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Short Communication

Effects of dietary cassava dough (Fufu) kitchen waste as a replacement for maize on growth performance of *Clarias gariapinus* fingerlings

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Abstract: The study was carried out to determine the growth performance of *Clarias gariepinus* fingerlings cultured in the circular plastic ponds and fed diets containing varying level of cassava dough (fufu) kitchen waste at 0, 2.5, 5, 7.5, and 10% levels of inclusion. Two hundred and twenty-five fingerlings were randomly distributed into five treatments, which were replicated thrice-using completely randomize design. While the diet with 0% serves as a control. *Clarias gariepinus* with average initial weight of 10 g were stocked at the rate of 15 fishes per replicates. The result shows that there were no significant different among the treatment as compared with mean weight gained, feed intake, specific growth rate, protein efficiency ratio, and feed conversion ratio. *Clarias gariepinus* fingerlings fed with 2.5% level of inclusion of cassava dough kitchen waste had the highest weight gained with the value of 11.66 g, followed by treatments 1, 4, 3 and 5, respectively. The result shows that the feed with 4.96% of cassava dough kitchen waste has the highest feed intake, specific growth rate, protein efficiency ratio and feed conversion ratio. Therefore, a diet with 4.96% level of inclusion of cassava dough kitchen waste is hereby recommended to be in the diet of *C. gariepinus* fingerlings for economic reasons over maize.

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Introduction

The growth of Nigerian Aquaculture sector is currently being undermined by the challenges of inadequate supply and prohibitive cost of quality fish feeds. Feed accounts for over 60% of the cost of fish production and maize is the major source of carbohydrate or energy source in the fish diet (Fagbenro et al., 2003). The cost of maize is relatively high compared to other sources because of its competitive use as food for human and feed for livestock and fish. In order to develop practical diets for farm fish at relatively low cost, research efforts must therefore be geared towards evaluating alternative feedstuff ingredient that can replace maize without compromising fish growth and health (Olurin et al., 2006).

Cassava (*Manihot esculenta*), the plant which is native to South America, especially Brazil is widely cultivated in the tropics and appears to be the best possible alternative for overcoming the chronic high feed cost in the livestock industry and its by-product such as fufu waste after processing is of little or no food value to man (Ukachukwu, 2008). Fufu is dough made from boiled cassava paste and a stable food in part of the west and central Africa (Obadina et al., 2006). Fufu contained about 0.35-4.8% crude protein, 0.2-1.42% crude fiber, 1.19-1.32% fat, 77.97-87.24 soluble carbohydrate and 312.78-375.40 Kcal/g of energy (Lancaster et al., 1982; Etudaiye et al., 2009; Ojo et al., 2014; Bamidele et al., 2015). The cooking of fufu in southwestern part of Nigeria result in the generation of caked deposit at the base of the pot, which are often discarded and constitute nuisance in commercial fufu production centers. This caked deposit composed majorly of cooked and dried fermented soluble carbohydrates which is suggestive of high energy value.

This research was therefore designed and conducted to evaluate the effect of replacing maize with dried fufu waste in the diets of *Clarias gariepinus*

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Table 1. Composition of the experimental diets.

Ingredient	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5
Fish meal	36.72	36.72	36.72	36.72	36.72
Soya bean meal	36.72	36.72	36.72	36.72	36.72
Maize	19.83	14.87	9.915	4.96	0.00
Fufu waste	0.00	4.96	9.915	14.87	19.83
Methionine	0.56	0.56	0.56	0.56	0.56
Lysine	0.56	0.56	0.56	0.56	0.56
Vitamin C	0.56	0.56	0.56	0.56	0.56
Bone meal	2.25	2.25	2.25	2.25	2.25
Premix	1.40	1.40	1.40	1.40	1.40
Salt	1.40	1.40	1.40	1.40	1.40
Calculated Analysis					
Crude Protein	44.38	44.17	43.95	43.74	43.52
Metabolizeable Energy	2627.62	2614.80	2601.99	2589.17	2576.36

so as to establish it as alternative source of energy in fish feed formultion.

Materials and Methods

The study was carried out in the aquaculture unit of the Department of Fisheries Technology, Lagos State Polytechnic, Ikorodu Nigeria. The rearing chambers used for were 15 circular plastic tanks of 60 cm in diameter and 30 cm deep each, 225 mixed sex fingerlings of catfish, locally formulated feed, weighing scale, and water test kits. The tanks were placed in the aquaculture unit of Fisheries Technology Department. Clean water from an overhead tank that is connected to borehole was used throughout the experiment period and the essential physicochemical parameters of the water were observed before and during the experiment. The temperatures of the water were measured with thermometer, the dissolved oxygen was determined using digital oxygen meter and pH of the water was measured with pH meter. The tanks' water was changed twice a week and fresh water is supplied to the tanks to improve water quality and avoid pollution from uneaten food and metabolites.

Experimental Design: 225 fingerlings of catfish with average initial weight of 10 g were randomly allotted to five treatments with three replicates per treatment in a Completely Randomized Design (CRD) experiment.

