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GROWTH STUDIES ON *Clarias gariepinus* JUVENILES FED DIFFERENTLY FORMULATED FISH FEEDS WITH NEEM LEAF ADDITIVE CULTURED IN FIBRE GLASS TANKS

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Abstract
Studies on the growth of *Clarias gariepinus* juveniles (initial mean weights of 13.33 ±0.18g) fed four differently formulated fish diets and control were carried out in fibre glass tanks for eight weeks to assess the effect of neem leaf additive on bambara nut waste and *Mucuna* based diets. At the end of the experiment, fish fed commercial feed (E) had the highest growth response(58.33 ± 3.18g) followed by bambara nut-neem diet (C) (39.17 ± 1.41g), while fish fed bambara nut waste based diet (A) (33.77 ± 1.68g) had the lowest. The highest mean weight gain per day was observed in fish fed commercial diet (E) (0.80 ± 0.06g) followed by fish fed bambara-neem diet (C) (0.46 ± 0.02g), while bambara nut waste (A) (0.35 ± 0.01g) recorded the lowest. The highest specific growth rate (SGR) value was observed in fish fed commercial diet (E) (2.64 ± 0.10), followed by *bambara nut-neem* diet (C) (1.92 ± 0.05g), while fish fed bambara nut waste diet (A) (1.55 ± 0.07) had the lowest value. Feed intake was highest for fish fed commercial diet E (84.23 ± 11.20g), followed by *Mucuna* diet B (72.87 ± 9.21g), while fish fed *Mucuna*-neem leaf diet (C) (53.23 ± 2.84g) had the lowest. The highest feed conversion ratio was observed in fish fed bambara nut waste diet (A) 2.90 ± 0.11g), followed by fish fed bambara nut waste-neem leaf diet (C) (2.69 ± 0.12g), while commercial diet (E) (1.8 ± 0.14g) had the lowest value. All the results were significant ($P<0.05$). There was no significant ($P> 0.05$) difference on percentage mortality among the dietary treatments, which ranged from 1.67 ± 0.33 to 3.33 ± 0.67%. The result from this study indicate that, though response from neem leaf additive was low, percentage mortality was not significant. Neem leaf additive is therefore recommended in the diet of *C. gariepinus* juvenile without compromising growth performance and feed *utilization*.

Keywords: *Clarias gariepinus*, protein sources, neem additive, and growth performance

Introduction

Aquaculture is one of the fastest growing food production sectors in the world accounting for approximately 50% of fisheries products (FAO,2010), and has grown into a multi-billion dollar industry, helped to alleviate human over dependence on depleted natural fish stocks (FAO, 2006). Catfish is one of the major fish aquaculture in Nigeria, and commands high commercial value (Ogwuba, 2003). It has been advocated that *Clarias gariepinus* contributes substantially to the total fish produced under culture system in Nigeria (Aniebo *et al.*, 2009). *Mucuna pruriens*, family *Fabaceae* has been described as a multipurpose plant used extensively both for its nutritional and medicinal properties (Adepoju and Odubena, 2009). The seeds have been found to have anti-depressant properties when consumed, and it has also shown to be neuro-protective (Manyham *et al.*, 2004).The effects of these anti-nutritional factors include: dizziness, diarrhea, pathologic changes in organs, growth decrease and death (Wanjekeche *et al.*, 2003).

Bambara nut (*Vigna subterranean,* family Fabaceae) is an herbaceous legume of African origin grown primarily for human consumption (Obizoba and Egbuna, 1992). It is cheap, easily obtainable and the waste meal is either thrown away or sold at cheap price. Bambara nut waste is a by-product of bambara nut flour production. The protein content was reported to be about 24.14 % (Enyidi and Mgbenka, 2014), and carbohydrate content estimated at 60% (Mgbenka and Orji, 2014), also richer in essential dietary amino acids like lysine and methionine that is lacking in other known legumes. Feed additives are substances which are added in trace amount to diets or feed ingredients to preserve their nutritional characteristics prior to feeding, facilitate -ingredient dispersion or feed pelleting, -feed ingestion, consumer acceptability of the product or to supply essential nutrients in purified forms. Some of these additives used in feed formulation are chemical products such as hormones and antibiotics which may cause unfavorable side effects (Baruah *et al*., 2008). The use of medicinal herbs as an alternative to antibiotic growth promoters in fish feeds is becoming widely acceptable (Bai *et al.*, 2001; Adedeji *et al.,* 2008).

