Performance of *Clarias gariepinus* fed poultry offal meal as a replacement for fishmeal

A. A. Adekunmisi¹, H.A. Awojobi², M.A.S. Mulero³ and M.A. Onigemo⁴

^{1,2}Department of Animal Production, Faculty of Agricultural Production and Renewable Resources, College of Agricultural Sciences, Olabisi Onabanjo University, P. M. B. 2002, Ago – Iwoye, Ogun State, Nigeria.

³Chi Limited (Aquaculture Unit), Ajao Estate, Ikeja, Lagos State.

⁴Lagos State Polytechnic, School of Agriculture, Ikorodu, Lagos State.

Abstract

Juvenile of *Clarias gariepinus* (average initial weight $32.89g \pm 0.36$) were stocked at a density of $56/m^2$ in concrete tank and fed diets containing varying levels of poultry offal meal as partial/total replacement for fish meal. The poultry offal meal was included at 0%, 10%, 20% and 40% levels of inclusion representing, 0%, 25%, 50%, 75% and 100% replacement of fish meal in the diet of the fish. Results showed that fish fed 20% level of inclusion of poultry offal meal (50%) (replacement of fish meal) had the highest average final weight/fish (104.85g) and a significantly ($P < 0.05$) better feed conversion efficiency (0.53) than the other diets. However, fish on diet containing 40% level of inclusion of poultry offal meal (100% replacement of fish meal) had equal feed conversion efficiency (0.49) as the control and the least cost of feed per unit gain in body weight ($\text{N}0.15/g$). Feed intake and live weight gain were not significantly ($P > 0.05$) different among all dietary treatments. It is therefore established from this study that poultry offal meal; can completely replace fishmeal in the diet of *Clarias gariepinus*. The best overall performance was obtained at 50% replacement of fish meal with poultry offal meal.

Key words: Fish meal, poultry offal meal, performance, *Clarias gariepinus*.

Introduction

Low level of animal protein intake among most Nigerians has been documented (Ndubuisi, 1991). The animal protein intake is less than 10g which is far cry from the Food and Agriculture Organisation (FAO) recommended 35g per head per day (David-West, 1982). The livestock and poultry industry has not been able to address this problem adequately due to myriads of constraints. Unconventional supply through "bush meat" has been limited by the inherent productive capacity of the particular aquatic ecosystem. Attention is therefore shifting to

aquaculture to supplement animal protein from these other sources.

One of the major constraints to aquaculture development is high cost/in-availability of feed which constitute the major fraction of the operational cost. Protein, which acts both as a major structural component and a major nutrient source in fish (Brett and Grooves, 1979) is generally the most expensive component of artificial diets. Dietary protein constitute about 50% of diets (Benitez, 1989) hence a sizeable portion (about 40% or more) of fish diets are

made up of fish meal. In order to provide fish at a price that is affordable to most Nigerians, effort should be geared towards replacing fish meal in the diet of fish.

Poultry offal, a by-product of poultry processing which largely constitutes a waste on the farm can be utilized. This research was therefore carried out to determine the suitability of replacing fish meal with poultry offal in the diet of *Clarias gariepinus*. The specific objectives are:

1. To determine the effect of replacing fish meal with poultry offal meal on the growth of *Clarias gariepinus*.
2. To determine the extent to which poultry offal can be substituted for fish meal for optimum fish production
3. To determine the cost implication of substituting fish meal with poultry offal meal.

Materials and Methods

Location of the experiment

The experiment was carried out at the Fishery Unit of the Teaching and Research Farm of the Lagos State Polytechnic, School of Agriculture, Ikorodu, Lagos. The climate of Ikorodu is humid tropical.

Processing of poultry offal and experimental diets

Fresh poultry intestine (gut content inclusive) was obtained from the processing unit of a big commercial poultry enterprise in Ota, Ogun State. The Offals was cleaned of residues and washed with water to remove dirt. It was then transferred into a drum and processed by wet rendering. The procedure involved cooking the intestine at about 120°C for 3 hours. Temperature was measured using a thermometer. After cooking the broth was left to cool. The cooled broth was then stirred. Thereafter the required amount of poultry offal

meal (POM) based on the replacement of POM for fish meal (FM) was weighed and other ingredients, maize, 200g kg⁻¹; soybean meal, 200 g kg⁻¹, palm kernel cake, 90 g kg⁻¹; blood meal, 100 g kg⁻¹, premix g kg⁻¹, added to it and thoroughly mixed to form a thick slurry. Starch (100 g kg⁻¹ of diet) was added as a binder. The feed was then pelleted using a locally fabricated pelletizer. Pellete size was 3mm in diameter and 6mm long. The dietary treatments were made up of the control (T1) which contained FM (72%CP) at 400 g kg⁻¹ of diet and four other diets in which POM was used to replace FM at 25%, 50%, 75%, and 100% represented as T2, T3, T4 and T5 respectively. The replacement was on a weight for weight bases.

