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Fermented cassava peel meal as dietary energy for Nile tilapia (*Oreochromis niloticus* Linnaeus, 1758)

Ojukannaiye, A.S., Agbabiaka, L.A.* and Ekeocha, C.A.

Department of Fisheries Technology, Federal Polytechnic Nekede Owerri, Imo State, Nigeria.
*Corresponding author: adegokson2@yahoo.com

Abstract

Effect of fermented cassava peel meal (FCPM) based diets on the growth and survival of *Oreochromis niloticus* was studied. Five diets containing 35% crude protein were formulated such that fermented cassava peel meal (FCPM) replaced maize at 0%, 25%, 50%, 75% and 100% dietary levels respectively in a completely randomized design. 150 fingerlings of *Oreochromis niloticus* weighing 2.4± 0.1g were allotted to the five treatments at 30 fish each and were replicated three times. Diets containing 0% CPFM had the highest weight gain (24.35g). Similar observation was recorded for feed intake whose values were 20.00, 19.00, 18.00, 16.00 and 20.16g at 0%, 25%, 50%, 75% and 100%FCPM dietary inclusions respectively. The highest specific growth rate (SGR) value of 1.40 was obtained from the fish fed 50%FCPM diet, though, the best FCR (0.73) was obtained from fish fed 75%FCPM ($p< 0.05$). This study based on weight gain and FCR revealed that fermented cassava peel meal may be tolerated in the diets of *Oreochromis niloticus* without compromising performance.

Keywords: Cassava peels, Fermentation, Nile tilapia, Growth, Diets.

Introduction

Fish is a major source of animal protein and an essential food item in the diets of many people in Nigeria and the world (Omojowo *et al.,* 2010). Fish is a good source of thiamine, riboflavin, vitamin A and D phosphorus, calcium and Iron (Agbabiaka,2010). It is also very high in poly unsaturated fatty acids which are important in lowering blood cholesterol, hence, it is suitable for complementing high carbohydrate diets typical of the low income group in Nigeria (Aro *et al.,* 2010; Agbabiaka, 2010).

Fish farming become profitable with enhanced provision of good quality feed at economic price (Eyo 2001). However the development of fish production is adversely affected by high cost of fish feed which is about 60-80% of the total input (Omojowo *et al*., 2010). Most of fish feed ingredients are also being competed for as food by man, hence, the continuous increase in the cost (Okoye and Sule, 2001).

Cassava (*Manihot esculenta)* is a staple food in tropical Africa, Central and South America. Nigeria with annual production of 34-40 million tones is the largest producer of the crop (FAO, 2005). It is estimated that about 4million tones of cassava peel are generated from cassava processing in Nigeria annually. During processing, the peels discarded as waste constitute 10 and 22% by weight of the tuber (Oresegun and Alegbeleye, 2001). The peels contain some amounts of crude protein, fat mineral, crude fiber than the pulp where higher amount of carbohydrate are found (Oresegun and Alegbeleye, 2001). The potential of cassava based ration in the monogastric diets has been limited due to the present of cyanogenic glucoside-linamarine and lotaustraline (Oresegun and Alegbeleye, 2001; Udedibie *et al.,* 2007) which is substantially higher in the peel fraction of the tuber than in the pulp. However, this anti-nutrient has been reported to decrease in the feedstuff during fermentation/ hydrolysis while the crude protein is improved accordingly (Udedibie *et al.,* 2007; Ezeronye, 2001). This study therefore was aimed at investigating the growth response of *Oreochromis niloticus* fingerlings fed FCPM based diet.

Materials and Methods

Experimental site: The feeding trials were conducted at the Teaching and Research Farm of the Department of Fisheries, Federal Polytechnic Nekede, Owerri, Imo State.

Source and processing of cassava peels: Fresh cassava peels were obtained from Nigeria starch mill limited, Uli Ihiala Local Government Area of Anambra State Nigeria. It was washed and fermented for 72 hours after which it was sundried

for 3 days (Eyo, 1994), ground and stored at room temperature. Sample of FCPM was analyzed for proximate composition (AOAC, 2000) as presented in Table (1).

Experimental diets: The feed ingredients used were obtained from Fidelity Agro-Service, Owerri, Imo State. Five diets were formulated to contain 35% crude protein using fermented cassava peel meal to replace maize (W/W) at 0% 25%, 50% 75% and 100% dietary levels respectively (Table 2). The pelletized diets were sundried for 3 days until crispy (Eyo, 1994) and stored in an air tight container at room temperature.

Experimental fish: A total of one hundred and fifty (150) fingerlings of *Oreochromis niloticus* with average weight of 2.4± 0.1g were obtained from Africa Regional Aquaculture Centre (ARAC) Port-Harcourt Nigeria. The fish were acclimated for 72hrs. and also starved for 24 hrs. prior to the commencement of the trials (Okoye and Sule, 2001; Agbabiaka *et al.,* 2012) respectively in other to empty their gastrointestinal track and prepared them for the new diet.

The fish were stocked at the rate of 10 fish per hapa such that each treatment was in triplicate i.e. 30 fish per treatment. The fish were fed 5% body weight daily shared between 8.00 -9.00am and 5.00pm – 6.00pm as recommended by Madu *et al*. (2001). Fish were weighed at the beginning of the experiment and forth nightly thereafter on digital weighing scale; feeding rate was adjusted accordingly.

Statistical procedure: Data obtained were subjected to one-way analysis of variance (ANOVA) while treatment means were separated using Least Significant Difference as described by Obi (1990).

