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Effect of different dietary protein sources on the growth performance of *clarias gariepinus* fingerlings

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ABSTRACT
Growth performance and body composition of catfish (*Clarias gariepinus*) Fingerlings fed diets containing different protein sources (maggot meal (T_1), crayfish dust meal (T_2), fish meal (T_3), blood meal (T_4), soybean meal (T_5), a combine protein sources (T_6), at a level of 45% were studied for a period of 42 days. Fish fed diet containing maggot meal and fish meal as protein concentrates showed the maximum weight gain, highest daily growth and specific growth rate of 0.80% 3.33, 3.53. Respectively. The optimal body condition (0.76) was observed for maggot meal. The diets containing soybean and the combined protein sources did not show any significant different ($p<0.05$) between each other. The blood meal diet showed the least value of daily growth rate (0.03), specific growth rate (2.16), feed conversion ratio (11.10): net protein retention (NPR) (87.67), while the diet containing crayfish dust showed the highest net protein retention (NPR = 101.78). The result did not differ significantly among soybean and combined protein sources ($p>0.05$). While maggot meal and fish meal based diets perform better when compared with soybean and combined protein sources. Fish fed with all diet containing protein sources did not show any significant different ($p>0.05$) in their body moisture and fat contents. The study indicated that the sources of protein used in the diet affected the crude protein ash content of fish ($p>0.05$) and also revealed that protein source from fish meal, maggot meal and crayfish dust at the 45% level of inclusion can be utilized in the diet of *Clarias gariepinus* fingerlings to achieve optimal growth performance.

Keywords: *Clarias gariepinus*, fingerlings, protein sources, growth performance.

1. Introduction
In recent, there have been several reports on the prevalence of protein malnutrition in Nigeria. This could be addressed among other ways by increasing the per capital fish production through extensive action programmes for intensive fish culture. To achieve this in aquaculture industry, the encouragement of supplementary feeding practice with well formulated feed stuff of optimum level of crude protein and energy can be a panacea. It has been reported that weight gained in fish fed with supplementary feed is 3 to 4 times more than may gained on natural feed. Feeding is a major aspect in fish farming, and the need to meet the fish nutrition requirement is a great task that should be overcome by fish farmers in order to acquire desired goal. These, in recent times have led fish farmers to rely on imported feeds for their animals. It therefore becomes absolutely necessary to explore the sources of materials that will be available to boost and increase food conversion efficiency of the cultured fish. Current studies on fish nutrient requirement are conducted in other to improve the quality of fish feed and to achieve high production of attractive table fish with low inputs. Madu *et al.* 2000 study six types of feed to be able to recommend one suitable for the growth of catfish fry. They discovered that the fish feed with lysine and methionine produced better result than those with only fish meal and vegetable oil. The latter treatment (i.e. Fish meal and Vegetable Oil) caused weight loss in specimens which lead to weight reduction of the fry.
Cruz and landencia, (1976) studied the protein requirement of *Clarias batrachus* that were fed for 70 days with diet containing 20-45% crude protein. The results indicated that rations containing 35.65 and 37.72% crude protein gave optimum weight gain with better feed conversion. They also determined the effect of feeding rates on growth feed conversion and nutrient absorption of

the channel catfish (*Ictalurus punctatus*). Feeding efficiently was improved by reduction of the feeding rate to 90 and 75% instead of the control level (100%). To determine the protein requirement of *Tilapia zilli*, Mazid, *et al* (1979) exposed the species to six purified isocaloric casein diet, containing 21-53% crude protein. The result indicated that *Tilapia Zilli* requires about 35% protein diets for optimum growth. Fish has need for a balanced meal containing protein, carbohydrates, liquids minerals and vitamins for growth, maintenance and other physiological activities as other vertebrates. These nutrient are derived from the organism that they feed on their other environment but in extensive fish farming their natural food cannot be sufficient because of severe competition.

To ameliorate the situation, extra food in the form of supplementary feeds are necessary for fish to attain table size in a shorter culture period.

