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A Comparative Study on the Growth and Survival Rate of the African Catfish *Clarias gariepinus* Fingerlings Fed With Different Inclusions of Ripe Plantain Peel Meal

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ABSTRACT

This study was conducted to investigate the growth response of African Catfish (Clarias gariepinus) fed varying inclusions of Ripe Plantain Peel Meal. 120 Clarias gariepinus fingerlings with mean body weight 1.5±0.4g were assigned to four diets in which ripe plantain peel meal was used in place of maize at 0, 10, 20 and 30% respectively in a completely randomized design. The trial fish were fed at 5% body weight daily for a period of 42 days. Data collected showed that those fed on 20% Inclusion had a better weight increase (3.03g) and the least weight increase was observed on those fed on 10% inclusion (2.63g).It was observed that both the weekly mean length and the weekly mean weight of the fish followed the same pattern with those fed on 20% ripe plantain peel inclusion having the highest weekly mean weight all through the experiment. Also, it was observed that Clarias gariepinus fingerlings fed with 20% ripe plantain peel inclusion had the highest percentage weight gain (202.57±16.35) with those fed on 10% ripe plantain peel inclusion having the lowest percentage weight gain (173.85±11.61). Result also shows that Clarias gariepinus fingerlings fed with 20% ripe plantain peel meal (RPPM) had the highest Mean Specific Growth Rate (SGR) of (18.44±0.89) with those fed 10% RPPM having the least value (16.78±0.71). Ripe Plantain Peel Meal inclusion in the feed of fish beyond 20% does not show a concurrent better yield hence; ripe plantain peel meal could be recommended as a dietary supplement in the diets of African catfish.

***Key words**: Growth, Survival rate, Weight Gain, Feed and Length Increase*

INTRODUCTION

The 361 million square kilometers surface area of sea-water covering approximately 71% of the earth's surface in addition to numerous continental Inland freshwater, provides mankind's major sources of edible and other aquatic foods. With the world's population rising increasingly, a decline in fish availability will have a detrimental effect on the nutritional status of the citizenry, particularly in places where fish contributes significantly to the protein intake of the people[6]. Since aquatic resources are finite, though renewable; every effort should be geared towards increased fish production through intensive aquaculture practices. Olubusin[12] reported that fish constitutes 40% of animal protein intake in Nigeria. He also noted that the only means of meeting up with the projected fish demand in Nigeria is through pragmatic option of Intensive fish farming. Nevertheless, it has been estimated that Nigeria has the potential to produce up to 1-5 million metric tons of fish through aquaculture[15].

In a bid to fight protein deficiency, many countries including Nigeria have been making significant advances in fish farming with nutritional studies as an important aspect. There has been a great interest in fish farming by both government and private organizations in the country. This may be a reflection of the desire to produce high protein food in the country.

Also, the high demand for fish fingerlings in the phenomenal growing aquaculture industry has stimulated the need for artificial propagation of cultural warm water fishes[10]. However, this noble goal may not be achieved if all the facets of fish culture e.g. nutrition (fish feeding), physiochemical factors (water quality), and pathology e.t.c is not understood. This trend has brought about the diversified diet experiment on different species of catfish worldwide so as to get numerous suitable and financially cheap diets for a good fish yield.

Among the cultivable fish in the world, catfish is the most sought after fish species, very popular with fish farmers and consumers and commands a very good commercial value worldwide including the Nigerian market[4,13]. The African Catfish (*Clarias gariepinus*) is a type of fish that has been widely introduced around the world. According to Gaffer[8], they migrate within streams and rivers and can be found in a variety of freshwater bodies including lakes, ponds and pools and this necessitated this study on the growth and survival rate of the african catfish *clarias gariepinus* fingerlings fed with different inclusions of ripe plantain peel meal.

MATERIALS AND METHODS

Study location

This study was conducted at the Animal House of the Department of Zoology Nnamdi Azikiwe University Awka, Anambra State Nigeria. It lies between latitude 50°N and 60°N and Longitude 7°E and 8°E along Enugu-Onitsha expressway, which is in the tropical zone of Nigeria.

