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Evaluation of Poultry Feather Meal as a Dietary Protein Source for *Clarias Gariepinus* and *Heterobranchus Bidorsalis* Hybrid

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ABSTRACT

The effect of supplementing soya bean meal with feather meal was investigated to determine diet acceptability and growth performance of Heteroclarias species. The fishes were divided into six treatment groups containing three fishes per replicate basin. The groups were control (0% FEM), 2.5% FEM, 5% FEM, 7.5% FEM, 10% FEM and 12.5% FEM. Acceptability was calculated using the ‘‘time to strike index’’. The weight and length of fishes were measured weekly. The specific growth rate, food conversion ratio, condition factor and percentage weight gain were derived. There was no significant difference (P>0.05) in acceptability in all the dietary types. The increase in weight and length in all dietary types was not significantly different (P>0.05). There was also no significant difference (p>0.05) in SGR, FCR and K- Factor in all dietary types at the end of the study. Increasing levels of feather meal inclusion within the diets reduced the percentage weight gain. Only catfishes fed 12.5% FEM differed significantly (P<0.05) from the control (0% FEM). The results suggest that feather meal can replace up to 10% of soya bean meal in diets for Heteroclarias species.

Keywords: *Catfish, Heteroclarias species, feather meal diet, Soya bean meal, acceptability, growth performance.*

1. INTRODUCTION

The aquaculture sector in developing nations is confronted with the problem of high cost and irregular supply of conventional fish feed ingredients. Omitoyin (1995) observed that majority of feed ingredients required for animal feeds can be met by using agro-industrial waste products. In Nigeria, many semi-intensive farmers particularly in the rural and peri-urban cities are faced with the problem of availability of cost effective fish feed. In other to solve this problem, many of these fish farmers feed their fish directly with feather meal in addition to other forms of supplementary feed. Since the growth, development and reproduction of fish takes place at the expense of the energy derived from food, the practice of supplemental feeding of fishes and the improvement of the quality of fish diets production should be of great importance. The desire of every fish farmer is to produce table sized fish within the shortest possible time. Long term success in meeting this goal and having an all-year round supply of fish depends on the ability of the farmer to control the entire life cycle of the fish. This desire is met by two popular cat fish species of the genera *Clarias* and *Heterobranchus*. *Clarias gariepinus* occupies a unique and prominent position in commercial fisheries in Nigeria because of its ability to be tasty, hardy as well as tolerant to poor water conditions. It is also capable of reproducing in captivity and growing to a size of about 7.0 kg (Idodo-Umeh, 2003). In addition, it has an efficient feed conversion ratio in the males and as such attracts high market price. Similarly, *Heterobranchus bidorsalis* is also important in growing to a size of 14.0 kg but not as hardy as Clarias (Idodo-Umeh, 2003). Aquaculturists have been able to harness the qualities of these two species by cross breeding them to produce a hybrid referred to as *Heteroclarias*, which is hardy and grows to a large size. According to Dada and Madu (1996) the high performance of *Heteroclarias* over their parental stock could be attributed to improved hybrid vigor. This finding corroborates earlier reports on *Heteroclarias* (Madu and Ita, 1990). Cho et al. (1974), Reinitz (1980), Reinitz and Hitzel (1980) have all used soya bean meal as a substitute for fish meal in diets fed to rainbow trout with encouraging result. According to cited studies, soya bean is a good alternative because of its reasonable cost, high protein contents and abundant supply. Eyo and Ezechie, (2004), worked on the effect of rubber seed meal based diets on the growth performance of *Heterobranchus bidorsalis* and *Clarias gariepinus*. They reported that 10% and 20% levels of substitution of cornmeal with rubber seed meal gave better weight gains and growth rates when compared to the control diets and other dietary types. Garling and Wilson (1976) observed that the channel catfish (*Ictalarus punctata*) grew well when fed diets containing 24% crude protein and energy level of between 275-341 kcal/100g of diets. Tacon and fern (1976), worked on activated sludge from domestic waste with some degree of success. Eyo (2005) has successfully utilized maggot meal as a substitute for soya bean meal. He reported that the best acceptable diet was 100% soya bean meal being replaced with maggot meal and that one would have expected the best acceptable diet to produce the best weight gain but the reverse was the case. He thereby concluded that 10% inclusion of maggot meal tends to benefit maximally in net returns on

