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Response of Genetically Improved *Heterobranchus Longifilis* Juveniles to Different Diets Containing Beniseed Meal and Extruded Soybean Meal

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ABSTRACT: Three isoproteic 35% crude protein diets were formulated with same basal ingredients and ranging levels of extruded soybean, beniseed and yellow maize meals and fed at 5% body weight to groups of genetically improved *Heterobranchus longifilis* juveniles of mean weight 79.57± 0.365g in nine out door concrete tanks each measuring $2x2x1m^3$. The tanks were filled to 2/3 of their holding capacity with water fertilized with poultry manure 2 weeks prior to the commencement of the experiment. Growth and nutrient utilization indices; %Weight Gain (WG), Specific Growth Rate (SGR), Feed Conversion Ratio (FCR) and Protein Efficiency Ratio (PER), and water quality parameters; pH, Dissolved oxygen and Temperature were monitored for 56 days. The best growth and nutrient utilization values were observed in beniseed based diet with a significantly high values ($P \leq 0.05$) for WG, SGR FCR, and PER. The high methionine content of beniseed meal coupled with the abundant lipids having a good array of polyunsaturated fatty acids were suggested as possible reasons for the better growth performance of the beniseed based diet. *@JASEM*

Fish feed account for about 70% of aquaculture operation (FAO, 1983) and most fish farmers in Nigeria do not make use of standard fish feeds due to high cost (Eyo, 1995). Fish feeds were developed on the concept of `fish eat fish', which is why fishmeal is often a traditional component of fish feeds. However, in recent times, the cost of fishmeal has made scientists to suggest the possibility of replacing plant protein feedstuff in fish feed production to reduce cost of producing the feed and the cost per kilogramme of produced fish weight (Falaye, 1992). Among the potential plant protein feedstuffs are soybeans and beniseed with crude protein ranging from 24 - 48 percent, crude lipids 15.0 - 50 percent, and very high nitrogen free extract (NFE) (Shiau *et al.,* 1990, Aduku and Olukosi, 1991). Both are abundantly produced in Nigeria especially in the guinea savannah region of Benue and Oyo States.

Catfish is highly relished in Nigeria because of its fast growth and the high taste value of the fish (Oladosu *et al.,* 1994). The wild and the local fingerlings do not grow as fast as those that have been improved genetically through manipulations and this is a major constraint to rapid development of aquaculture industry and stock management in Nigeria (Aluko, 1994). The aim of the study is to determine the response of genetically improved *Heterobranchus longifilis* juveniles to diets containing beniseed and extruded soybean meals. In order to achieve this, the proximate composition of beniseed was determined as well as valuation of the growth performance and nutrient utilization of the genetically improved catfish on diets formulated with both plant protein sources.

MATERIALS AND METHOD

Feedstuffs used in the study were yellow maize grains, extruded soybean meal, groundnut cake, fish meal (clupeid), beniseed, blood meal, cod liver oil, bone meal and vitamin and mineral premixes. The genetically improved *Heterobranchus longifilis* juveniles were obtained from the NIFFR genetic laboratory. The clupeid fish were sun dried and milled to fine particles. Soybean seed was extruded at temperatures ranging from 135-140^oC and 30-40 bar pressure (Eyo *et al*, in press). The beniseed was toasted in an electric oven at 100^oC for one hour in the laboratory to destroy antinutritional factor especially Trypsin inhibitor, which is destroyed by heat treatment (Eyo 2001). The blood meal was prepared by first cooking the scarlet bovine blood in an aluminum pot to extract the serum and the black semisolid left over was sun dried and incorporated in the feed as blood meal.

All ingredients except the cod liver oil, common salt, vitamin and mineral premix were milled together with hammer milling machine to obtain fine particulates, which was incorporated in the diets at various levels of inclusion as shown in Table 1. The crude protein content of the diets were kept essentially at the 35% level since this was determined as the protein requirement of juveniles catfish hybrid in a previous experiment (Eyo and Falayi, 1999) Each diet was first mixed dry and later with just enough warm water to obtain homogenous hard-paste

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mixture (dough) in a pelletizer and rolled out into flat tray through 2mm die disc holes in different lengths. The pellets were dried in electric oven at 105°C for 2 hours. 100g samples of each diet was put in sealed sampling bottles and sent to the laboratory for proximate analysis and the bulk was put in sealed polythene bags for feeding trial.

Ninety juveniles of genetically improved *Heterobranchus longifilis* with mean weight 79. 57± 0.365g were acclimatized for 48 hours and arranged in groups of 10 homogenous fish. Each juveniles group was stocked in triplicate in nine concrete tanks each measuring 2x2x1m^3 located outdoors. The fish were stocked in water fertilized with poultry manure 2 weeks before the commencement of the experiment. The fish were starved for 48 hours to empty their gastro-intestinal tract before the feeding trial. Fish were fed at 5% body weight daily (2.5% in the morning (7-8am) and 2.5% in the evening 5-6 pm, local time) throughout the duration of the experiment.

