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GROWTH PERFORMANCE AND NUTRIENT UTILIZATION OF POST FINGERLINGS *Clarias gariepinus* FED VARIED LEVELS OF BISCUIT WASTE

Agbebi, O.T., S.O *Sofela*, M.A *Idowu* and A.O *Cole*
Department of Aquaculture and Fisheries Management, Federal University of Agriculture, Abeokuta. Ogun State, Nigeria. *PMB 2240, Abeokuta, Nigeria, Tel. Nos.:+2348037045878, +2348072723153, Email: agbebi20@yahoo.com*

ABSTRACT
A feeding trial was conducted to determine the effect of biscuit waste meal on the growth performance and utilization of *Clarias gariepinus* juveniles. A total of 300 juveniles of average weight 8.85g were randomly divided into 5 Treatments, each with three replicates. Twenty juveniles were distributed into fifteen happas ($0.7m^3$) and each happa was suspended to ¾ of its volume using kuralon ropes carefully tied round the bamboo poles across the concrete tanks. Five diets containing 40% crude protein were formulated in which maize was replaced with biscuit waste meal at Treatment Diet 1 (TD1) 0%, 25% (TD2), 50% (TD3), 75% (TD4), 100% (TD5) levels. The juveniles were fed at 3% body weight per day for 10weeks. It was recorded at the end of the experiment that biscuit waste was most suitable as an energy supplement when incorporated at 25% replacement (TD2) with maize. TD1 had the highest weight gain followed by TD2, TD3, TD4 and TD5 respectively. There were no significant differences ($P>0.05$) in the growth response in TD1 (0%), TD2 (25%) and TD3 (50%). It is therefore concluded that biscuit waste meal is a cheap source of non conventional energy source which can be used favorably to replace maize (25% inclusion level) as an energy source in the diets of *Clarias gariepinus*.
Keywords: Treatment, Biscuit waste, Net hapa, Juveniles, Crude protein

INTRODUCTION

In the developing worlds, fish is a highly acceptable food that supplies as much as 40 percent of all animal protein of the countries where fish is the main source of animal protein. The poor spends a large proportion on cheap fish protein source rather than on meat or other sources of expensive animal protein (Amoa, *et al.*, 2006). Hence, fish demand is greater in tropical Africa with increasing rising human population (Andrew, 2001). The per capita consumption of aquatic foods in the tropics, which has well over 90 percent of the world population growth, may be maintained at 14.5 kg/capita, if there is a corresponding increase in fish supply (Andrew, 2001). Nigerians are large fish consumers. Fish imported into Nigeria in 2007 was given as 739,666.12 tons while the percentage contribution of aquaculture to the nation's domestic fish production was given as 13.8 percent in same year (FDF, 2007). The projected increase in populations and fish demand in Nigeria from year 2006-2025, shows a drop in the availability of fish which will have a detrimental effect on the nutritional status of the citizens, particularly the rural places where the contribution of fish is significant to the protein intake of the people. Since aquatic resources are finite, although renewable, every effort should be geared towards increasing fish production through improved aquaculture with the use of cheap and cost effective feeds, which accounts for 70-80 percent of aquaculture production. The metabolizable energy in most compounded diets for fish and livestock is maize (Fagbenro *et al.*, 1992).

The high cost and shortage of commercial feeds for agriculture ventures in Nigeria places constraint on the successful operation of intensive aquaculture business (Akegbejo, 2004). Utilization of compounded commercial feeds is an acceptable practice, but there is a need for feed formulation strategies, that are aimed at using more available and cheap feed stuffs (biscuit waste) as substitute for conventional feed ingredient (maize) as this will help to give desired result at a cheaper feed cost. Moreover, profit margins in fish culture in Nigeria does not permit too much dependence on commercial feeds, therefore future strategies are needed to improve the situation (New, 1990). Okoye and Sule (2001), also emphasized that nutrient values estimated from locally available conventional and non-conventional plant source are high and would appear to justify continuous investigation and utilization of their nutritional potential to enhance an economic fish production.

The major source of commodity as a result of its many competing uses (especially in developing African countries) has made it necessary to evaluate other ingredients to replace maize with cheaper carbohydrates (Olurin *et al.*, 2006). However, the use of biscuit waste is yet to be fully exploited in fish diet.