Experimental design and fish management

One hundred and thirty five (135) juvenile *Clarias gariepinus* (mean weight 32.89g ± 0.36) were purchased from Chi Limited, Ajao Estate, Lagos State. The fish were randomly allotted to the five dietary treatments in a complete randomized design after equalizing the average initial weight. Each dietary treatment was replicated thrice with 9 juveniles per replicates. The experiment was carried out in 3 concrete tanks 150 x 180cm in dimension. Each tank was partitioned into 5 equal parts 30 x 30 x 180 with the use of mosquito net. The source of water used in this experiment was bore-hole. The fish were fed their allotted experimental diet daily at 09 and 16 hours at the rate of 4% body weight. The experiment lasted for 56 days.

Analytical technique

The proximate constituents of poultry offal meal and fish meal (Table 1) and experimental diets (Table 2) were analysed for using the methods of A.O.A.C (1990). The metabolizable energy was computed using the equation of Pauzenga (1985). The physico-chemical parameters of the water, temperature, pH, dissolved oxygen and conductivity (Table 3) were monitored during the experiment using the standard methods of APHA (1980).

Poultry offal meal in the diet of *Clarias gariepinus*

Table 1: Proximate composition of dried poultry offal meal and fish meal

Component %	Poultry Offal	Fishmeal
Dry matter	90.14	94.69
Crude Protein	56.67	70.32
Ether extract	5.84	3.65
Crude fibre	2.72	1.03
Ash	6.76	9.56
Nitrogen free extract	18.18	10.13
ME(Kcal/kg)	3219.89	3260.03

Table 2: Proximate composition of experimental diets

Component %	Dietary Treatments				
	1	2	3	4	5
Dry matter	90.30	89.42	90.65	92.51	90.85
Crude Protein	58.56	57.68	55.75	52.84	51.69
Ether extract	4.57	6.80	6.86	6.89	6.94
Crude fibre	3.19	3.30	3.22	3.29	3.25
Ash	5.62	6.67	6.32	5.15	6.03
Nitrogen free extract	18.36	14.91	18.50	23.34	22.71
ME(Kcal/kg)	3192.84	3292.84	3280.65	3384.24	3296.42

Table 3: Physico-chemical parameters of water

Component %	Range	Mean
Temperature	25-38	31.5
pH	7.3-7.8	7.55
Dissolved oxygen (p.p.m)	4.2-6.6	5.4
Conductivity (I.U)	800-1000	900

Data collection and analysis

During the experiment the entire fish population (27) in each treatment were scooped out and weighted on a weekly basis. Daily feed intake, feed conversion efficiency, protein efficiency ratio and economics of diets in relation to weight gain were also calculated. All experimental data were subjected to a one-way analysis of variance. Where statistical significant differences were obtained, mean separation was carried out using Duncan's multiple range test (Steel and Torrie, 1980).

Results and Discussion

Performance of fish on the experimental diets

The response of fish on the experimental diets with respect to performance indices is given in Table 4. inclusion of poultry offal meal at the expense of fish meal in the diet did not have significant ($P>0.05$) effect on the average daily feed intake, total feed intake, average weight gain and final weight. However, feed conversion efficiency (FCE) of diets with 25%, 50% and 75% replacement of FM by POM showed slightly better values compared with the 0% and 100% replacement of FM by POM.

The protein in the diets containing POM were better ($P<0.05$) utilized as the fish consumed less protein per unit weight gain. The best ($P<0.05$)

protein efficiency ratio (PER) were obtained in diets with 50% and 100% POM replacement for FM.

Table 4: Productive performance of *Clarias gariepinus* fed diets containing varying levels of poultry offal meal

Measurement	Replacement level of fm POM					SEM
	0%	25%	50%	75%	100%	
Initial wt of fish (g)	33.70	31.85	32.59	33.33	32.96	2.33
Final wt of fish (g)	92.85	93.30	104.85	94.44	92.19	4.59
Av. Wt gain day (g)	1.06	1.10	1.22	1.09	1.06	0.03
Total feed intake (g)	120.96	120.40	129.36	123.30	120.40	1.91
Av. Feed intake g/fish/day	2.16	2.15	2.31	2.20	2.15	0.11
FCE (wt gain feed intakes)	0.49 ^a	0.51 ^{abc}	0.53 ^c	0.50 ^{ab}	0.49 ^a	0.01
PER (Protein intake/wt gain)	1.19 ^a	1.26 ^b	1.05 ^d	1.09 ^c	1.05 ^d	0.01
Cost/kg feed (₦)	102.55	95.55	88.55	81.55	75.55	
Cost of feed/fish (₦)	12.42 ^a	11.49 ^{ab}	11.43 ^{ab}	10.06 ^c	8.99 ^d	0.47
Cost/wt gain ₦/g	0.21 ^a	0.19 ^b	0.17 ^c	0.16 ^{cd}	0.15 ^d	0.01