investment through low cost of feeding, better growth rate and improved profits. *Heteroclarias* was used for this research because it has better growth performance than both parents. Hybridization was essential because *Heterobranchus bidorsalis* does not have the same high survival rate as *Clarias gariepinus* and *Clarias gariepinus* does not grow as large and quick as *Heterobranchus bidorsalis*. The blending of high survival rate and fast growth rate into the hybrid "*Heteroclarias*" offers higher production prospects. Poultry feather meal was used as the protein source because it is a cheaper source of protein and by using it helps in recycling of poultry by- products.

2. MATERIALS AND METHOD

2.1 Procurement of Experimental Catfish

Seventy *Heteroclarias* species were obtained from a private fish farm at Nsukka and transported to the Fisheries and Hydrobiology Wet laboratory, Department of Zoology and Environmental Biology, University of Nigeria, Nsukka and acclimatized for two weeks. The water in the culture basins was changed twice weekly and during each change the bottom of the culture basins was washed thoroughly to reduce the risk of infection as well as prevent fungal and algal growths (Eyo, 1999). The culture basins were covered with nets to prevent fishes from jumping out. During the acclimatization, catfish were fed regularly (twice a day) with fish feed containing 40% crude protein.

2.2 Processing and Preservation of Dietary Ingredients

Poultry feathers, soya bean, dent yellow corn, crayfish, animal blood, vitamins and mineral supplements were the dietary ingredients used for the research.The ingredients were processed s follows:

(a)Feather meal: The feather meal was prepared by treating poultry feather with 6N HCL under pressure in the presence of 3 grams of calcium bicarbonate (Eyo, 1999). The partially hydrolyzed feather was rinsed in tap water to remove treatment chemicals, oven dried at 50^0C for 6 hrs and milled to powder.
(b)Soya bean: The soya bean was soaked overnight and boiled for sixty minutes. It was then sun dried for 3 days, milled and sieved. The resultant powdered soya bean was stored in an air tight container.
(c)Dent yellow corn: The corn was finely grounded into powder.
(d)Animal blood: The blood was cooked or boiled to firmness. The congealed blood was then cut into bits and pieces and oven dried for 3 hrs
(e)The dried blood was finely ground into powder.
(f)Fish meal: This was finely ground into powder.

2.3 Experimental Design

The catfishes were distributed into six treatment groups with each treatment group containing three replicates. There were three fish per replicate. Each treatment groups was fed with a different percentage of feather meal in this way; diet A (0%FEM), diet B (2.5%FEM), diet C (5% FEM), diet D (7.5% FEM), diet E (10% FEM) and diet F (12.5% FEM).

2.4 Diets Formulation

One kilogram each of the diets was weighed using a triple beam balance as shown in Table 1. The ingredients were homogenously mixed with 250 ml of water per kilogram of diet to produce dough. The major difference between the control diet and other dietary type is the absence of feather meal in the control diet (diet A). diet B contained 2.5% feather meal; diet C, 5% Feather meal; diet D, 7.5% feather meal; diet E, 10% feather meal and diet F, 12.5% feather meal.

The mixed diets were transferred into heat resistance polythene bags, sealed and boiled for 30 minutes. According to Eyo (1997), the heat treatment aided binding of diet through gelatinization of starch. The different dough were individually cut into pellets and oven dried separately for 3 hours.

2.5 Palatability of Feather Meal Diets to *Heteroclarias*

The palatability of each formulated diet was determined using the time to strike index. The catfish were starved overnight. Thereafter, one pellet of each diet type was dropped into plastic basin. The time that elapsed from moment the pellet penetrates through the water surface to the moment the last fish struck the pellet with its mouth was recorded in seconds. The above experiment was replicated three times for each dietary type.

2.6 Determination of Growth Performance of *Heteroclarias* species Fed with Different Inclusions of Feather meal.

In this experiment, the different diets A to G were administered to six treatment group of each replicated thrice. Each group was fed specific diet. The weight and length of the catfish per replicate basin was taken at the commencement of the experiment and at weekly interval. The specific growth rate (SGR), condition factor (K-Factor), feed conversion ratio (FCR) and percentage weight gain (PWG) were used as the growth parameters and were calculated using the formula;

SGR= Final weight- Initial weight/t × 100.