This supplementary feed should meet the nutrient needs of the fish at all developmental stages of their growth (Faturoti and Akinbite 1986; Ayinla and Akande, 1988; Degani, *et al*, 1989; Lall, 1991; Eyo 1996; and Madu *et al* 2001).

In this study, we assessed the effect of six raw material- sources containing 45% protein each on the growth of *C. gariepinus fingerlings* and their influence on the body composition of the species. These results are expect to provide date on possible alternative source of feed stuff for the fish farmer in particular and food nutritionist in general.

2. Material and Method

2.1 Preparation of Experiment Diets

Six experiment diets were formulated with crude proteins components from different sources (Soybean, Cow Blood, Fish, Crayfish dust and Maggot) as presented in Table1. All the component, were purchase from the local market except Maggot that was cultured in the Maggotory using cow blood from abattoir and decomposed fish. All the fed stuff were dry – milled and sieved to fine particle size (250–400 um) prior to analysis according AOAC method (AOAC 1990). The ingredient used and nutrient compositions of experiment diets expressed in g/100 are shown in the Table 1. The proximate compositions of the protein component are presented in Table 2.

2.2 Experimental Facility and Production

Clarias gariepinus fingerlings with an average weight of 1.2085 g were collected from the fish hatchery in Eket in Akwa Ibom State, Nigeria. The initial weight and nutrient composition of a sub sample of the fish were determined, 110 fish were divided into six groups (15 fish each) and stocked in glass aquaria (2 x 1 x 1) m^2 filled with well aerated fresh water (average temperature 28±1 ^{0}C). Daily monitoring of the water quality was carried out for temperature pH, dissolved oxygen, and ammonium nitrate and nitrate levels. These were maintained at the tolerante limit for *Claria gariepinus.*

2.3 Application of Feeds

The experimental fish were acclimatized for 1 week and later fed at the rate of 5% body weight, three (3) times daily for 42 days.

2.4 Data Analysis

The weekly data obtained were analyzed to determine significant effect of treatment on growth of the fish .feed conversion ration (FCR) daily growth rate (DRG), specific growth rate (SGR), condition factory (k) net protein retention ration (NPR) were computed:

$$FCR = \frac{\text{Qty of feed consumed (g)}}{\text{Weight gained (g)}}$$

$$DGR\ (g/day) = \frac{\text{Final weight (g) – initial weight (g)}}{\text{Numbers of days}}$$

$$SGR = \frac{\text{Final weight – in initial weight}}{\text{Time (days)}} \times \frac{100}{1}$$

$$NPR = \frac{\text{Increased in carcass protein}}{\text{Protein fed}} \times \frac{100}{1}$$

The condition fact (k) was calculated according to the equation:

$$k = [Wg \div L(cm^3)] \times 100$$

Where w; is the wet weight of the fish in grams and L; is the length of the fish in centimeters. Analysis of variance technique was also used in testing the data and the Mean were compared by Fisher's LSD test according to Nedecor and Cochran (1989).

3. Result

The result of the growth and nutrient utilization in *Claria gariepinus* fingerlings fed different protein component are presented in table 3. The fish fed diets containing maggot meal (T1) as protein source showed the maximum weight gain and the best specific growth rate (SGR) in comparison with all other diets. The lowest weight gain and SGR was observed in the fish fed diet containing blood meal. The diet containing soybeans meal, blood meal and combined protein T6 showed significant difference ($p>0.05$) in the growth performance of the fish ($p>0.05$). The body condition factor of the fish fed diet containing maggot meal (T2) and fish meal (T2) gave the highest growth performance (T3), followed by diet containing blood meal (T5) and soybeans (T3). Meal and crayfish meal, the least in performance.