Experimental Diet and Feeding Regime: Five diets were prepared. Each diet contained: maize, soya meal, fishmeal, bone meal, vitamins - minerals, premix and salt that were obtained from toll feed millers at Sabo market Ikorodu Lagos Nigeria, and fufu kitchen waste was obtained from reputable food processing unit. The brittle fufu kitchen waste was sun dried and fine crushed and mixed with other feedstuffs using the formulations as shown in Table 1. The experimental fish were fed base on 5% body biomass and the quantity was adjusted as the fish increase in body weight. The feed was divided into two equal meals and fed at 07:00 and 16:00 hrs for 12 weeks.

Growth Performance Evaluation: Weighing of fish was carried out early in the morning once in a week by transferring fish from the tanks into the weighing bowl. The weight of fish was taken and recorded using a digital weighing scale (Ohaus Scout Pro Balances Models SP-601). These data were used to compute the growth parameters i.e. Mean Weight Gain, Specific Growth Rate, Feed Conversion ratio, Protein Efficiency Ratio, and Mortality Rate according to Amisah et al. (2009) and Amoah (2012).

Data Analysis: All data collected were subjected to analysis of variance (ANOVA) using Assistat-Statistical Assistance 7.6 Beta software developed by Silva and Azevedo (2009).

Results and Discussion

The growth performances of fish fed with the experimental diets are shown in Table 2. Statistical analysis revealed that the levels of fufu meal did not significantly (P>0.05) influence the weight gain, feed

Table 2. Performance characteristics of fish fed different percentage of fufu kitchen waste.

Parameters	T1	T2	T3	T4	T5	SEM
Final weight (g)	20.43	21.66	19.21	20.28	18.64	
Weight gain (g)	10.43	11.66	9.21	10.28	8.64	1.17
Feed intake (g)	18.29	20.35	16.97	18.15	15.18	1.90
Feed Conversion Ratio	1.75	1.75	1.84	1.77	1.76	0.04
Specific Growth Rate(%/day)	4.06	4.12	3.91	4.00	3.86	0.11
Protein Efficiency Ratio	1.28	1.30	1.23	1.29	1.31	0.03

Table 3. Mean values of water quality parameters.

Parameters	T1	T2	T3	T4	T5	SEM
pH	6.60	6.70	6.80	6.50	6.70	0.05
DO (mg/l)	5.28	5.30	5.30	5.30	5.30	0.00
Temperature (°C)	28.7	27.0	27.4	28.5	26.1	0.48
Salinity(ppt)	76.3	75.3	76.4	76.3	75.5	0.23

intake, feed conversion ratio, protein efficiency ratio, and specific growth rate of the fish. The average physicochemical parameters of the rearing medium are presented in Table 3 and all measured variables are within the values suitable for the culture of *C. gariepinus*.

These results indicated that all the measured parameters were statistically similar for the fish fed with experimental diets. Similar results were also obtained when cassava peel was used to replace maize in the diets of *Orechromis niloticus* (Fakunmoju et al., 2014). The highest weight gain was recorded in fish fed with diet 2 (11.66 g) while the lowest weight gain was recorded in fish fed diet 5 (8.64 g). The differences in the weight gain might be attributed to the feed intake of the fish, which follows a similar trend as the weight gain. Feed consumption has been reported to influence weight gain and other growth parameter of fish (Du et al., 2005; El-Haroun, 2007). The similarity of the weight gain and feed intake of the fish could be because of the fact that the metabolizeable energy values of fufu waste and maize are within the same range (Lancaster et al., 1982; Honeyman and Zimmerman, 1991; Etudaiye et al., 2009; Ojo et al., 2014; Bamidele et al., 2015) and energy is the major determinant of feed intake in fish (Boujard and Médale, 1994; Morales et al., 1994; Yamamoto et al., 2000). The specific growth rate follow the same trend as the weight gain, hence, cassava dough waste could be used to replace maize in diet of *C. gariepinus* without compromising the growth of the fish.

The data obtained from the study also show that the fish fed with the diet 5 had the highest protein efficiency ratio (1.31) while the lowest was observed among the fish fed with the diet 3 (1.23). The feed conversion ratio does not follow any particular trend, the best feed conversion ratio was recorded among the fish fed with the diets 1 and 2 (1.75); while, the numerical worst feed conversion ratio was recorded in fish fed with the diet 3 (1.84). The feed conversion ratio recorded in this study is within the range reported by many authors for pond-reared fish (Bjorkli, 2002; Robinson and Li, 2015). This implied that the experimental diets are well utilized by the fish. The numerical differences in the performance indices may be due to the growth of any animal which is influenced by many factors such as the internal growth during their life cycle and external changes as influenced by environmental factors (Babalola et al., 2016).

Table 3 showed the means of all essential water quality parameters recorded during the experiment. The water quality parameters were measured and found to be in the range of tolerance for *C. gariepinus* culture with a pH range of 6.5-6.8, Dissolved Oxygen range of 5.28-5.3 mg/l, a Temperature range of 26.128.7°C, and a salinity range of 75.3-76.4 ppt (Mustapha and Omotosho, 2005; Omotayo et al., 2011). This perhaps may be responsible for 100% survival rate of the *C. gariepinus* fingerlings during the experimental period.

It is therefore expedient to conclude that fufu waste

can be used to replace maize as an energy source in the diets of *C. gariepinus*. The inclusion level of 4.96% (25% replacement value for maize) is hereby recommended due to the optimum performance of the fish.

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