Experimental Fish Collection

The experimental fish, fingerlings of the catfish *Clarias gariepinus*, were collected from Ezealagba Fish Farms, Ezi-agnes bus-stop, Nise Anambra State. The fish were collected in the Last week of July. A total of 120 fingerlings were collected. The fish were transported in a well aerated bucket with well oxygenated water to the Animal House. The fish samples were acclimatized in the hatchery conditions for Seven (7) days in big plastic tanks of Seventy (70) Litres volumes each.

Experimental Design

The Fish were stocked at a density of 10 fish per plastic bowl of 70 litres volume and covered with nets to prevent the fish from jumping out at night. The main source of water used was the Nnamdi Azikiwe University Bore-hole at Garuba Square. Fish in each tank were of homogenous size and were fed the experimental diet with respect to different ration levels of ripe plantain peel (0%, 10%, 20% and 30%). The fish were fed the experimental diet for period of 6 weeks at the rate of 5% body weight per day, shared between morning (7 – 8 am) and evening (5 – 6 pm).The quantity of feed given was calculated thus;

$$P = \frac{\text{Total weight of Fish}}{100} \times \frac{5}{}$$

Scatter feeding method as proposed by Rad *et al*; (2003) was used. The study lasted for a period of 6 weeks.

Cleaning of the Plastic Bowl

Fecal materials and left-over food were siphoned daily and water replaced before feeding. Complete cleaning of the plastic bowl and changing of water was done at intervals of two days.

Weighing

All the fish in each tank were weighed individually at the beginning of the experiment and thereafter, on weekly basis using a digital weighing balance and the weights were recorded. The results obtained were tabulated for later analysis.

Experimental Diet

The diet was formulated from locally available feed materials namely: Fish meal, soya bean meal, Ripe Plantain peel, shrimp waste, groundnut cake, Cassava Flour, bone meal, Palm oil, vitamin premix and mineral premix. The Minerals were bought from Awka local market; Eke Awka and a feed shop at Nnobi, all in Anambra state. The feed formation was based on NAERLS (2002), (National Agricultural Extension and Research Liaison Services). The ripe plantain peels were gathered from the shop of beans and Plantain sellers along Regina Caeli Junction Awka, Anambra State.

The proximate chemical composition of feed ingredients were analyzed using the A.O.A.C[3] model, to determine the Carbohydrate, ash, moisture, fat, fibre and crude protein content. The ripe plantain peels were sun-dried and properly ground and afterwards were milled with a milling machine to powdery form. In formulating the feed, the ground plantain peels and the locally available feed materials were then weighed out in quantities needed to compose the feed.

Experimental Diet Formulation

The different ingredients needed for the feed formulation were weighed out according to their proportions for the feed formulation and Cassava flour was added to the feed to act as a binder to hold the feed together. Warm water was added in order to increase the edibility, digestibility of the diet, and also to bring about the binding ability and homogeneity of the Cassava Flour to dough-like-paste. The wet mixture was pressure pelleted immediately using a pelleting machine with a pelleting head mounted with dice dimension of 3mm. The pellets were collected and dried at room temperature for 24 hours and stored in air-tight containers. The experimental feed consists of four different diets. The first treatment being the "control" contained 0% inclusion of the Ripe Plantain Peel meal. The second, third and fourth treatment contained 10%, 20% and 30% inclusions of the Ripe plantain peel meal respectively. All treatments were done considering 40% crude protein requirement for fingerlings using trial and error method.

Table 1: % Composition of Experimental Diet with varying Inclusion Levels of Ripe Plantain Peel Meal

Gross Composition (100g) Ingredients	**0% PPM Control (Diet 1)**	**10% PPM (Diet 2)**	**20% PPM (Diet 3)**	**30% PPM (Diet 4)**
Yellow Maize	12%	10.8%	11.4%	11.6%
Ripe Plantain Peel Meal	0%	1.2%	0.6%	0.4%
Fish Meal	35%	35%	35%	35%
Soya Beans	15%	15%	15%	15%
Groundnut Cake	22%	22%	22%	22%
Palm Oil	5%	5%	5%	5%
Cassava Flour	5%	5%	5%	5%
Bone Meal	2%	2%	2%	2%
Shrimp Waste	2%	2%	2%	2%
Vitamin Premix	2%	2%	2%	2%
Total	100%	100%	100%	100%

Water Quality

The following water parameters were monitored during the course of the experiment. Temperature (with mercury-in-glass thermometer and recorded in ^{O}c), pH (with Litmus paper), Dissolved Oxygen (using Winkler's method and recorded in ppm), total carbon dioxide(using standard NaOH solution and phenol phthalein indicator and recorded in ppm) and total alkalinity (using Methyl Orange indicator and recorded in Mg/l of $CaCO_3$).