Therefore, this study aims at evaluating the growth performance and the optimal inclusion of biscuit waste in diet of *Clarias gariepinus* juveniles.

MATERIALS AND METHODS

The experiment was carried out in fish happa nets ($0.7m^3$) suspended by bamboo poles in an outdoor concrete tank (5m x 3m x 1.5m). Fifteen (15) hapas ($0.7m^3$) were suspended to ¾ of their volume, using kuralon twine (No. 15),

tied to carefully arranged bamboo poles. The concrete tank was filled to a considerable volume and continually supplied with water to sustain optimal medium and to preclude primary productivity.

African catfish (*Clarias gariepinus*) post fingerlings (average weight 8.85g) were obtained from a Private Fish Farm and acclimatized for 5 days, with diet before the commencement of the experiment.

Biscuit waste was purchased from the grocery company and the waste was properly grounded into fine particles for perfect homogenizing with other ingredients. Five iso-nitrogenous diets were formulated (40% crude protein) in which maize was progressively replaced with biscuit waste at 25%, 50%, 75%, and 100% levels. The feed was pelletized into 2mm diameter, sun dried for few days and stored in polythene bags.

Table 1: Proximate composition of feed ingredients.

	Crude Protein (%)	Ether Extract (%)	Crude Fibre (%)	Ash (%)	NFE (%)
Fish meal	67.68	4.10	1.31	14.80	8.00
Soybean meal	45.30	18.00	5.00	4.60	10.00
Groundnut Cake meal	34.46	8.80	4.31	13.80	10.90
Maize	10.81	5.50	1.40	1.40	11.00
Biscuit Waste	10.36	4.67	5.98	10.21	6.84

The experimental fish were randomly distributed at the rate of 20 fish per happa. Each Treatment was triplicated. Fish were fed at 3% body weight twice daily for the period of the experimental diet (10 weeks). The fish were batch – weighed weekly with an electronic balance (Mettler BD 601) and the amount of feed was adjusted accordingly. At the beginning and the end of the experiment, five fish were collected from each diet Treatment, sacrificed for carcass analysis.

Growth Performance: Fish growth and nutrient utilization parameters were calculated as follows:

Percentage weight gain PWG (%) =

$$\frac{\text{Final mean body weight}}{\text{Initial mean body weight}} \times 100$$

$$\text{Specific Growth Rate} = \frac{L_n W_2 - L_n W_1}{\text{Time (days)}} \times 100$$

W_1 = initial weight gained, W_2 = final weight gained

L_n = natural logarithm

$$\text{Protein Efficiency Ratio} = \frac{\text{Mean weight gain}}{\text{Average protein fed}}$$

Average protein fed = Feed Intake x % C.P of feed

Weight gain (g) = W_2-W_1

$$\text{Feed Conversion Ratio} = \frac{\text{Weight of feed (g)}}{\text{Weight gain (g)}}$$

Mortality rate =

$$\frac{\text{No of fish dead at end of the experiment}}{\text{No of fish at the beginning of the experiment}} \times 100$$

Statistical Analysis: The growth performance and feed utilization were analyzed statistically by one way analysis of variance (ANOVA), (Steel and Torie,1980), and the differences among means were tested for significance (p= 0.05) (Duncan, 1955) using SPSS 16.0 statistical package.

Water Parameter: In the course of the experiment, the essential physio-chemical parameters were monitored and measured weekly. Water temperature, Dissolved oxygen and pH were determined using a test kit.