Where t= time in days (time interval between final weight and initial weight measurement).

K- Factor = W ×100/L^3

Where W= weight of fishes

L= Length of fishes

FCR= Fish feed intake/ Weight of fish.

PWG=W_1-W_0/W_0 × 100

Where W_1 = Final weight

W_0 = Initial weight

2.7 Data Analysis

Results were analysed by a one-way analysis of variance (ANOVA) and the treatment means compared by Duncan's multiple range tests. Significance was tested at the $P<0.05$ level. Results are presented as mean ± standard deviation (SD). Statistical analyses were performed with SPSS 16 for windows statistical package.

3. RESULTS

Table 1: Compositions (g) of Dietary Ingredients

INGREDIENTS	DIET A (O% FEM)	DIET B (2.5%FEM)	DIET C (5FEM)	DIET D (7.5FEM%)	DIET E (10%FEM)	DIET F (12.5%FEM)
Cornmeal	28.30	28.30	28.30	28.30	28.30	28.30
Fish meal	20.00	20.00	20.00	20.00	20.00	20.00
Blood meal	3.00	3.00	3.00	3.00	3.00	3.00
Soya bean meal	46.50	45.30	44.20	43.01	41.85	40.69
Feather meal	-	1.20	2.33	3.50	4.65	5.81
Vitamin premix	3.00	3.00	3.00	3.00	3.00	3.00

3.1 Palatability of Feather Meal Diets to Heteroclarias species

Palatability was determined by the time it took the catfish to strike each of the pelleted diet formulated with feather meal. It took the catfish 27.1 ± 10.51 seconds to strike the diet containing 12.5% feather meal. A lesser time of 14.80 ± 0.33 seconds was used by the catfish to strike diet A. However, there was no significant difference ($P> 0.05$) among all dietary types in their palatability to the *Heteroclarias* species.

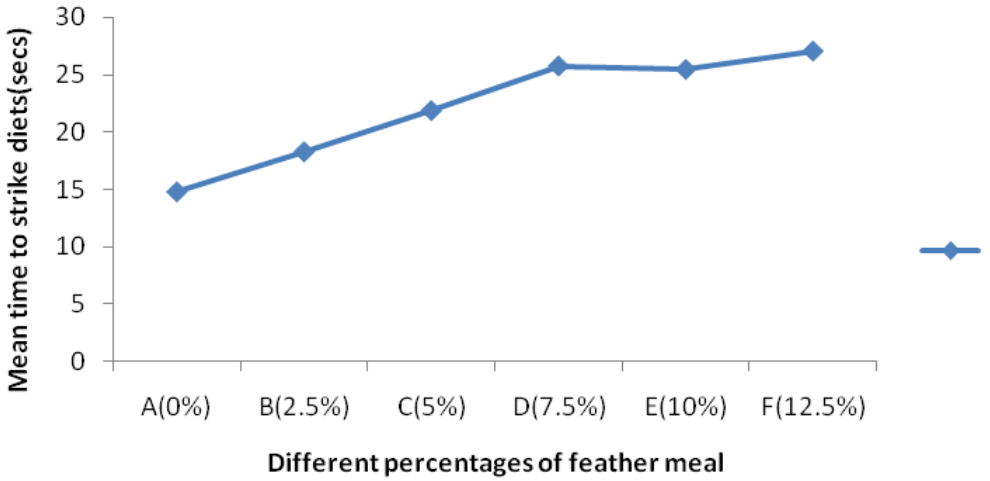

Fig 1: Palatability of Catfish fed different inclusions of feather meal.