Data Collection and Analysis

Data were collected every one week on fish growth performance and nutrient utilization. The weight of the individual fish was determined with an Electronic Sensitive Scale while the standard length was determined with a measuring meter rule. Each experimental plastic bowl was inspected daily to remove dead fish, if any. Fish weight gain, specific growth rate, mortality and feed utilization ratio were determined.

Weight Gain (WG): This is increase in the weight of the fish during the experimental period.

This was calculated as;

Weight gain = Final body weight – Initial body weight

Percentage Weight Gain (P.W.G)

This was calculated using the formula:

$$P.W.G = \frac{\text{Mean final Weight} - \text{Mean initial Weight}}{\text{Mean Initial Weight}} \times \frac{100}{1}$$

Measurement of Specific Growth Rate (SGR)

$$SGR\ (\%\ \text{per day}) = \frac{\text{Loge}W_2 - \text{Loge}W_1}{T_2 - T_1} \times \frac{100}{1}$$

Where W_2 = Weight of fish at time T_2 (final)

W_1 = Weight of fish at time T_1 (initial)

e = Base of natural logarithm

Feed Conversion Ratio (FCR)

This has been calculated from the relationship of feed intake and wet weight gain.

$$F.C.R = \frac{\text{Total feed consumed by fish}}{\text{Weight gained by fish}}$$

Mortality (M)

$$M = \frac{(Nt - No) \times 100\%}{No}$$

Where No = Number of fish from the start of the experiment

Nt = Number of fish at the end of the experiment

Statistical Analysis

Data was subjected to Analysis of variance (ANOVA) followed by the comparison test for significant mean difference which was separated at 0.05 probability level according to (steel *et al*., 1997).

RESULTS AND DISCUSSION

Proximate Composition of Ripe Plantain Peel

The result of the proximate composition of the different trial diets is as presented in Table 2 below. The result of the moisture content showed that there is an increase in moisture content, as the percentage of the Ripe plantain peel inclusion increased with those with 20% Ripe plantain peel inclusion having the highest moisture content (8.78%).This makes feed with 20% Ripe plantain peel more prone to deterioration since foods with high moisture content are prone to perishability[7]. For the ash content, there is a decrease in ash content as the percentage of the ripe plantain peel increased. The low ash content of the feed with more ripe plantain peel inclusion is a reflection of the poor mineral contents preserved in the food material i.e plantain peel[11]. Also from Table 5 we can observe that fibre and fat content of the feed followed the same trend as the moisture content with those with 20% ripe plantain peel having the highest value in all (2.75% and 11.25% respectively) while for protein and carbohydrate, the feed with 30% ripe plantain peel had the highest value (7.00% and 65.65%) respectively thereby making it a good feed ingredient for growth and a better source of energy to fish as carbohydrate are the primary energy source in the diet of the Rabbits and in extention animals.

Table 2: Proximate composition of the test Ingredient (Ripe Plantain Peel)

Component	% Composition
Moisture	7.04
Crude Protein	7.18
Fat	6.22
Carbohydrate	42.95
Ash	2.00
Fibre	14.31

Table 3: Nutrient Composition of the Treatment Diets (0, 10, 20 and 30% ripe plantain peel inclusion) used to feed the fish for six weeks

Proximate Composition	Dietary Treatments (%)		
	0%(Control)	20%	30%
Moisture Content	7.18 %	8.78%	5.50%
Ash Content	22.65%	16.10%	10.50%
Fibre Content	0.85%	2.75%	1.65%
Fat Content	10.85%	11.25%	9.70%
Protein Content	3.85%	3.15%	7.00%
Carbohydrate Content	54.62%	57.97%	65.65%

Water Quality Parameter

The result of the Physico-chemical Parameters of the water used as in Table (4) below shows that it was in line with the values recommended for Freshwater fish farming in the Tropics by the Water Quality and General Pond Management, www.ag.auburn.edu.

