkg313
- Chauynarong N.: A. V. Elangovans and P.A. Iji. 2009. The potential of cassava products in diets for poultry word poultry Sci. *J.* 65 (1): 23 – 26
- development in sub-Saharan Africa. In M.R. Hasan, T Hetch, S.S. De Silva and A.G.J. Tacon, eds. Study and analysis of feeds and fertilizers for sustainable aquaculture development, pp. 77-110. FAO Fisheries
- Gabriel U.U., Bekibele D.O., and Anyanwa P. (2007): Locally produced Fish food; potentials for aquaculture development in sub-Saharan African. *African journal of Agricultural Research* 2(7)



**NOVEMBER, 2025 EDITIONS. INTERNATIONAL JOURNAL OF:
AGRICULTURAL RES. & BIOTECHNOLOGY VOL. 10**

- Gilbert, M. (2000), Medicinal importance of Copaiba oil acid 4:1164.
- Hetch, T. (2007). Review of feeds and fertilizers for sustainable aquaculture
- Isyagi N., Karen V., Rashid A. and Willam H.D.(2009): Manual for the commercial pond production of the African catfish in Uganda pg. 10-15.
- Lamai S.L (2011): Inaugural Lecture delivered at Federal University of Technology Minna. Niger State pg5
- Omitoyin, B.O. (2017). *Introduction to Fish Farming in Nigeria*. Ibadan University Press, Publishing House, University of Ibadan, Nigeria, pp. 35-40
- Onyimonony, A.E and J.O. onukwufor. 2003. Effects of toasted bambara waste (TBW) on the performance of growing pullets in *Proc. Of the 28th ann. Conf. of Nig. For anim. prod. (NSAP)/ P. 237-239*.
- Singh S.P.and Singh D. (2010): Biodiesel production through the use of different sources and characterization of oils and their esters as a substitute of diesel. *Renewable and sustainable energy Reviews*. Vol .14(1) January 2010, pg 200-216
<https://doi.org/10.1016/j.user.2009.07.017>
- Spellberg, B., Bartlett, J. G. and Gibert, D N.(2013). The future of antibiotics and resistance. *N. Engl. J. Med.* 368, 299-302. Doi 10.1056/NEJMp1215093
- Technical paper No. 497. Rome, FAO. 510pp.
- Zezi A.U., Ahmadu A., and Yaro A.H (2007): Anti-Diarrheal activity of the leaf extracts of *Daniella Olivera* hutch: African Traditional herbal medicine Science <https://journals.athmsi.org> vol.3(2)pg51-59