GROWTH RESPONSE AND NUTRIENT UTILISATION OF AFRICAN CATFISH *Clarias gariepinus* FED *Cucumeropsis edulis* SEEDMEAL

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ABSTRACT
A feeding trial was conducted to evaluate the growth response and nutrient utilisation of Clarias gariepinus juveniles fed Cucumeropsis edulis meal as replacer for soybean meal. Five diets (40% Crude protein) containing soybean which was replaced by Cucumeropsis edulis at a rate of 0%, 7.5%, 15%, 22.5% and 30% were formulated. C. gariepinus juveniles of an average weight of 10.0±0.07g was stocked in ten plastic bowls at 10 fish per bowl replicated in a completely randomized design and fed at 5% body weight twice daily for 56days. Significant variation (P<0.05) existed in weight gain, specific growth rate; feed conversion, and survival rate among the fish fed various dietary treatments. There was no significant difference (P>0.05) in all the parameters between fish fed diet 1 and diet 2. A decrease in growth and nutrient utilization parameters of fish fed various dietary treatments was observed as the level of Cucumeropsis edulis seed meal increased. The results show that it is possible to replace soybean meal in the diet of Clarias gariepinus juveniles with soaked Cucumeropsis edulis meal, with optimum growth response at 15% replacement level. It is recommended that other processing techniques be employed in removing the antinutrients in Cucumeropsis .edulis.

Keywords*;* Fisheries, Isonitrogenous, Conventional feedstuff, Aquaculture

INTRODUCTION

Soybean meal (SBM) is currently the most common plant protein source used in feeds for freshwater species, due to its high protein content, balanced amino acid profile, consistent quality and abundant supply (Trosvik *et al*., 2012). Due to its high demand as a protein source for feedstock animals, SBM is a competitive ingredient and, consequently, its cost increased significantly (Hossain *et al*., 2012). Therefore, alternative sustainable plant-based protein sources must be identified without compromising fish growth rates (Barros *et al*., 2002). SBM has been successfully replaced by cheaper plant-based protein ingredients in feeds including cottonseed meal (Yue and Zhou, 2008; Kleemann *et al*., 2011), canola meal (Soares *et al*., 2001; Zhou and Yue, 2010), and sesame meal (Guo *et al*., 2011).

Clarias gariepinus belongs to the order Siluriformes and the family clariidae. It has a scaleless smooth and slimy skin. It has grey to dark color and a white under belly. The body of the fish is depressed with a flatten head which ended in a slightly sub- terminal mouth surrounding by four pairs of barbel. It has strong spines located just in front of the pectoral fin on each side of the body. In the mouth are vomerine teeth that are arranged in bands on the jaw thus it could be carnivorous or omnivorous feeder (Bard *et al.*,1976).

The African catfish, *Clarias gariepinus* is the favorite fish for fish farming in West Africa and other part of the African continent Adewumi and Olaleye (2011) .The species is dominant in freshwater environments including lakes, rivers and dams. *C. gariepinus* has been preferably in aquaculture due to its ease of culturing, fast growth rate, high resistance to disease, tolerance of a wide range of temperature, low dissolved oxygen as well as high salinity levels and most importantly high commercial value (Oyeleye *et al.* 2016).

Cucumeropsis edulis belongs to the Cucurbitaceae, family. *C.edulis* plants are widely cultivated for their seeds, which have high content of fat and protein. *C.edulis* seeds can be obtained either in shelled or unshelled forms in West African markets and are used greatly in West African Cookery. *Cucumeropsis edulis* is a yearly, rampant or trailing plant of more than 3 meters long dinging by its gimlets rowers. *C.edulis* is a variety of melon seeds, which is a creeping annual plant and an intercropping plant made use of in traditional farming practices thrives well on rich light soil in the hot climatic regions of Africa. However, and has been noted to tolerate low rainfall (Cobley, 1957).

However, there is paucity of information on the use of *Cucumeropsis edulis* meal as dietary protein source for fish.This work therefore seeks to study the growth response and nutrient utilization of *Clarias gariepinus* fed *Cucumeropsis edulis* meal as a replacer for soybean.