Table (1): Proximate composition of fermented cassava peels.

Parameters	Concentration (%)
Moisture	10.98
Crude Fiber	7.12
Crude Protein	12.30
Crude Fats	2.00
Ash	10.05
NFE	57.25

NFE= Nitrogen Free Extracts

Table (2): Proximate composition of the experimental diets.

Parameters	FCPM Dietary levels				
	0%	25%	50%	75%	100%
Moisture	9.60	10.20	10.57	10.89	10.97
Crude Fiber	34.54	34.56	34.25	34.66	34.30
Crude Protein	4.25	5.36	4.38	5.42	5.46
Crude Fats	7.02	6.05	6.32	6.35	5.68
Ash	10.00	10.03	11.00	10.03	10.68
NFE	34.59	33.80	33.48	32.65	32.91
ME	2743.68	2759.28	2847.89	2867.20	2902.17

NFE=Nitrogen free extracts; ME=Metabolisable Energy.

Results and Discussion

The result of the proximate composition of test ingredient and diets are presented in Tables (1 and 2). The crude protein value (12.30%) obtained from FCPM was higher than 4-6% reported by Oresegun and Alegbeleye (2001) on cassava peel, this might be as a result of fermentation of the cassava peel meal; similar observation was reported by Agbabiaka *et al*. (2013) and Ezeronye (2001) when tigernut discards and Cassava were fermented respectively.

The crude protein of the diets varied from 34.54% in control diet to 34.25% in diet containing 50% FCPM. The crude fiber decreases from 7.02 in 0%FCPM (control diet) to 5.68 in 100%FCPM diet. Nevertheless, the crude fiber and soluble carbohydrate values decreased in the diets linearly with FCPM perhaps due to the actions of microbes of fermentation that utilized sugar for energy (Ezeronye, 2001) .

Data on growth performance of *Oreochromis niloticus* did not follow a definite pattern. Fish fed 0% FCPM diet recorded the best weight gain of 24.35g while values of 21.86, 20.72, 22.00 and 22.66g were recorded from fish fed diets containing 25%, 50%, 75% and 100%FCPM respectively ($P<0.05$). Similar observation was recorded for feed intake whose values were 20.00, 19.00, 18.00,

16.00 and 20.16g at 0%, 25%, 50%, 75% and 100%FCPM dietary inclusions respectively. There was a significant difference among the treatment groups (P<0.05) as shown in Table (4). The feed intake of *Oreochromis niloticus* decreased as the dietary inclusion of FCPM increased. This may be attributed to the residual anti-nutrients of cassava peel meal such as tannins, oxalate and phytic acid which has been severally reported to impair feed intake in monogastrics especially the polyphenols, this relatively low feed intake linearly with FCPM is in agreement with findings of Esonu (2000); Agbabiaka, (2012); Aderolu and Sogbesan, (2010). However, Ofojekwu *et al.,* (2003) also reported decreased weight gain of *Oreochromis nilocutus* as levels of palm kernel meal increases in the diets.

The highest specific growth rate (SGR) value of 1.40 was obtained from the fish fed 50%FCPM diet, though, the best FCR (0.73) was obtained from fish fed 75%FCPM (P<0.05). The general increase in body weight of the experimental fish in all the treatments indicated that the diet were adequate in essential nutrients especially dietary protein (30-35%CP) required by *Oreochromis niloticus* (Omoniyi and Fagade, 2003). Nevertheless, the high survival rates of experimental fish in all treatment groups show that FCPM is not toxic to the fish fed such diets and did not pose any threat to water chemistry throughout the duration of the study.

Table (3): Gross composition of the experimental diets.

Ingredients	Inclusion levels of FCPM				
	0%	25%	50%	75%	100%
	Cassava				
	0%	3.75	7.50	11.25	15.00
Maize	15.00	11.25	7.50	3.75	-
Soybean	35.00	35.00	35.00	35.00	35.00
GNC	35.00	35.00	35.00	35.00	35.00
Fish meal	10.00	10.00	10.00	10.00	10.00
Oil	2.00	2.00	2.00	2.00	2.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Salt	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100

Table (4): Growth performance of Nile tilapia fed FCPM based diets.

Parameters	Dietary levels of FCPM					
	0%	25%	50%	75%	100%	SEM
Initial weight of fish (g)	2.40	2.30	2.50	2.50	2.40	0.04
Final weight of fish (g)	26.75	24.16	23.22	24.50	25.06	0.71
Weight gain of fish (g)	24.35^{a}	21.86^{b}	20.72^{bc}	22.00^{b}	22.66^{b}	0.73
Total feed intake (g)	20.00^{a}	19.00^{a}	18.00^{a}	16.00^{b}	20.16^{a}	0.83
SGR (%day $^{-1}$)	1.20^{a}	1.10^{a}	1.40^{b}	1.30^{ab}	1.20^{a}	0.06
Feed Conversion Ratio	0.82^{a}	0.87^{a}	0.87^{a}	0.73^{b}	0.89^{a}	0.03
Cost per Kg feed (N)	124.70	122.07	119.45	116.82	114.20	2.10
Survival rate (%)	86.00	90.00	90.00	87.00	90.00	0.80

$^{a, b, c}$ Means within the row having the same superscripts do not differ significantly (P> 0.05), SGR = specific growth rate

Conclusions

This study revealed that Fermented Cassava Peal Meal can be used to replace maize in a practical diet of *Oreochromis niloticus* without compromising growth/performance.

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