Replacement value of tigernut meal (C*yperus esculentus*) with Maize in catfish (*Clarias gariepinus*) diets

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ABSTRACT

A seventy days experiment was conducted to evaluate the potential of tigernut (*Cyperus esculentus* L.) as substitute for maize in diets of African catfish (*Clarias gariepinus* Burchell) juveniles. Five isonitrogeneous diets (CP=40%) were formulated such that tigernut replaced maize at 0%, 25%, 50%, 75% and 100% respectively in a completely randomized design. The control diet contained no tigernut. The experiment was conducted in hapa nets suspended in an outdoor concrete pond at the rate of ten fish per hapa in a triplicate, making a total of fifteen experimental units and fed at 5% biomass daily. Result of the growth performance revealed that control diet has the best weight gain and specific growth rate ($P<0.05$) while the least was obtained from diet containing 100% tigernut. Mean weight gain decreased as tigernut increased in the diet similar observation was recorded from the feed intake ($P<0.05$). This study revealed that tigernut cannot totally replace maize in diets of *Clarias gariepinus* but may be used at dietary level not beyond 50% for catfish production.

Keywords: Replacement value, tigernut, C*larias gariepinus*, diets.

INTRODUCTION

The incessant high cost of maize as main energy source for livestock and fish feeds being a staple food for Nigerians and Agro-allied companies including brewing industries cannot be over-emphasized. The resultant effect is high cost of animal protein hence inability of the populace to meet the minimum dietary protein intake of 56g per person per day as recommended by FAO (Fasuyi, 2005).

Many attempts have been made to solving this problem through the use of some non-conventional energy sources in poultry such as maize offal (Vantsava *et al.,* 2008), palm oil sludge (Esonu *et al*., 2006), cassava (Udedibie *et al*., 2009) and in fish nutrition, wild variegated cocoyam (Agbabiaka *et al.,* 2006), cocoyam corm (Omorege *et al*., 2009, Aderolu and Sogbesan, 2010). These tuber crops have been found to be of good potential but with limited crude protein content which is often below 3%. Tigernut (*Cyperus esculentus* L.) has been reported to be rich in energy while its oil content (about 25%) is resistance to peroxidation (Belewu and Belewu, 2007). Tigernut has been reported to be eaten raw, fermented and processed as beverages. It has the medicinal quality of preventing colon cancer, heart attack and diabetis (Belewu *et al.,* 2007). There is paucity of information on its potential as catfish feedstuff in Nigeria, this study is therefore designed to evaluate its suitability as replacement for maize in catfish production.

MATERIALS AND METHODS

Experimental station:- The research was conducted at the fish farm complex of Federal Polytechnic Nekede, Owerri. Fifteen hapa nets measuring 1.0 x 1.0. 1.2m each suspended by bamboo were used for this study in an outdoor cistern.

Tigernut processing:- Tigernut seeds were purchased from open market "Ama Hausa" in Owerri, Imo state, Nigeria. They were sundried for 14 days prior to milling to produce tigernut meal. The tigernut meal so produced was subjected to proximate analysis (AOAC, 2000) as presented in Table1.

Fish diet formation and processing:- Five iso-nitrogenous diets were prepared to contain 0% (control), 25%, 50%, 75% and 100% tigernut meal to replace equal weight of maize respectively. These were thoroughly mixed with other feedstuffs and pelleted with die 2mm before sundried for 3 days until crispy (Eyo; 1994).

The pelleted diets were packed in water impermeable bags (Nylon bags), labelled accordingly and kept at room temperature.

Experimental design

A total of 150 *Clarias gariepinus* with mean weight 18.00 ± 0.5g were purchased from the hatchery of African Regional Aquacultural Centre (ARAC), Aluu, Portharcourt, Nigeria. The fish were acclimatized for 72 hours (Okoye and Sule, 2001) and were fed control diet at 5% biomass twice daily (8 - 9.00 hrs) and (17 – 18.00 hrs) as recommended by Madu *et al.,* (2001). The fish were randomly allotted to five dietary treatments in a triplicate at ten fish per replicate, that is, thirty fish per treatment. All experimental fish were starved for 24 hours before commencement of the feeding trial. Stale water was usually drained off pond forthnightly and replaced with bore- hole water at the farm complex.

Data collection

Fish were batch weighed with digital weighing balance at the beginning of the experiment and weekly thereafter. Feeds were adjusted according to the new body weight changes. Other biological evaluations such as feed intake, body weight gain were recorded on replicate basis. Feed conversation ratio (FCR) was computed according to Lambert *et al*., (1936). Dissolved oxygen, Water temperature, Dissolved oxygen and Hydrogen ion concentration were measured according to Boyd, (1979). The experiment lasted for 70 days.

Statistical Analysis

Data obtained were subjected to Analysis of variance (ANOVA) and the means separated ($p< 0.05$) with Duncan Multiple Range Test (DMRT); Duncan, (1955).