Neem (*Azadirachta indica*, family Meliaceae), is a green tree of potential medical value found in most tropical countries. Neem is a multipurpose tree, people consume its fruits raw or cooked and sometimes eat the young twigs and flowers as vegetable (Orwa *et al*., 2009). Neem leaf, bark and seed extracts have been used for countries in India in ethmo-medicine and ethno-veterinary medicine (Biswas *et al*., 2002). Neem leaf supplementary diets on innate immune respond in juveniles against *Vibrio harveyi* infection and serves as a possible replacement for synthetic antibiotic growth promoters (Ifeanyi and Bratte, 2015), help to reduce feed cost and reduce competition between man and the livestock industry for the available conventional feedstuffs (Muriu *et al*., 2002). In Nigeria, the bulk of feed used in fish production especially for catfish (*Clarias gariepinus*) are imported and this has led to high production cost of farmed fish (Aniebo *et al.,* 2009), constraining aquaculture development (Gabriel *et al.*, 2007). This study was carried out to assess the use of neem leaf as a phyto-additive on *Mucuna* and bambara nut based diets on the growth and feed utilization of *Clarias gariepinus* juveniles.

Materials and Methods

The experiment was carried out at the fish production unit, Department of Fisheries Technology, Federal College of Agriculture, lshiagu (FCAI), Ebonyi State, Nigeria. *Mucuna* seeds and neem leaves were obtained within the FCAI, while bambara nut waste was sourced from local market. *Mucuna* seeds were subjected to wet treatment as described by Egounlety (2003). The boiled seeds were sun dried, while neem leaves were air dried for some days, and each ground to power and sieved using 595H mesh. The ingredients and proximate chemical composition of feed were estimated by the method of Gurumoorthi *et al.* (2003). Four different diets were formulated, pelleted using manual machine and sun dried, while the fifth was control diet. One thousand (1000) juveniles *Clarias gariepinus* fish with average 13.33 ±0.18g were procured and transferred to the tanks, each held 200 fish batch weighed. Feeding trials at 5% body weight started after 24hours (Madu *et al*., 2003) and adjusted weekly in accordance with change in fish body weight (Hogendoorn and Vismanas, 1980) for 56 days. Water quality parameters were managed and maintained as recommended by Boyd (1990). Water quality parameters were taken weekly throughout the period of the experiment. Water temperature, Dissolved Oxygen (DO), pH, Total Dissolved Solids (TDS), Ammonia (NH_3) and Nitrite (NO_3) were measured using water test kit. All the data obtained from the experiment were subjected to one-way analysis of variance (ANOVA).

Results and Discussion

The result in Table 2 shows that the highest fish weight at the end of the experiment was observed in the control (commercial) diet (E) (58.33 ± 3.18g), followed by fish fed Bambara nut waste/neem leaf diet (C) (39.17 ± 1.41g), while fish fed bambara nut waste diet (A) (33.77±1.68g) had the lowest value and significant (P<0.05). Therefore, the observed best growth response from commercial diet might be due to the processing and digestibility of the feed nutrient content that reflected in the fish. It might also be because commercial feed floats unlike other test diets that happened to be fast sinking feeds, hence there were easily eaten by the fish, thereby influencing their increase. The growth response of *Clarias gariepinus* showed that the mean weight gain of catfish juveniles in this experiment significantly differed during the 56 days of the research study. The highest mean weight gain was recorded in fish fed commercial diet (E) (45.10 ± 3.20g), followed by fish fed Bambara/neem diet (C) (25.83 ± 1.32g), while fish fed Bambara nut waste diet (A) (19.57 ± 0.79g) had the lowest value. The highest mean weight gain per day was equally observed in fish fed commercial diet (E) (0.80 ± 0.06g), followed by fish fed Bambara/neem diet (C) (0.46 ± 0.02g), while fish fed Bambara nut waste diet (A) (0.35 ± 0.01g) had the lowest value. There was significant (P<0.05) difference among dietary treatments. The highest specific growth rate (SGR) value was observed in fish fed commercial diet (E) (2.64 ± 0.10g), followed by fish fed Bambara/neem diet (C) (1.92 ± 0.06g), while fish fed Bambara nut waste diet (A) (1.55 ± 0.07g) had the lowest value. The highest feed intake was observed in fish fed commercial diet (E) (84.23 ± 11.00g), followed by fish fed *Mucuna* diet (B) (72.87 ± 9.21g), while fish fed *Mucuna*/neem diet (D) (53.23 ± 2.84g) had the least. There were no significant (P > 0.05) differences among the feed intake. The highest value of feed conversion ratio was observed in fish fed Bambara nut waste diet (A) (2.90 ± 0.11g), followed by fish fed Bambara nut waste and Neem leaf diet (C) (2.69 ± 0.12g), while fish fed commercial diet E (1.80 ± 0.14g) had the lowest value. This result was significant at (P< 0.05). There were no significant (P> 0.05) differences among the dietary treatments on fish mortality which ranged from 1.67 ± 0.33% in control diet to 3.33 ± 0.67% in Bambara based diet. Table 3 shows the economic value of fish fed different fish feeds. Fish fed Bambara nut waste based diet and commercial feeds were not profitable (-N358.00 and –N2133.00 respectively) due to the cost of Bambara nut waste and high cost of commercial fish feeds. Fish fed Bambara-neem leaf based diet had the highest appreciable profit of N841.00, followed by *Mucuna*-neem leaf based diet (N510.00) and *Mucuna* based diet (N241.00). On large scale production of the fish using the same feed treatments, while management cost remain low, the locally formulated fish feeds will eventually bring in more profit to the fish farm business due to the low cost of locally formulated fish feeds as a result of local materials incorporated into the feeds.