3.2 Growth performance of *Heteroclarias* species Fed Different Inclusions of Feather Meal

The effect of increasing levels of feather meal diet on the weekly mean weight gain (Table 2) of *Heteroclarias*, indicates that the weight of fishes increased slightly from the first to the fourth week of treatment. However, the observed increment was not statistically different (P>0.05). The mean food conversion ratio (FCR) values of fishes fed feather meal diets from first to fourth week was between 0.15 ± 0.17 to 0.06 ± 0.01. Equally, the observed food conversion ratio (FCR) in the *Heteroclarias* species was statistically insignificantly different (P>0.05). The specific growth rate (Fig 2) of the *Heteroclarias* species showed some form of weekly variation. In the first week, there was no significant difference (P>0.05) in SGR of fishes fed Diets A, B, C, D and E while Diet F was significantly different (p<0.05) from Diets A and B. In the second week, there was no significant difference (P>0.05) in the SGR of fishes fed Diets B, C, D, E and F, but Diet A differ significantly (p<0.05) from Diets B and D. In the third week, there was no significant difference (P>0.05) in SGR of Diets B, C, D, E and F, but Diet A differed significantly (P<0.05) from Diets B, C and E. However, at the fourth week, all the dietary types did not differ significantly (P>0.05) from each other. The condition factor (K) of fishes fed the different dietary inclusions of feather meal were insignificantly different (P>0.05) from each other. Diet A had the highest percentage weight gain. On the other hand, the percentage weight gain (Fig 3) was found to be decreasing as levels of substitution of feather meal increases. Whereas there was significant difference (P<0.05) between Diets A and F, no significant difference (p>0.05) occurred between Diets A, B, C, D and E. Similarly, there was no significant difference (p>0.05) between Diets B, C, D, E and F.

Table 2: Weekly mean weight gain of *Heteroclarias* fed different diets containing feather meal.

TREATMENT	DIET A (CONTROL)	DIET B (2.5% FEM)	DIET C (5% FEM)	DIETD (7.5% FEM)	DIET E (10% FEM)	DIET F (12.5% FEM)
WEEK 0	12.43±2.33^a	12.02±1.49^a	11.27±4.03^a	12.87±2.98^a	12.52±3.37^a	12.99±4.63^a
WEEK 1	12.99±2.56^a	12.58±1.42^a	11.96±3.40^a	13.24±2.93^a	13.04±3.30^a	13.19±4.65^a
WEEK 2	13.55±2.87^a	12.66±1.45^a	12.30±3.22^a	13.27±3.06^a	13.04±3.17^a	13.02±3.07^a
WEEK 3	13.87±2.87^a	12.76±1.48^a	12.42±3.27^a	13.54±2.96^a	13.19±3.18^a	13.48±4.59^a
WEEK 4	14.46±2.90^a	13.09±1.58^a	12.69±3.29^a	13.84±2.82^a	13.51±3.16^a	13.54±4.44^a

Result are expressed as mean± S.D. P<0.05. Mean values with different superscripts are significantly different from each other