However, there is no significant different in the total feed consumption of the fish ($p<0.05$) among the treatments. The feed conversion ratios (FCR) values differed significantly ($p<0.05$) but was optimal with diet containing blood meal and poorest in fish meal based diet. The Net protein retention was high in fish in all treatments. Although the diet containing crayfish meal (T3) was highest (101.78). However the result did not differ significantly between the soybeans and combined diets (T5, T6). ($P>0.05$) with lower values. The data on the body composition of the fish fed different protein components are presented in Table 4. Significant different were observed in the crude protein, fat, ash and nitrogen free extract ($p<0.05$). The crude protein content of the fish fed diet containing fish meal was the highest while diet containing crayfish dust meal, maggot meal, soybeans and combined meal did not show any significant different between their crude protein contents ($p>0.05$). The result of the body fat content was inversely related to the crude protein content. The fish fed diet containing blood meal showed the highest fat content. This could be as a result of variation in the protein content of the diet component. The best growth performance was obtained from the maggot and fish meal containing diets (T1 & T3 respectively), whereas the blood meal diet showed the poorest performance. The diet containing soybeans and combined protein source did not show any significant different between their Crude protein contents ($p>0.05$). The fish fed diet containing Blood meal showed the highest fat content.

Table 1: Ingredient and nutrient composition of experimental diets (g/100)

Diets Treatments						
Ingredients	**T1(g)**	**T2(g)**	**T3(g)**	**T4(g)**	**T5(g)**	**T6(g)**
White offal	13.50	13.50	13.50	13.50	13.50	13.50
Yellow Maize	13.50	13.50	13.50	13.50	13.50	13.50
Maggot meal	63.00	-	-	-	-	12.60
Crayfish meal	-	63.00	-	-	-	12.60
Soybean meal	-	-	63.00	-	-	12.60
Fish meal	-	-	-	63.00	-	12.60
Blood meal	-	-	-	-	63.00	12.60
Vitamin mix	2.00	2.00	2.00	2.00	2.00	2.00
Mineral mix	2.00	2.00	2.00	2.00	2.00	2.00
Oil palm	1.50	1.50	1.50	1.50	1.50	1.50
Naol	0.50	0.50	0.50	0.50	0.50	0.50
Bone meal	2.00	2.00	2.00	2.00	2.00	2.00
PKC	2.00	2.00	2.00	2.00	2.00	2.00

Nutrient Content (**Dry Weight Basis**)						
Moisture (%)	39.11	29.01	36.71	35.05	38.19	40.11
Crude protein (%)	48.88	45.00	50.75	49.00	44.50	45.50
Crude fibre (%)	16.67	8.67	10.00	11.67	10.00	16.00
Crude lipid (%)	5.71	5.71	5.40	7.35	6.67	4.35
Ash (%)	5.32	5.31	3.20	4.36	7.03	6.29
NFE	32.42	35.31	28.31	27.62	21.80	33.36

NFE: Nitrogen Free Extract = 100 – (Crude protein % + crude fibre % + crude lipid % + Ash %), PKC = Palm Kernel Cake.

Table 2: Proximate composition of different protein components (g/100)

Protein Components					
Parameters	**Maggot**	**Crayfish**	**Fish**	**Soybean**	**Blood**
(%)	Meal	dust meal	meal	meal	meal
Dry matter	30.18	25.11	35.04	37.15	29.10
Crude Protein	81.26	43.08	83.04	39.89	87.46
Ether Exact	1.56	19.26	2.88	20.07	1.20
Ash	7.38	4.88	6.88	5.0	5.98
Crude fibre	-	5.73	-	4.61	0.36
Nitrogen fibre	9.80	27.05	6.82	30.43	4.00
Extract					

Table 3: Growth performance and nutrient utilization in *Claria gariepinus* Fingerlings fed diets of different protein sources. (g/100)

Parameters	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**SE**
Initial weight	1.20	1.21	1.20	1.21	1.21	1.21	±0.00NS(g)
Final weight	4.58	3.33	4.48	2.47	2.53	2.69	±1.23*
Total weight gained (g/day)	3.38	2.12	3.28	1.26	.1.32	1.48	±0.53*
Daily growth rate (g/day)	0.06	0.04	0.07	0.03	0.03	0.04	±0.02NS
Specific growth rate (%day)	3.33	2.56	3.53	2.16	1.95	2.43	±0.52*
Survival rate (%)	80	93.3	86.7	86.7	80	80	±0.86*
Condition factor (k)	0.76	0.72	0.76	0.73	0.73	0.70	±0.01NS
Total feed consumed (g)	37.85	38.09	37.83	38.22	38.22	38.22	±0.07*
Feed conversion ratio (FCR)	7.48	8.92	6.97	11.10	10.75	9.81	±1.03*
Net protein retention	95.79	101.78	93.91	87.67	97.75	97.69	±2.58*