Fish sampling: Fish sampling were done biweekly. Beach seine net was used to trap the fish and weighing was conducted with sensitive top loading balance.

*Physico-chemical parameters***:** Water samples were collected weekly for analysis of Temperature, Dissolved Oxygen (D0), pH and conductivity parameters using the APHA (1990) methods.

Table 1: Composition of experimental diets and the proximate analysis.

	Inclusion in diet			
Ingredient	Diet 1 (g)	Diet 2 (g)	Diet 3 (g)	Beniseed meal
Fish meal	10.3	10.3	10.3	
Extruded soybean meal	27.8	-	13.9	
Beniseed meal	-	51.0	25.5	
Blood meal	8.1	8.1	8.1	
Groundnut cake meal	21.8	21.8	21.8	
Yellow maize meal	27.8	4.6	16.2	
*Vitamins/mineral mix	1.0	1.0	1.0	
**Cod liver oil	2.0	2.0	2.0	
Bone meal	0.5	0.5	0.5	
Common salt	0.5	0.5	0.5	
Chemical Composition				
% Moisture	5.5	5.6	6.6	3.5
% Ash	6.3	7.4	7.7	7.7
%Lipid (Ether Extract)	16.4	31.4	31.7	51.0
%Crude protein	35.6	34.2	34.9	25.3
%Crude fibre	2.1	3.1	2.9	3.8
Nitrogen Free Extract (N.F.E)	32.9	11.1	13.6	8.5
Gross Energy (Kcal/kg)	2837.7	3906.4	3371.4	4971.0

* Vitamins and minerals supplied as follows (mg/kg) of Premix). Riboflavin 6,000; Pyridoxine 24,000; Folic acid 12,000; Manganese 60,000; Iron 40,000; Copper 5,000; Choline 30,000; Selenium 100; iodine 1,100; Ascorbic acid 25,000; antioxidant 125,000; Vitamins A, D, and E were added at 350,000, 130,000 and 7,500 I.U./Kg respectively.
** Cod liver oil supplied per 10ml: Vitamin A, 7,000I.U; Vitamin D, 800 I.U; Vitamin E, 1 I.U.

Feed utilization parameters: The feed utilization parameters namely; specific growth rate (SGR) feed conversion ratio (FCR), protein efficiency ratio (PER) and survival were determined by the methods of Olvera Novoa *et al.*, 1990.

Chemical analysis: The proximate compositions of beniseed and feed samples were determined according to AOAC (1990) methods.

Statistical analysis: The biological and chemical data obtained were subjected to the statistical analysis of Variance (ANOVA) and where there was significant difference, the difference in mean were ascertained by use of Duncan Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

The weekly mean water quality parameters: Temperature (°C), Dissolved oxygen (D.O), pH and conductivity were 28.62°C, 2.21mg/l. 7.55 and 107.5 µmho/l respectively, (Table 2) and were within those recommended by Boyd and Lichtopher (1990) for warm water fishes.

The proximate composition of the experimental diets and that of beniseed meal are shown in Table 1. The crude protein content of the three diets was similar but higher than that of the beniseed meal. The crude lipids and crude fiber were higher in beniseed meal with 51.00 and 3.90 percent respectively. The NFE was highest in diet I with extruded soybean meal (27.84 percent) and highest inclusion of yellow maize (27.84 percent). The result of the proximate composition of beniseed meal is comparable to that reported by Aduku (1992), Aduku and Olukosi (1991). The high gross energy of the beniseed meal compared to those of the experimented diets is a reflection of the high lipid content of the meal.

The growth performance and nutrient utilization indices measured are summarized in Table 3. There was no statistical difference ($P \geq 0.05$) in the initial mean weight of the fingerling However, difference were observed in the final mean weight of the fingerlings with diet 2 recording the highest final mean weight which was statistically significant ($P \leq 0.05$). The FCR was lowest in diet 2 ($P \leq 0.05$) which indicate more efficient utilization of the diet by the fingerlings. The SGR was highest in diet 2 and this was significantly different from that of the control (diet 1) ($P \leq 0.05$) but not different from that of diet 3 ($P \geq 0.05$). The PER was also highest in diet 2 (P= 0.05) indicating better utilization of protein for growth in fingerlings fed the diet. There was no mortality during the experimental period, which was attributed to the maturity of the juveniles, which enabled them to withstand stress during weighing, and the congenial water environment In general, Diet 2 with higher beniseed meal (51.04 %) gave the best in % weight gain (WG); specific growth rate (SGR), feed conversion ratio (FGR), and protein efficiency ratio (PER), which was significantly different (P= 0.05) in comparison to Diet 1. The result did generalize the findings of Fashakin and Balogun (1998) that relatively low fiber, high protein and fairly high lipid contents enhance fish growth and better utilization of diets.