Table 4: Water Quality Parameter Monitored During the Experimental Period

	Water Quality Parameter Monitored				
Range	Temperature	Ph	Dissolved Oxygen	Free CO_2	Total Alkalinity
Range	26^{o}C - 32^{o}C	6.5 - 9.0	6.96mg/l-8.31mg/l	0.00-4.05ppm	>60ppm

Weight Gain / Indices of Feed Utilization

The result of the weekly length increase (Table 5) showed that *Clarias gariepinus* fingerlings fed on 20% inclusion of ripe plantain peels had the highest weekly mean weight which might be as a result of higher protein content in the feed. Surprisingly this increase in length as a result of plantain peel inclusion did not increase sequentially, as those fed with 10% ripe plantain inclusion had a lower length increase than the control (0% inclusion). However, the differences in the weekly length increase of *Clarias gariepinus* fingerlings fed on different percentage inclusion of ripe plantain peel for six (6) weeks were significant ($p<0.05$) Table 6.

From the result of the weekly mean weight increase of the fish (Table 9), it can be observed that both the weekly mean length and the weekly mean weight of the fish followed the same pattern with those fed on 20% ripe plantain peel meal inclusion, having the highest weekly mean weight all through the experiment. This is in line with Agbabiaka (2013) who stated that weight gain and specific growth rate of the fish fed plantain peel based diets were superior to the control group ($p<0.05$) except at 25% dietary inclusion which was not significantly ($p>0.05$) different from the group of fish fed the control diet.

From the result of the percentage weight gain (Table 5), it can be observed that *Clarias gariepinus* fingerlings fed on 20% ripe plantain peel inclusion had the highest mean percentage weight gain (202.57±16.35) followed by those fed with 30% ripe plantain peel inclusion (193.49±17.82) with those fed with 10% ripe plantain peel inclusion having the least PWG (173.85±11.61).

The result of the specific growth rate (Table 5) shows that there is a general increase in the specific growth rate of *Clarias gariepinus* fingerlings as the percentage inclusion of ripe plantain peel meal increased and this was significant at $p<0.05$ (Table 6). Similar observation was recorded when cassava peel and leaves, yam peel meal were fed to Rabbits[2,5] respectively and is in agreement with finding of Omole *et al*.,[14] when snails were fed composite meal containing peels of mango, plantain, cocoyam and pawpaw.

Table 5: Growth Performance / Indices of Feed Utilization of *Clarias gariepinus* fingerlings fed with different percentage inclusions of ripe plantain peels for six weeks

Parameter	Dietary Treatments (%)			
	0% Control	10%	20%	30%
Length Increase(cm)	3.00 ± 0.47	2.96±0.43	3.30 ±0.47	3.23 ±0.47
Weight gain (g)	2.73 ± 0.43	2.63 ±0.42	3.03 ±0.58	2.77 ± 1.02
% Weight gain	185.88 ±2.31	173.85 ± 11.61	202.57 ± 16.35	193.49 ± 17.82
Specific growth rate	17.50 ± 0.43	16.78 ± 0.71	18.44 ± 0.89	18.06 ± 0.81

Table 6: ANOVA of Results of Growth Performance / Indices of Feed Utilization of *Clarias gariepinus* fingerlings fed with different percentage inclusions of ripe plantain peels for six weeks

Parameter	F-test	P-value
Length Increase	5.730	0.001
Weight gain	12.069	0.000
% weight gain	2.295	0.155
Specific growth rate	0.965	0.417

CONCLUSION AND RECOMMENDATION

This study has shown that ripe plantain peel meal can be tolerated by African catfish (*Clarias gariepinus*) hence, can replace the more expensive maize, thereby, reducing cost of production and curtail environmental filth and disposal problems associated with ripe plantain peel in Nigeria. Also a ripe plantain peel inclusion in the feed of fish beyond 20% does not show a concurrent better yield hence should be discouraged. Based on the findings from this study, I thereby recommend that A comparative study should be done using ripe and unripe plantain peel so as to ascertain and compare the growth performance of cat fish fed on them, Further research should be done using other agricultural waste like water melon peel, cucumber etc. and that Ripe Plantain peel inclusion in the feed of *Clarias gariepinus* should not exceed 20% inclusion for optimum performance.

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