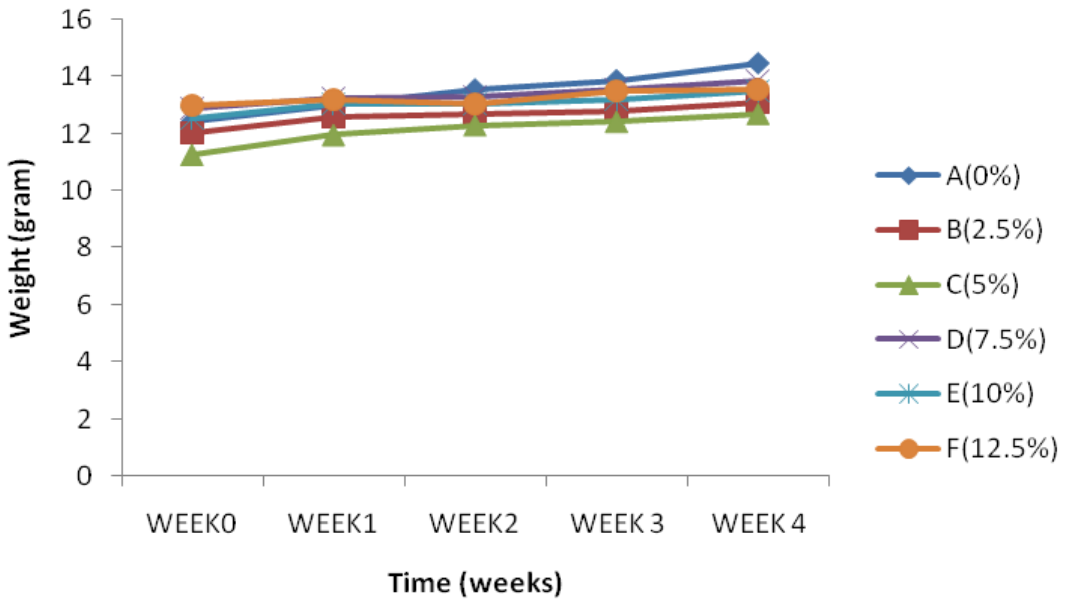

Fig 2: Weight of catfish fed different inclusions of feather meal

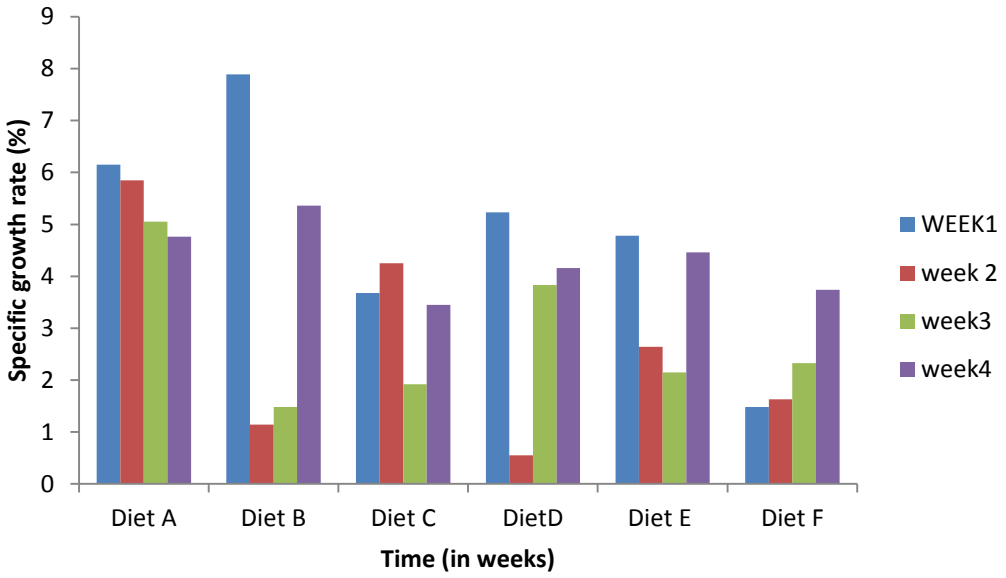

Fig 3: Specific growth rate of Catfish fed different percentages of feather meal

4. DISCUSSION

The substitution of fish meal and soya bean meal with feather meal had been reported (Fowler, 1991; Hughes, 1991; Eyo, 1999). Palatability is defined as the degree of acceptability of feed materials by a particular animal. The Palatability of the different inclusions of feather meal in the various treatment groups was not significantly different (P>0.05). This is in contrast to the work of Eyo (1999), where the incorporation of feather meal reduced the acceptability of the diet to *Clarias gariepinus* and Chinook salmon respectively. Insignificant difference in the palatability observed among the treatment groups in this study may be attributed to the percentages of substitution of feather meal. The insignificant difference observed in the length and weight of fishes in all dietary types agrees with the work of Morenike *et al*. (2010). In their study, animal protein mixture can replace up to 50% of fish meal components in diet fed to *Clarias gariepinus* fingerlings without causing adverse effects on the weight and length. The insignificant difference (P>0.05) in feed conversion ratio as observed in the present study is in line with the report of Hasan *et al*.(1997) that inclusion as high as 20% can be used for *Labeo rohita* without compromising feed conversion ratio. The insignificant difference observed in the specific growth rate (SGR) of fishes, suggests that fishes had the same growth performance in SGR irrespective of the percentage feather meal inclusion. Condition factor agreed with the report of Hosein *et al*. (2011) where there was no significant difference in the condition factor of Rainbow trout fed different percentage of poultry by product meal. The decrease in PWG observed was in line with the report of Emre *et al*. (2003), that poor growth of fish can be attributed to the presence of keratin in feather meal which might be difficult for fish to digest. This study suggests that up to 10% inclusion of feather meal can be substituted for soya bean meal. The substitution of soya bean meal for feather meal is an environmental friendly technology that assists in recycling of poultry feather into fish protein. This technology offers many prospects towards the sustainable integration of poultry cum- fish farming-systems (Eyo, 1999).

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