RESULTS AND DISCUSSION

In this study, catfish juveniles grew and survived well on all experimental diets containing varying levels of inclusion of biscuit waste (Table 4 and 5). This indicates that the formulations were sufficient at 25% and 50% inclusion. This is in agreement with similar studies by (Alegbeleye *et al.*, 2008) where maize was replaced with boiled *colocassia esculenta* flour. It was observed that there was a trend of decrease in weight gain with increasing level of inclusion from 20% inclusion level. Lasisi *et al.* (2008) also recorded similar results. The effect of substituting sweet potato peel meal with maize in the diets of *Clarias gariepinus* fingerlings was studied and it was observed that 25% inclusion level was favorably tolerated.The result of the study indicated that the best response of the diet in the growth of the catfish was observed in the Treatment diet 1 (0%), Treatment diet 2 (25%) and Treatment diet 3 (50%) respectively (Table 5). Growth rate in terms of weight gain decreases with increase in the inclusion level of biscuit waste in Treatment diets 3, 4 and 5 respectively which is contrary to studies by (Tiamiyu *et al.* 2007) where an increase in growth rate was recorded for 50% and above inclusion level of Cassava flour in the diet of *Clarias gariepinus*. Biscuit waste meal used in these study has almost equal crude protein content (10.36) compared to maize (10.81), and was supposed to perform well as those fed with 100% maize (Treatment diet 1), the reason for this could possibly be the presence of a high fibre content (Table 1), present in biscuit waste (5.98). The difference in amino acid profile which was inferior to that of maize could also be a reason for the result obtained in treatment 2 & 3 compared to treatment 1, which shows that biscuit waste can favorably replace maize at these inclusion levels. The study reported growth decrease with increasing inclusion levels of biscuit waste from Treatment 4 to Treatment 5. It is assumed that the anti-nutritional level is not at acute level.

The high increase in the growth rate of *Clarias gariepinus* in the first few weeks of culture in the study may be due to initial starvation of the fish which made them more active (Table 4). This was similar to observations in juvenile *Heterotis niloticus* (Faturoti,et al, 1998), where an increase in growth of the fish as they were subjected to delay in feed distributed was recommended.The proximate analysis of the carcass of the initial fish and those fed the different experimental diets at the start and end of the experiment is represented in Table 6.0. There was increase in ash, crude fibre and fat of the final carcass analysis. Crude protein content of the carcass reduced with increase in the inclusion level of biscuit waste in the diet.

Water quality parameters of the concrete pond during the experimental period are presented in Table 7.0. The values observed were within the tolerant range of *Clarias gariepinus*. The p^H (Table 7) was between 6.9-7.61, dissolved oxygen 6.2-8.5mg/litre and temperature 26.00-29.00°C. The phsico-chemical parameters of water were within the range for culturing African catfish, *Clarias gariepinus* and conform to the finding of Adekoya *et al.*, (2004) recommended dissolved (DO) level of between 4-8mg/litre in ponds.

Table 2: Percentage and proximate composition of experimental diets.

Components	TD1, 0%	TD2, 25%	TD3, 50%	TD4, 75%	TD5, 100%
Biscuit Waste meal	-	5.84	11.68	17.53	23.37
Maize	23.37	17.53	11.69	5.84	-
Soybean meal	27.56	27.56	27.56	27.56	27.56
Fish meal	27.56	27.56	27.56	27.56	27.56
Groundnut Cake	14.26	14. 26	14. 26	14. 26	14. 26
Vegetable Oil	5.00	5.00	5.00	5.00	5.00
Calcium Phosphate	0.50	0.50	0.50	0.50	0.50
Vitamin C	0.10	0.10	0.10	0.10	0.10
Salt	0.15	0.15	0.15	0.15	0.15
Lysine	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
Premix	1.00	1.00	1.00	1.00	1.00

Table 3: Proximate Composition of Experimental Diets.

	TD1, 0%	TD2, 25%	TD3, 50%	TD4, 75%	TD5, 100%
Moisture (%)	9.10	9.43	8.45	8.88	8.71
NFE (%)	37.80	36.72	35.85	37.05	35.72
Crude protein (%)	39.70	39.30	41.00	40.08	40.90
Crude fibre (%)	4.28	4.01	3.50	3.58	4.08
Ether extract (%)	6.89	7.01	6.76	6.18	6.97
Ash (%)	2.23	3.50	4.44	4.23	3.62

*NFE (Nitrogen free extract) = 100 – (MC + C.P + ASH + C.F + E.E)

Table 4: Mean weekly growth trend of *Clarias gariepinus* fingerlings fed various level of biscuit waste based diets.