Table 2: Bi-weekly water quality parameter of the concrete tanks.

Parameters	2 weeks	4 weeks	6 weeks	8 weeks	Mean
Temperature ^{o}C	29	29	28.5	28	28.6
Dissolved oxygen	2.20	2.10	2.25	2.30	2.21
pH	7.50	7.50	7.60	7.60	7.55
Conductivity	100	110	110	110	107

Table 3: Growth, feed utilization and % survival rate of cultured fish reared in concrete tanks

Treatment	Initial mean weight (g)	Final mean weight (g)	Mean weight gain %	Food conversio n ratio (FCR)	Specific growth rate (SGR%)	Protein Efficiency Ratio (PER)	Daily weigh gain (g)	% Survival rate
1	79.16^{a}	182.08^{a}	138.86^{a}	2.35^{a}	1.48^{a}	1.22^{a}	1.84^{a}	100
2	79.71^{a}	248.90^{b}	212.26^{b}	1.75^{b}	2.05^{b}	1.63^{b}	3.02^{b}	100
3	79.85^{a}	210.48^{ab}	163.59^{ab}	2.13^{ab}	1.73^{ab}	1.34^{ab}	2.33^{ab}	100

Figures followed by the same letters in each column are not significantly different (P>0.05)

The result further indicated the presence of better growth factors in Diet 2, which could be attributed to the presence of essential nutrients in beniseed meal. Beniseed meal has been reported to have high methionine content (Seegler, 1989). It has been shown that soybean, which form the basal ingredient in diets 1and 3 are deficient in methionine (Eyo 2001). This may give diets formulated with high levels of beniseed better nutritive value than the high soybean diet. Furthermore, the lipid content of beniseed which contain high linoleic acid, an essential fatty acid, (Seegler, 1989) may have contributed to the rapid growth of the fish. The high polyunsaturated fatty acid content of groundnut cake was found to add to its nutritive value (UNDP/FAO, 1983). Shepherd and Bromage (1992), and Rebecca *et al.,* (1995) affirmed that fish utilizes lipids for energy, for cellular structure and for maintenance of the integrity of biomembrances and that neutral fat are far the most important members of the lipid groups in nutrition and cellular physiology in fish. Catacutan (1991) revealed that homoeothermic animals have dietary requirements for essential fatty acids i.e. fatty acids with a double bond (unsaturated) in the ω-6 position, counting from the methyl end of the fatty-acid chain. From the standpoint of practical fish culture, dietary lipids are an important source of energy and the only source of essential fatty acids (EFA) in fish and are different from species to species and from age and size (Shepherd and Bromage 1992).

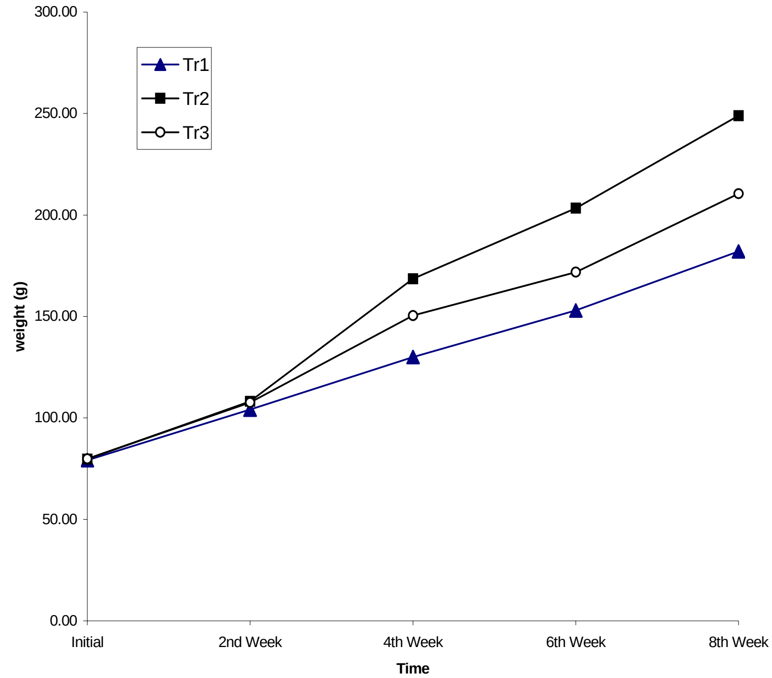

Fig. 1: Growth performance of genetically improved *Heterobranchus longifilis* juveniles fed with different experimental diets.

Although the fatty acid profile of beniseed meal was not determined in this study, the presence of essential fatty acids in beniseed reported in literature could also lead to the improved growth of fish fed beniseed based diets. Further research will be carried out to support the validity of this inference. There was no mortality among the experimental fish in the tanks indicating that the environmental conditions in the tanks were suitable for the raising of these catfishes. This was supported by the exceedingly fast growth rate exhibited by these juveniles during the duration of this experiment.

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