Conclusion

There were significant differences (P<0.05) observed in all the dietary treatments from the analysis of growth studied. In other to meet the demand for fish, the development of cheap, balanced and nutritional adequate diets are required; *Mucuna* seed and Bambara nut waste are cheap to procure, has considerable protein, minerals and vitamins, amino acid and the anti-nutritional factors of *Mucuna* seed can easily be removed by boiling. Also the growth rate parameters and economics analysis of diet fed to *C. gariepinus* using Bambara nut have also proven to be nutritive source of protein and a good replacement for soybean meal in formulating aqua feed for *C. gariepinus* juveniles without deleterious effect. However, on large scale fish production, while management cost remain low, the locally formulated fish feeds will eventually bring in more profit to the fish farm business due to the low cost of locally formulated fish feeds as a result of local materials incorporated into the feeds.

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Table 1: Feed Composition

Ingredients	**Bambara**	***Mucuna***	**Bambara/Neem Leaf**	***Mucuna*/Neem leaf**
Fish meal	19	19	19	19
Blood meal	17	17	17	17
Bone meal	1	1	1	1
G.N.C	9	9	9	9
Bambara nut waste	32	-	27	-
Mucuna seed	-	32	-	27
Neem leaf	-	-	5	5
Starch	4	4	4	4
Palm oil	3	3	3	3
Maize	10	10	10	10
Salt	0.5	0.5	0.5	0.5
Vitamin premix	0.5	0.5	0.5	0.5
Methionine	2	2	2	2
Lysine	2	2	2	2
TOTAL	100	100	100	100

Crude protein Bambara based feed=40%; *Mucuna* based feed=44%; Bambara-Neem leaf based feed =40% *Mucuna*-Neem leaf based feed = 43%

Table 2: Growth performance of *Clarias gariepinus* fed differently formulated feeds

Parameter	A Bambara Nut waste	B *Mucuna*	C Bambara Nut waste/ Neem leaf	D *Mucuna*/ Neem leaf	E Commercial feed
Initial wt (g)	13.20 ± 0.20	13.33 ± 0.33	13.00 ± 0.00	13.00 ± 0.00	13.23 0.23
Final wt (g)	33.77 ± 1.68^{b}	36.66 ± 3.71^{b}	39.17 ± 1.41^{b}	37.63 ± 0.61^{b}	58.33 ± 3.18^{a}
Mean wt gain (g)	19.567 ± 0.79^{b}	23.33 ± 3.38^{b}	25.83 ± 1.32^{b}	24.63 ± 0.56^{b}	45.10 ± 3.20^{a}
MWG/D	0.35 ± 0.01^{b}	0.42 ± 0.06^{b}	0.46 ± 0.02^{b}	0.44 ± 0.01^{b}	0.80 ± 0.06^{a}
S G R	1.55 ± 0.07^{b}	1.79 ± 0.14^{b}	1.92 ± 0.06^{b}	1.88 ± 0.01^{b}	2.64 ± 0.10^{a}
Feed Intake (g)	56.76 ± 3.46	72.87 ± 9.21	69.70 ± 5.51	53.23 ± 2.84	$84.23 \pm 11.$
F C R	2.90 ± 0.11^{c}	2.63 ± 0.09^{c}	2.69 ± 0.12^{c}	2.16 ± 0.10^{b}	1.80 ± 0.14^{a}
Mortality (%)	3.33 ± 0.67	2.67 ± 0.67	2.33 ± 0.67	3.00 ± 0.57	1.67 ± 0.33

Mean within the same column with different superscripts are significantly different ($P<0.05$)

Table 3: Economic analysis of production cost and income (N) of fish fed 15kg fish feed/treatment

Parameter	Bambara Nut waste	*Mucuna*	Bambara Nut waste/ Neem leaf	*Mucuna*/ Neem leaf	Commercial feed
Feedstuff, processing (N)	N550.00	550.00	415.00	425.00	50.00
Other feed ingredients	N1500.00	1500.00	1500.00	1500.00	8500.00
200 fish seeds	N4000.00	4000.00	4000.00	4000.00	4000.00
Management cost	N500.00	500.00	500.00	500.00	500.00
Production cost	N6550.00	6550.00	6415.00	6425.00	13055.00
Income	N6192.00	6791.00	7256.00	6935.00	13050.00
Profit/Loss	(358.00)	241.00	841.00	510.00	(2133.00)