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Growth performance of juvenile *Clarias gariepinus* fed *Ipomoea aquatica*-based diets

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Abstract

A feeding trial was conducted to assess the replacement value of I. aquatica-based diet as dietary replacement of maize in the diets of juvenile C. gariepinus. Five isonitrogenous diets were formulated to contain 0% (control diet), 15%, 30%, 45%, and 60% I. aquatica. Each Treatment was carried out in triplicate using ten C. gariepinus juvenile per replicate with mean initial weight of 9.0g. The fish were fed at 5% body weight per day for a period of 8 weeks. The best growth response in terms of mean weight gain was obtained in fish fed 15% I. aquatica diet inclusion (35.57±3.44g), while fish fed 60% I. aquatica diet had the lowest growth response (23.80±1.18g), the highest FCR was obtained in fish fed 60% I. aquatica (1.79±0.04), while the lowest was obtained in fish fed 15% I. aquatica (1.58±0.06). There was no significant difference (p>0.05) in all the parameters of the treatments. The results revealed that any of the inclusion level can be used up to 60% inclusion level of I. aquatica. However, 15% inclusion level gave the best result in terms of growth.

Keywords: I. aquatica, dietary ingredients, isonitrogenous, experimental diets, inclusion levels.

Introduction

Fish feed is one of the major inputs in aquaculture production which accounts for at least 60% of the total cost of production (Gabriel et al., 2007). Fish feed technology is one of the least development sectors of aquaculture particularly in Africa and other developing countries of the World (Gabriel et al., 2007). The main constraints of fish feed production include scarcity of fish feedstuffs, high cost of ingredients, and competition of ingredients for human use. This constraints have motivated the research for local available, and cheap alternative protein feed source that compete less with human for aquaculture industry, which aim to reduce the cost of production without compromising fish quality. In the view of the worldwide demand for additional sources of food to meet the needs of ever increasing population, the exploitation of plants of low economic importance is a step towards better resource utilization (Telek and Martin 1983).

Water spinach (*I. aquatica forsk.*) is a common emergent aquatic plant found in marshy or wet sandy areas or floating on water. Water spinach or morning glory is basically a vine, which may form dense masses of tangled vegetation, thus developing impenetrable canopies over the water surface, restricting light penetration into the depths. It is found growing wildly in tropical and subtropical countries and is cultivated widely in China, Indonesia, Thailand, Vietnam, Myanmar, Philippines, Bangladesh, and India (Naskar, 1990). Water spinach (*I. aquatica*) is a vegetable that is consumed by people and animals (Kean and Preston, 2001). It has a short growth period, resistant to common insect pests, and can be cultivated either in dry or flooded soils. Moreover, water spinach is a vegetable with a high potential to convert efficiently the nitrogen in bio-digester effluent into edible biomass with high protein content (Kean and Preston, 2001). Water spinach is a potential source of feed protein concentrate; the edible portion contain up to 29% crude protein on a dry matter basis, and a number of nutrients and minerals (Ly, 2002). He further stated that it has been used successfully for growing rabbits and pigs as the only source of supplementary protein in a diet based on broken rice. Significantly, *I. aquatica* contains very low amount of anti-nutritive factors such as trypsin inhibitor, calcium oxalate, tannin, and phytate (Mandal et al., 2008). Although, various leaf meals have been experimented as potential fish feed ingredients to decrease diet cost, the use of water spinach leaf meal has not been experimented. It is against this background that the study was designed to evaluate the growth potentials of incorporating water spinach leaf meal into the pelleted feed of juvenile *C. gariepinus*; a widely culturable fish species.

Materials and methods

The experiment was conducted in the Fish Hatchery Complex, Federal University of Agriculture, Abeokuta, Nigeria. The flow through system consisted of 15 rectangular plastic tanks. Each tank has a water holding capacity of 50 liters (L x B x H = 0.49 x 0.34 x 0.34 m), but water was maintained at the 45 liters volume throughout the study. One Hundred and Fifty (150) juvenile African mud catfish (*C. gariepinus*) of average weight 9.0+0.05 g were obtained from Aqua Century Fish Farm, Abeokuta. Fish were randomly distributed at the stocking rate of 10 fish per tank in triplicate per treatment. The fish were acclimatized for one week (Okoye and Sule, 2001) and were fed with control diet at 3% body weight twice daily (9:00–10:00 GMT) and (18:00–19:00 GMT) Madu and Aliko (2001). However, feeding rate was adjusted to 5% body weight during the feeding trial. Fish were batch weighed for each treatment and replicate weekly with a weighing balance (Mettler 601 BD) and feed was adjusted accordingly (Jauncey and Ross, 1982). Water temperature and pH were monitored weekly with pH/EC/Temperature meter, Hanna Instruments (Model HI98129) while dissolved oxygen was monitored with Jenway DO meter (model 9071).