SEM: Standard error of means

^{abcd}: Means with different superscripts on the same row differ significantly ($P<0.05$)

The substitution of one ingredient for another in a compounded diet are usually carried out to expand the frontiers of feed resources especially the cheaper ones and to establish the safe inclusion level of such novel feedstuff in the diets of various classes of farm animals (Salami, 1999). The inclusion level of a feedstuff in a compound feed that will not impair the health of the recipient animal is regarded as safe. The similar feed intake, final weight and feed conversion observed in fish fed the control (100% FM) and the fish on diet containing 100% POM gives an indication that 100% replacement of FM by POM is safe for the species of fish under investigation.

The feed consumption pattern observed in this study gives credence to the generally held belief that most animals will eat to satisfy their energy requirement. It is also evident that fish did not show aversion to the poultry offal meal. Although the rate of weight gain were not significantly ($P>0.05$) different across

treatments, fish on diets with combination of FM and POM appear to gain slightly more than those on either FM or POM only. This relative better weight gain on diets with mixed animal protein may be attributed to the complimentary effects of both ingredients on each other as the nutrient that is deficient in one might be taken care of by the other.

The significantly ($P<0.05$) better FCE by fish on POM (25%, 50% and 75%) based diets mean they gain more weight per unit feed intake. The superior FCE of *C. gariepinus* on POM may be due to its higher fat content (Table 1) sparing proteins for growth. This is further reflected in the operative PER, as the fish on POM had a significantly ($P<0.05$) better protein utilization. All these facts put together suggested that POM may be a better substitute for FM in *C. gariepinus* feeding. There was no mortality throughout the experiment. The 100% survival rate was partly attributable to the tolerable range

Poultry offal meal in the diet of *Clarias gariepinus*

of physico-chemical parameters of the water (Table 3) during the experimental period.

Effect of feed on economy of production

The total cost of feeding per fish varied significantly ($P<0.05$) among dietary treatments. Fish on the control diet and the highest ($P<0.05$) cost of feeding while the lowest ($P<0.05$) cost of feeding was recorded for fish on diet containing 40% POM (100% replacement of FM with POM). The cost per gramme of feed and cost of feed per unit weight of fish decreased as the replacement of FM protein with that of POM increased. Cost per unit weight gain was significantly ($P<0.05$) lower in the POM containing diets. Thus POM is a cheaper substitute for FM in the production of *C. gariepinus*. This reduction in cost of feeding is similar to the findings with studies on laying hens, broilers starters and finishers (Salami, 1999).

Conclusion

The utilization of POM for fish feeding should be encouraged to reduce over dependence on expensive and scare conventional protein sources (especially fish meal) and also to solve the disposal and pollution problem encountered at poultry processing plants. This study was carried out with *C. gariepinus*, trials using other fish species will permit comparison of notes.

References

- A.O.A.C. 1990. Official Methods of analysis 15th edition. Association of Official analytical chemists. Washington D.C., U.S.A.
- APHA 1980. American Public Health Association Standard Methods for the examination of water and waste water, Washington D.C.
- Benitez, L.V. 1989. Amino acid and fatty acids profiles in aquaculture nutrition studies. In Desilva S.S. (ed) Fish nutrition research in Asia. Proceedings of the 3rd Asian Fish Nutrition Network, Manila, Philippines.
- Bret, I.R. and Grooves, T.D.D. 1979. Physiological energetics. In Hoar W. S. and Rental R.L. (eds) Fish Physiology Vol. 8: 279 – 352.
- David-West, B. 1982. Government activities in beef industry. In Osinowo, O.A., Ikhatua, U.J. and Enoche, E.O. (eds) Beef production in Nigeria. Proceedings of National Conference on Beef production NAPRI, Zaria. Pg 44 – 57.
- Ndubuisi, E.C. 1991. The role of Poultry Association in Nigeria in rural development. In: Igbo Zurika U.M., Okpara E.E. and Ijeoma M.A. (eds) Corporate role in rural development. Karto Press Owerri. Pg 7 – 10.
- Pauzenga, U. 1985. Feeding parent stock. *J. Zootec Int.* 1: 22 – 24.
- Salami, R.I. 1999. A review of studies on poultry visceral offal meal as a substitute for fish meal in poultry diets. *Trop Anim. Prod. Inves.* Vol. 3 No. 2, 143 – 153.
- Steel, R.G.D. and Torrie, J.H. 1980. Principles and procedures of statistics. A Biometrical approach (2nd ed) McGraw Hill Book Company N.Y.

(Received 13 September 2001; Accepted 18 October 2003)