MATERIALS AND METHODS

Sources and Processing of Ingredients

Cucumeropsis edulis were purchased from an open market in Oyo State. .The seeds was de hulled to obtain the inner edible cotyledon. *C. edulis* were soaked in water for 2hours removed after which it was sundried for three days and then ground with a blender. The feed ingredients used in the feed formulation which includes Fish meal, Soybean meal, fish oil, fish premixes and starch were purchased from commercial feed mill, they were then separately milled, screened to achieve 0.5mm particles sizes . All the feed ingredients were analyzed for their proximate composition (AOAC,2005).

Experimental Diets

Based on the nutrient composition of the protein feedstuff (Table 1), five iso-nitrogenous diets containing 40% crude protein at various replacement levels of soaked *C. edulis* meal (CESM) were formulated. Diet 1(D1) without CESM served as control, Diet 2 (D2), D3, D4, and D5 had soybean meal component progressively replaced by CESM at 0%, 7.5%, 15%, 22.5% and 30% respectively. The feed ingredients were weighed, mixed, moistened with hot water and processed into 2mm pellets in a pelleting machine to produce the pellet strands which were sun-dried and packed into a well labelled polythene bags.

Experimental Fish and System

One hundred and fifty *Clarias gariepinus* juveniles (average weight 10.0±0.07g) were purchased from a commercial fish farm and transferred to the hatchery unit of the Federal College of Animal Health and Production Technology, Moor Plantation Ibadan, Oyo state. The fish were acclimated and fed a commercial diet for one week prior to the feeding trial. The juveniles were randomly distributed at a rate of 10 fish per plastic tank (30 litres). Each treatment was in triplicate. All fish were fed at 5% body weight twice daily for the period of the experiment (8 weeks) at 9:00 and 17:00 hours local time. The fish were batched weighed biweekly using an electronic balance and the amount of feed was adjusted accordingly. Growth response and feed efficiency parameters were evaluated following the method of Jimoh and Aroyehun (2011) as:

Mean weight gain= final mean weight –initial mean weight

$$\text{Percentage weight gain} = \frac{\text{Mean weight gain}}{\text{Initial mean weight}} \times 100$$

$$\text{Specific growth rate} = \frac{\text{Log (Log } W_2\text{) — (Log } W_1\text{)}}{T_2 — T_1} \times 100$$

Where W_2= Natural log of the final weight of fish
W_1 = Natural log of the final weight of fish
T2 — T1= Experimental period in days.

$$\text{Feed conversion ratio} = \frac{\text{Feed fed}}{\text{Weight gain}}$$

$$\text{Protein efficiency ratio} = \frac{\text{Mean Weight gain}}{\text{Protein Intake}}$$

Protein intake (g) = Feed intake x Crude protein in feed

$$\text{Percentage survival} = \frac{\text{Number of fish at the end of the experiment}}{\text{Number of fish at the beginning of the experiment}} \times 100$$

Statistical Analysis

Data obtained from the experiment were expressed in mean ± SD and it was subjected to one way analysis of variance (ANOVA) using SPSS 16.0 version. Where the ANOVA reveals significant difference ($P<0.05$) Duncan multiple range test was used to compare differences among individual treatment means.

RESULTS

Table 3. shows the growth response and nutrient utilisation of *Clarias. gariepinus* fed diets containing *C. edulis* seedmeal. The mean weight gain of fish fed D1 was the highest while fish fed D5 had lowest weight gain. There existed significant variation ($p<0.05$) in the mean weight gain of fish fed the various dietary treatments. However, there was no significant variation ($P>0.05$) in the weight of fish fed D1 and D2. So also there was no significant different in the weight of fish fed D3 and D4.

The percentage weight gain of fish fed D1 was the highest while the fish fed D5 had the lowest percentage weight gain. There existed significant difference ($p>0.05$) in the percentage weight gain of fish fed the various dietary treatment. However, there was no significant difference ($P> 0.05$) in the % weight gain of fish fed D1, D2 and D3. There was no significant different ($p>0.05$) in the percentage weight gain of fish fed D3 and D4. Similar trends of results as obtained for percentage weight gain was also recorded in the specific growth rate of fish fed the various dietary treatments.