Table 1: Proximate composition of Tigernut meal

Parameters	Concentration (%DM)
Moisture content	7.62
Crude protein	8.44
Ether extracts	27.71
Crude fiber	11.69
Ash	3.51
NFE	41.03

Table 2: Minerals composition of raw tigernut

Elements	mg/100g Sample
Sodium	525.98
Potassium	542.08
Calcium	37.14
Magnesium	27.37
Zinc	45.19
Iron	5.15
Manganese	0.02
Phosphorus	11.79

RESULTS

The result of the proximate composition of the test ingredient and diets are presented in tables 1 and 4. Data on the biological evaluations of *Clarias gariepinus* fed tigernut based diets is shown in table 5. The crude protein content of the diets varied from 37.30% in diet 5 (100% tigernut) to 40.11% in control diet (0%). The crude fiber increased from 4.28% in control (0%) diet to 5.96% in 100% tigernut based diets. However, the crude fat was highest in 100% tigernut based diet while the lowest was recorded in the control (0%) diet.

Table 3. Composition of experimental diets fed to catfish (*Clarias gariepinus*)

	DIETARY INCLUSION (%)				
INGREDIENTS	**0**	**25**	**50**	**75**	**100**
Maize	25.0	18.75	12.50	6.25	-
Tigernut	-	6.25	12.50	18.75	25.0
Soybean Meal	25.0	25.0	25.0	25.0	25.0
Fish Meal	20.0	20.0	20.0	20.0	20.0
Groundnut Meal	10.0	10.0	10.0	10.0	10.0
Blood Meal	10.0	10.0	10.0	10.0	10.0
Spent Grain	5.0	5.0	5.0	5.0	5.0
Bone Meal	2.0	2.0	2.0	2.0	2.0
Vit/Premix	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
Vegetable Oil	2.0	2.0	2.0	2.0	2.0
Salt	0.25	0.25	0.25	0.25	0.25
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table 4: Proximate composition of tigernut based diets fed to Catfish (*Clarias gariepinus*)

Parameters	**Tigernut dietary Inclusion (%)**				
	0	**25**	**50**	**75**	**100**
Moisture	8.93	9.12	9.76	9.17	9.75
Ash	9.26	8.79	9.78	10.37	10.90
Crude fat	1.48	7.34	5.84	6.54	7.30
Crude fiber	4.28	4.31	4.84	5.52	5.96
Crude Protein	40.11	40.06	38.60	38.36	37.34
Nitrogen Free Extract	35.94	30.38	31.15	30.04	28.75

Table 5: Performance of *Clarias gariepinus* fed tigernut based diets

Parameters	**Dietary treatments (%)**				
	0	**25**	**50**	**75**	**100**
Initial mean weight (g)	18.22	18.17	18.26	18.33	18.03
Final mean weight (g)	164.58	127.84	136.78	133.26	116.16
Mean weight gain (g)	146.36^{a}	122.43^{b}	118.52^{b}	114.93^{bc}	98.13^{c}
Total feed intake (g)	259.35^{a}	255.25^{a}	240.00^{b}	203.85^{c}	207.85^{c}
Feed conversion ratio	1.78^{a}	2.09^{b}	2.00^{b}	1.78^{a}	2.14^{bc}
Spec. growth rate (% / day)	1.35^{a}	1.21^{b}	1.24^{b}	1.19^{c}	1.13^{c}
Mean growth rate (g)	2.09	1.75	1.69	1.64	1.40

Nevertheless, data on performance of the experimental *Clarias gariepinus* fed the test diets revealed that control (0%) diet had the best weight gain, while value of 98.13g was reported for the fish fed 100% tigernut based diet (P<0.05).

The feed intake values are 259.35, 255.25, 240.00, 203.85 and 207.85g for 0%, 25%, 50%, 75% and 100% dietary treatments respectively. There were significant differences among the treatments (P<0.05). The highest specific growth rate (SGR) value of 1.35 was obtained from the fish fed control (0%) diet while those fish fed 100% diet recorded least value of 1.13 (P<0.05).

DISCUSSION

The crude protein value obtained from tigernut meal, (8.44%) is within the range (7.15 – 9.70%) reported by Oladele and Aina, (2007). The general increase in body weights of the experimental fish in all the treatments indicated that the diets were adequate in dietary protein and other nutrients required by catfish; similar results were obtained when tilapia fingerlings were fed on different grains and *Clarias gariepinus* was fed cocoyam based diets respectively (Solomon *et al,* 2007; Aderolu and Sogbesan, 2010).

The observed decline in body weight gain of the trial fish as the dietary level of tigernut increased in the diets may be due in parts to the influence of anti – nutrients in tigernut such as trypsin inhibitors, tannins and phytate that impaired nutrients utilization in monogastrics and the relatively low dietary protein contents at high dietary inclusion of tigernut especially beyond 75% respectively (Officer, 2000; Oladele *et al.,* 2009; Okayi *et al.,* 2010) . Nevertheless, the feed intake of the catfish fed the experimental diets reduced as the dietary inclusion of tigernut increased .This is attributed to the inherent high fiber content of tigernut which has been reported to be poorly utilized by catfish being mostly carnivorous/omnivorous hence cannot effectively digest non starch polysaccharide like the herbivorous fish species (Officer ,2000; Agbabiaka *et al.,* 2011). This also agrees with report that feed intake of monogastric is influenced greatly by dietary fiber characteristics (Sundu *et al.,* 2005, Fetufe *et al.,* 2007).

CONCLUSION

This study revealed that maize in catfish (*Clarias gariepinus*) diets cannot be entirely replaced with tigernut but may be used at dietary level not beyond 50% inclusion for catfish production.

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