Weeks	TD1 (g)	TD2 (g)	TD3 (g)	TD4 (g)	TD5 (g)
0	8.89	8.89	8.84	8.25	9.37
1	11.61	11.13	10.45	11.99	11.78
2	14.00	13.67	13.51	13.23	13.11
3	16.12	15.78	15.70	15.10	14.87
4	19.90	19.10	18.97	18.10	16.20
5	20.60	20.24	19.65	19.00	17.05
6	22.15	22.05	21.73	19.90	17.92
7	23.97	23.66	23.01	20.76	18.55
8	25.03	24.87	23.87	21.33	19.01
9	26.73	25.04	24.05	22.31	19.69
10	28.01	26.54	25.10	22.98	20.51

Table 5: Growth Response and Nutrient utilization of *Clarias gariepinus* fingerlings fed various levels of biscuit waste meal diets.

Parameters	TD1	TD2	TD3	TD4	TD5
Initial mean body weight (g)	8.89±2.56	8.89±2.31	8.84±2.14	8.85±2.40	8.87±2.29
Final mean body weight (g)	28.01 ± 0.33^{a}	26.54 ± 0.23^{ab}	25.10 ± 0.65^{b}	22.98 ± 0.48^{c}	20.51 ± 0.45^{d}
Weight gained (g)	19.12 ± 0.22^{a}	17.61 ± 0.18^{ab}	16.26 ± 0.19^{b}	14.73 ± 0.21^{c}	11.14 ± 0.13^{d}
Specific growth rate per day (%)	2.07 ± 0.21^{a}	1.86 ± 0.29^{b}	2.01 ± 0.26^{c}	1.87 ± 0.21^{d}	1.83 ± 0.15^{e}
Protein efficiency ratio	1.45 ± 0.07^{a}	0.97 ± 0.1^{a}	1.21 ± 0.05^{a}	0.97 ± 0.10^{b}	1.21 ± 0.07^{b}
Feed conversion ratio (g)	1.74 ± 0.29^{b}	2.55 ± 0.31^{a}	2.06 ± 0.54^{a}	2.58 ± 0.59^{a}	2.07 ± 0.41^{a}
Mean protein intake (g)	9.98	11.32	9.38	9.88	5.72
Mean feed intake (g)	24.95	28.29	23.45	24.70	14.30
Survival rate (%)	75.0	63.0	70.0	65.0	62.0

a, b, c, Means followed by the deferent superscripts along the same row are significant different (P<0.005).
KEY: TD1 (0% BISCUIT WASTE MEAL, 100% MAIZE) TD2 (25% BISCUIT WASTE MEAL, 75% MAIZE)
TD3 (50% BISCUIT WASTE MEAL, 50% MAIZE) TD4 (75% BISCUIT WASTE MEAL, 25% MAIZE)
TD5 (100% BISCUIT WASTE MEAL, 0% MAIZE)

Table 6: Initial and final Analysis of fish carcass.

	INITIAL	FINAL TREATMENT				
		TD1	TD2	TD3	TD4	TD5
Moisture (%)	19.18	20.09	21.00	20.60	27.40	26.00
Ash (%)	2.99	7.60	7.62	7.40	7.10	7.25
Crude protein (%)	53.07	66.60	67.42	63.92	60.12	59.66
Crude fibre (%)	0.60	0.66	0.62	0.84	0.90	1.10
Fat (%)	11.20	14.98	15.20	16.42	10.60	10.10

Table 7: Mean weekly values of physio-chemical parameters during the experimental period.

Weeks	p^H	Dissolved Oxygen (mg/l)	Temperature
0	7.1	8.0	27.10
1	6.9	7.7	26.00
2	6.96	8.5	26.75
3	7.54	7.3	28.00
4	7.42	8.1	27.00
5	7.53	7.8	26.40
6	7.61	8.1	27.40
7	7.41	6.4	27.00
8	7.31	6.2	27.00
9	7.02	6.6	27.40
10	7.26	6.3	26.70

CONCLUSION AND RECOMMENDATION

All test diets were actively fed upon and accepted by the fishes, (*Clarias gariepinus* juveniles) all through the experimental period. There were no sign of pathological effects as a result of dietary deficiency.

Biscuit waste meal is a cheap source of non conventional energy sources which can be used favorably to replace maize as an energy source in diets of *Clarias gariepinus* at (25% inclusion level) and there were no significant differences in the growth response between Treatment 1 (0%), Treatment 2 (25%), and Treatment 3(50%) inclusion level.