The food conversion ratio of fish fed D5 was the highest while the fish fed D1 had the lowest food conversion ratio. There was a significant difference ($p<0.05$) in the food conversion ratio of fish fed the various dietary treatments. However, there was no significance different ($p>0.05$) in the food conversion ratios of fish fed D1, D2, D3 and D4. So also there was no significant difference P(>0.05) in the food conversion ratio of fish fed diet D3, D4 and D5.

The protein efficiency ratio of fish diet 1 was the highest while the fish fed D5 had the lowest. There exist significant difference ($p<0.05$) in the protein efficiency ratio of fish fed the various dietary treatment. However, there was no significance difference ($p>0.05$) in the protein efficiency ratio of fish fed D1 and D2; and protein efficiency ratio of fish fed D3 and D4.

The result in Table 4; shows the calculated proximate composition (g/100g dry matter) of experimental diets containing *C. edulis* seedmeal fed to *C. gariepinus* The dietary treatments are isonitrogenous and the protein requirement of *Clarias gariepinus* was met by the 40% provided in the experimental diets.

TABLE 1: Proximate composition of the protein feed ingredients

PARAMETERS	FISHMEAL	SOYBEAN MEAL	CESM
Moisture	9.75	10.70	6.30
Crude protein	72.4	45.74	22.41
Crude lipid	10.45	9.68	37.11
Crude fibre	-	5.10	16.02
Ash	8.32	4.48	3.73
*NFE	-	30.00	14.43
Total	100	100	100

CESM: *Cucumeropsis edulis* meal.
*NFE: Nitrogen Free Extracts

TABLE 2: Gross composition (g/100g) of experimental diets containing *C. edulis* seed meal fed to *C. gariepinus*

Ingredients	Experimental Diets				
	D1	**D2**	**D3**	**D4**	**D5**
Fishmeal @ 72	27.78	27.78	27.78	27.78	27.78
Soybean meal @ 45	44.44	41.11	37.78	34.44	31.11
*CESM @ 22.41%	-	6.69	13.39	20.08	26.77
Fish Oil	3.00	3.00	3.00	3.00	3.00
**Fish Premix	4.00	4.00	4.00	4.00	4.00
Starch	20.78	17.48	14.05	10.70	7.34
Total	100.00	100.00	100.00	100.00	100.00

* *Cucumeropsis edulis* Seed meal **Vitamin/ mineral premix supplied kg-diet
Vit A:20.000u; Vit D_3:4,000iu, Vit E:200,000iu:, Vit K:1,200 mg Vit B:10,000mg: Vit B_2:30,000mg:Vit BH6:19,000mg: vit B12:1,000 mg nNiacin;200,000mg: Folic Acid:5,000mg, panthothenic Acid;50,000 Biotin;400mg;Antioxidant 125g; vit C;150g;choline chloride 40g manganese; 30g; zinc; 40g; iron; 40g; copper; 4g; iodine 5g selenium: 0.2mg

Table 3: Growth performance *of C. gariepinus* fed diet containing C*ucumeropsis edulis* seed meal

Growth Parameters	Experimental Diets				
	D1	D2	D3	D4	D5
Initial weight	11.05 ± 0.07^{a}	11.00 ± 0.00^{a}	11.05 ± 0.07^{a}	11.00 ± 0.00^{a}	11.00 ± 0.00^{a}
Final Weight	26.22 ± 1.31^{a}	25.43 ± 1.22^{ab}	22.72 ± 1.62^{bc}	20.69 ± 0.63^{cd}	19.06 ± 1.33^{d}
Mean weight Gain	15.17 ± 1.38^{a}	14.43 ± 1.22^{ab}	11.66 ± 1.69^{bc}	9.69 ± 0.63^{cd}	7.96 ± 1.33^{d}
PWG	137.27 ± 13.39^{a}	131.17 ± 11.02^{a}	105.61 ± 15.94^{ab}	88.15 ± 5.75^{bc}	71.74 ± 11.94^{c}
SGR	1.54 ± 0.09^{a}	1.50 ± 0.08^{a}	1.28 ± 0.14^{ab}	1.13 ± 0.06^{bc}	0.96 ± 0.12^{c}
FCR	1.26 ± 0.07^{b}	1.28 ± 0.08^{b}	1.38 ± 0.45^{ab}	1.59 ± 0.11^{ab}	1.88 ± 0.05^{a}
PER	1.99 ± 0.13^{a}	1.96 ± 0.13^{a}	1.89 ± 0.56^{a}	1.57 ± 0.09^{a}	1.33 ± 0.04^{a}
% Survival	70.00 ± 0.00^{b}	70.00 ± 0.00^{b}	70.00 ± 0.00^{b}	75.00 ± 7.07^{ab}	80.00 ± 0.00^{a}