Table 1: Proximate composition (%) of experimental diets.

Parameters	Diet A	Diet B	Diet C	Diet D	Diet E
Crude protein (%)	38.20	38.00	39.10	39.40	40.22
Fat (%)	10.10	11.20	11.70	11.80	11.70
Moisture (%)	9.00	9.40	9.10	9.20	9.60
Fibre (%)	2.80	2.60	2.70	2.80	2.80
Ash (%)	9.43	10.14	10.08	10.46	10.21

Table 2: Growth response, nutrient utilization parameters and survival of catfish fed varying levels of *I. aquatica*-based diets.

Parameters	Diet A	Diet B	Diet C	Diet D	Diet E
Initial mean weight (g)	9.03±0.0	9.03±0.03^{a}	9.17±0.03^{b}	9.07±0.03^{ab}	9.07±0.03^{ab}
Final mean weight (g)	42.67±4.97	44.60±3.47	38.40±4.31	43.30±7.98	32.87±1.21
Mean weight gain (g)	33.63±5.00	35.57±3.44	29.23±4.28	34.23±7.99	23.80±1.18
Feed intake (g)	54.00±4.43	55.76±3.58	49.54±2.77	53.88±6.41	42.74±2.96
Feed conversion ratio	1.64±0.10	1.58±0.06	1.76±0.15	1.70±0.27	1.79±0.04
SGR (%/day)	2.75±0.21	2.84±0.14	2.54±0.19	2.73±0.37	2.30±0.06
Protein intake	20.63±1.70	21.19±1.36	21.73±1.89	21.23±2.52	17.19±1.19
Protein efficiency ratio	1.61±0.11	1.67±0.06	1.35±0.16	1.56±0.22	1.39±0.03
Survival (%)	90.00±0.00	96.67±3.33	90.00±5.77	83.33±12.02	96.67±3.33

Values with common superscripts in horizontal row are not significantly different from each other at P > 0.05.

Diet formulation and preparation

Fresh morning glory plant (*Ipomoea aquatica*) was collected from Iwopin, a wetland area in Ogun waterside, Nigeria. The plant was rinsed of dirt and then put in envelopes and oven dried at 60°C (Fasakin, 2004). The dried plant was ground into fine powder and sieved to obtain a homogenous particle size. Other dietary ingredients used include soybean meal, groundnut cake, fish meal and maize; which were obtained from local feed store. Five isonitrogenous experimental diets were prepared containing a control diet (A) and four test diets (B, C, D & E). In the test diets maize was partially replaced with *I. aquatica* at four inclusion levels (15, 30, 45 and 60%). Each of the treatments was carried out in triplicates. Catfish juveniles were fed daily at 5% body weight for 8 weeks and weighed on weekly basis. Crude protein, crude fiber, lipids, ash and moisture were determined in triplicate samples of the diets and fish carcass according to methods AOAC (1999). Experimental tanks were inspected daily to remove dead fish, if any. Data on fish growth and nutrient utilization parameters were determined every week. Data obtained were subjected to one-way analysis of variance (ANOVA) and Duncan's multiple range test to compare differences between diet treatment means at 0.05 significance level.

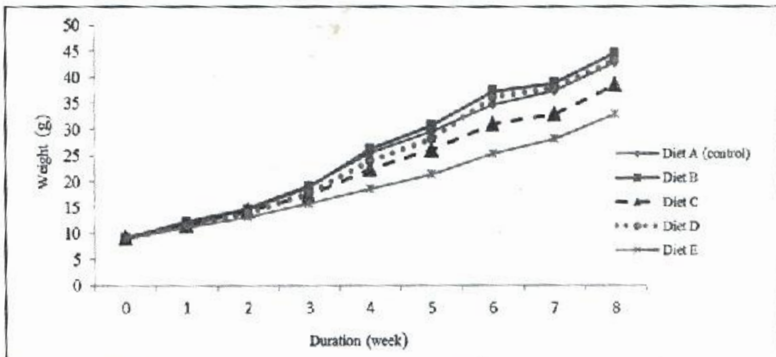

Fig. 1: Growth performance of juvenile Catfish fed I. aquatica diet inclusion.