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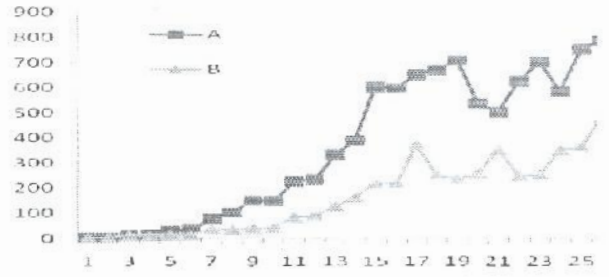
The experiment was set up in a Completely Randomized design (CRD) in four treatments and three replications only and the data were analyzed using the 17th version of the Social Package for Social Scientists (SPSS)while the means were compared using the analysis of variance (ANOVA) to test for significant differences among treatment means.

RESULTS AND DISCUSSION

The water quality parameters monitored (Table 1) revealed that the physico-chemical condition of the culture environment are within the acceptable limits for fish culture and these are in agreement with Boyd (1990) who stated that adequate water quality monitoring and control are essential in aquaculture. A significant increase in mean weight was observed in the mean weight gain of daily feeding as from the 8th week while the mean weight gain for once in two days feeding was noticed in the 22nd week of the experiment at 0.05 level of significance (Table 2).



W

Time (weeks)

Note: W=Weight gain (g), A= Daily feeding and B= Once in two days feeding

Figure 1: Chart showing weight gain of *C.*

Table1: Mean values of water parameters for 24 weeks culture period

Parameters	Concentrations	
pH		6.4
D.O (mg/L)		5.50
BOD(mg/L)		4.10
Hardness (mg/L)	55.42	
Alkalinity(mg/L)	140.00	
Calcium(mg/L)	21.50	
Conductivity (μScm^{-1})	0.20	
T.D.S. (mg/L)		80.70
Total solid (mg/L)	92.00	
T.S.S. (mg/L)		2.00
Nitrate(mg/L)	0.51	
Turbidity(cm)		33.70
Water temp (°C)	29.50	

Table 2: Mean weight gain of daily and once in two days feeding

Time (weeks)	Means weight gain of daily feeding	Means weight gain of once in two days feeding
0	1.10 ± 0.00^{f}	1.15 ± 0.05^{d}
2	11.37 ± 1.37^{f}	9.30 ± 0.21^{d}
4	32.50 ± 2.50^{f}	11.77 ± 0.23^{d}
6	87.50 ± 12.50^{f}	35.17 ± 1.84^{d}
8	146.60 ± 0.90^{de}	40.34 ± 1.34^{d}
10	227.57 ± 3.93^{d}	85.50 ± 2.50^{d}
12	359.44 ± 29.44^{c}	143.75 ± 18.75^{cd}
14	597.50 ± 2.50^{b}	217.71 ± 1.04^{bc}
16	660±18.75ab	245.67 ± 61.25^{bc}
19	621.07 ± 10.00^{b}	297.22 ± 12.34^{ab}
20	562.5 ± 62.50^{b}	311.25 ± 52.78^{ab}
22	770 ± 16.67^{a}	419.4 ± 58.10^{a}

Means with the same superscripts are not significantly different from each other at 0.05 level of significance.

The weight gain differences between the two feeding types could be associated with the differences in the frequencies of feed supply. Thesis in agreement with Okonji and Ewutanure (2011) that reported, for adequate growth to occur in fish, feeds must be supplied in the right quality, quantity and time. Figure 1also showed that the growth for the daily feeding was more rapid than the once in two days feeding which is not unconnected with adequate feeding and this is in agreement with Lovell (1989) who concluded that feed is an indispensable factor for fish growth. At the point of harvest, it was also observed that the fish from daily feeding appeared healthier than those once in two days feeding.

CONCLUSION

For an appreciable growth to occur in living organisms such as fish, the supply of good quality feed in sufficient quantity and at the right time is very essential. Based on the findings of this study, *Clarias gariepinus* (Burchell, 1822) should be fed twice daily with good quality feeds in sufficient quantity at the right time. Regular feeding necessitates regular water quality check, hence farmers should be encouraged to check and treat water regularly to improve growth rates. Government agencies such as the Standard Organization of Nigeria (SON) should monitor dealers of imported feeds.

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