T_1- T_6 = diet treatment T_1 to diet treatment $T_{6,;}$ SE = standard Error. NS = Not Significant.
Mean values with different superscripts in each were significant * ($p<0.05$).

4. Discussion

The results of the present study indicates that *Claria gariepinus* fingerlings exhibited optimal growth with diet protein at 45% level. The level of protein component adopted in this study were based on conclusions drawn by various workers (Cruz and Landencia 1976; Dabrowski and Kozak, 1979, Cho *et al* 1985; and Millah *et al*, 1973) this confirms that fingerlings of catfish and fish generally require protein in order to attain optimal growth. The mean Daily Growth Rate observed in diet with fish meal was the highest among the protein components. This could be as a result of variation in the protein content of the diet component. The optimal growth performance was obtained from the Maggot and fish containing diets (T1 and T3 respectively), whereas the blood meal diet showed the poorest performance, difference in their efficiency of utilization ($p>0.05$). However, crayfish dust meal showed a significant difference when compared with diets containing soybeans, Blood meal and combined protein sources. The results obtained in this research are comparable with the work by Shalaby, *et at.* (1989). They reported that wheat, Maize, and Rice could increase the growth performance of common carp more grain by-product. The preset study reveals that, Fish, Maggot and crayfish dust meal can improve the growth performance of *Claria gariepinus* more than the Blood and Soybeans based diets when used as protein sources. The protein level used in this study is in agreement with the report of Stinckney (1979). He indicated that young rapidly growing animals may need more protein than the older ones, while breeding animals may require high level during gamete formation than during period of reproduction activity. He noted that channel catfish *(Ictalurus punctatus*) fingerlings require diets containing 25 – 35 % whereas at fry stage is requires 50% protein level.

The least growth performance from Blood meal based diets (T4) observed in this study could be attributed to the nature of the sample used based on the common knowledge that proteins are easily denatured and rendered ineffective. The knowledge of the body composition of fish in this study and factors affecting it, enables the assessment of fish health, determination of efficient transfer of nutrient from the feeds to the fish and make it possible to predict and modified carcass composition. The results of the body composition of fish in this study (Table 4) are in accordance with Shearer (1994). The fish fed diet containing fish meal showed significantly lower body moisture, but higher protein and Ash content compared to other protein sources. The diets containing Maggot, crayfish dust, soybeans, Blood meal and combined sources did not have significant impact on the body composition of the fish. The nature of the Protein source did not affect the crude protein, fat and ash contents of fish except in fish meal (fat=10.21%) which is lowest. Similar results have been reported by Anderson et al. (1984) and Al – Asgah & Ali (1994) for *O. niloticus* and Degani, Viola & Levanon (1986) for young eels, *Anguilla Anguillia* L. The results of this present study suggest that protein source at the 45% level can be efficiently utilized in *Clarias gariepinus* diet and that fish, maggot and crayfish dust meal are preferred protein based components for formulating diets for *Clarias gariepinus* fingerlings.

5. Conclusion

Based on this study, the best protein sources with regards to Growth performance, Body Condition factor, Fed Conservation Ratio as well as Daily Growth and Specific Growth rate were observed in Fish Meal (T3) and maggot meal (T1), Followed by crayfish dust (T2). The best growth performance per individual fish and best achievement in all growth parameter measured were obtained in fish diets containing Maggot and Fish meal as protein sources.

Maggot meal and fish meal had no significant effect on the survival rate of fish. However, further investigations on protein source and its effect on the size of fish produced is recommended. In addition, the effect of different protein sources on water quality parameters of farmed fish could be beneficial to fish farmers and fish nutritionist

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