Results

The proximate composition of experimental diets (Table 1) showed that the crude protein was highest (40.2%) in diet E and least in Diet B (38.0%). It was observed that there was increase in crude protein, lipids, moisture and fiber content as the level of *I. aquatica* increases. Ash content did not depict any particular trend but ranged between 9.43 (Diet A) and 10.46 in diet D. Rapid response to experimental diets was observed during the first week of the experiment; which gradually reduced over time. This might be as a result of minimal feeding the fish were subjected to during acclimatization. Carcass proximate composition of *C. gariepinus* after the feeding trial showed increase in carcass protein as the level of inclusion of *I. aquatica* increase while other nutrients did not follow any particular trend. Table 2 shows the growth performance, feed utilization and survival of *C. gariepinus* fed varying of *I. aquatica* based diets for eight weeks. There was no significant difference (P > 0.05) in the treatments in all the parameters measured with the exception of initial weight. Highest values were recorded in fish fed with Diet B (15% inclusion level) for final mean weight, mean weight gain, feed intake, specific growth rate, protein efficiency ratio and survival rate but had the least in feed conversion ratio. Meanwhile, in terms of final mean weight, mean weight gain, feed intake, specific growth rate and protein intake it was observed that Diet E (60% inclusion) had lowest values with highest value (1.79) in feed conversion ratio. There were tremendous growth rates in most of the treatments, Diet A, Diet B, Diet C and Diet D while it was slow in Diet E between week 0 and week 3 as shown in Figure 1. The growth was also more rapid in Diet A, Diet B, and Diet D than Diet C and Diet E between week 3 and week 8. Water quality parameters in the tank during the experimental period indicated that dissolved oxygen (DO) ranged from 6.8 to 7.6 mg/l, pH between 7.20–7.42 and temperature from 28.8°C to 29.2°C.*

Discussion and conclusion

The proximate composition of *Ipomoea aquatica* leaf meal used in the experiment revealed that the crude protein content, crude fibre and ash content were lower compared to the result of Naren et al., 1994. These differences might be due to different environmental conditions such as soil type, local varieties, and processing methods. All the experimental feeds were actively fed upon and accepted by the fish throughout the experimental period which could be as a result of palatability of the feed indicating that the levels of incorporation of *I. aquatica* did not affect the palatability of the diets.

There was no significant difference ($p > 0.05$) in all the parameters measured for growth and nutrient utilization of *C. gariepinus* fed varying levels of *I. aquatica*. This observation showed that *I. aquatica* can be supplemented for maize as high as 60% inclusion level in the diet of *C. gariepinus* without compromising growth performance. Despite this, Diet 2 (15% inclusion level) displayed superior growth performance than others. Bichi et al. (2010) reported a different trend where significant decrease in weight gain was observed when cassava leaf meal was supplemented in the diet of *C. gariepinus*. The lower growth response by fish fed cassava leaves inclusion was probably caused by reduced palatability of the diet which causes reduction in feed intake. Obasa et al. (2007) favourably replaced soybean meal with chaya leaf meal up to 20% in the diet of Nile tilapia, *O. niloticus*. Likewise, *O. niloticus* fingerlings fed diet (10% replacement of soybean) showed optimum level of growth performance (Alegbeleye et al., 2005). Leucaena seed meal was considered a good alternative raw material in substitution to soya bean meal for *C. gariepinus* fingerlings' diets at 20% inclusion level (Sotolu, 2010). The high survival rate recorded in this study indicated that feeding *C. gariepinus* with *I. aquatica* based diet does not lead to mortality of the fish. The acceptance of *I. aquatica* diets by *C. gariepinus* indicates that supplementation of maize with *I. aquatica* could be more profitable to fish farmers as maize is more expensive than *I. aquatica*, which is considered as weed.

The experiment showed that feeds were actively consumed by the experimental fish; *C. gariepinus* which brought an increase in weight. Since there was no significant difference ($P > 0.05$) among the means of the treatments, it shows that any of the inclusion level can be used up to 60% inclusion level of *Ipomoea aquatica*. However, 15% inclusion level of *I. aquatica* produced best result in terms of growth. It is therefore recommended that *I. aquatica* plant can be incorporated at 15% inclusion without compromising fish growth.

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