Row means with the same superscript s are not significantly different ($p>0.05$) from each other

KEY-PWG – Percentage weight gain ,SGR – Specific weight gain , FCR – Feed conversion ratio ,PER – Protein efficiency ratio

Table 4: Calculated proximate composition (g/100g dry matter) of experimental diets containing *C. edulis* seed meal fed to *C. gariepinus*

Proximate Composition	Experimental Diets				
	D1	D2	D3	D4	D5
Crude protein	42.50	42.13	41.79	41.44	41.09
Crude lipid	9.64	11.78	13.93	16.07	18.22
Crude fibre	4.21	4.91	5.60	6.30	6.99
Ash	7.49	7.36	7.23	7.10	6.97
Dry matter	91.68	85.47	79.23	73.01	66.79

DISCUSSION

The results of the calculated proximate analysis of the diets shows that the diets were isonitrogenous . The protein requirement of *Clarias gariepinus* was met by the quantity provided in the diets. Uys and Hecht (1985) reported that the best growth rate and feed conversion efficient in *Clarias gariepinus* are achieved with diets containing 38-42% crude protein.

There is reduction in the growth parameters of fish fed test diets when compared to that of fish fed control diets.

The results of this experiment indicated that the growth and nutrient utilization of *C. gariepinus* were not significantly affected by up to 15% replacement level of soybean meal with *Cucumeropsis edulis* seed meal in the diet. This observation agrees with the finding of Jimoh *et al*. (2013) for *Clarias gariepinus* fed dry heat treated Lu*ffa cylindrica* seed meal .Davies *et al.* (2000) reported that the higher the inclusion levels of certain oilseed meal result in poor growth and nutrient utilization by *Oreochromis niloticus.* Although, lower nutrient utilization was recorded and the growth of the fish was retarded at higher level of inclusion of *Cucumeropsis edulis* (22.5 and 30%).

Possible explanation to this result could be attributed to the reduced feed in-take by *Clarias gariepinus* with increasing inclusion of test feed ingredients; an indication of poor palatability of the feed ingredients (Glencross *et al*., 2007). Domingues *et al*. (2003) reported that one of the difficulties observed when alternative sources of feedstuffs are used in fish diets is its acceptance. High fibre contents of the diet and its anti-nutritional factor could lead to poor palatability hence reduced feed intake by *Clarias gariepinus* fed *C.edulis* based diets. Aderolu and Oyedokun (2009) reported that

high fibre in diets limits the rate of digestion and nutrient absorption. It was also reported that high fibre in diets could result in increased weight of excreta and reduced nutrient absorption (Keembiyeethy and De silva, 1993).

Badifu (2001) reported that Phytic acid, oxalate, hydrocyanic acid and saponin are the known antinutrients present in *Cucumeropsis .edulis* . The lowered growth performance of fish fed *Cucumeropsis .edulis* based diets when compared to that of fish fed control diets could be attributed to the presence of these anti nutritional factors. Francis *et al* (2001) better explains this phenomenon by saying that fish have compensatory mechanism in their body system that can absorb the negative effect of anti-nutrients when the quantity is below certain threshold levels.

CONCLUSION AND RECOMMENDATION

The results of this study showed that soaked *Cucumeropsis edulis* seed meal, has a very high potential to supplement soybean meal in diets for *C.gariepinus* juveniles, with optimum growth response at 15% replacement level. It is recommended that other processing techniques should be employed in removing the antinutrients in *Cucumeropsis .edulis* so that its nutritional potentials can be exploited.

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