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Dried Poultry Manure Meal as a Substitute for Soybean Meal in the Diets of African Catfish *(Clarias gariepinus)* (Burchell 1822) Advanced Fry

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Abstract

The effect of replacement of Soybean meal with dried poultry manure meal in the diets of *Clarias gariepinus* advanced fry was investigated. Six iso-nitrogenous diets containing 40% crude protein in which the soybean meal protein was replaced by dried poultry manure meal protein at 0% (diet PM1), 20% (diet PM2), 40% (diet PM3), 60% (diet PM4), 80% (diet PM5) and 100% (diet PM6) levels were formulated and fed to *C. gariepinus* advanced fry of average weight of 0.35g for 8 weeks in adapted aquaria. At the end of the trial, weight gain of 1.35 g was the highest in fish fed diets PM1 and PM4. Feed conversion ratio (FCR) of 1.89 was the lowest in fish fed diet PM3 but not significantly different (P>0.05) from 1.90 of fish fed diets PM1 and PM4. Net protein utilization (NPU) was the highest in fish fed diet PM1 with a value of 39.35% and the lowest with a significant difference (P<0.05) in fish fed diet PM6 with a value of 34.26%. Percentage survival value of 87% in fish fed diet PMI was significantly the higher (P<0.05) than 80% of fish fed diets PM2,3 and 4 and the lowest in fish fed diets PM5 and PM6 with an equal value of 60% respectively. In view of the above, it is evident that dried poultry manure meal can replace up to 60% of soybean meal in the diets of *C. gariepinus* advanced fry.

Keywords: adapted aquaria, feed intake, feed conversion ratio, significant difference.

Introduction

The increasing cost of fish feed has made research interest to be focused on reducing cost of the most expensive ingredients by alternative protein sources. Since most of the research have been conducted for replacing fish meal with either plant protein sources or other un-conventional animal protein sources (Wee and Wang, 1987; Adeparusi, 1993; Keembiyehetty and Desilva, 1993; Martinez – Palacios *et al.*, 1998; Faluroti *et al*., 1998). On the contrary fewer works have been reported on the replacement of soyabean meal which is the costliest and the the most utilized plant protein source in most fish feed (Lovell, 1988) in developing countries (Alexis, 1990).

Poultry manure is a potential source of protein. It has attracted the attention of animal nutritionists all over the world because of its richness of protein, calcium (5.4%), phosphorus as K_2O and magnesium as MgO (0.335%) other minerals (Ranjhan, 1980; SPFG, 1994). Recently, fish farmers especially in the integrated farming system have been encouraged to recycle wastes from animal dung (especially poultry) as food for fish rather than discard them. Poultry manure is not only used as organic manure in the production of plankton but also directly consumed by fish in the culture system. Although, this observation has been verified by many workers (Oladosu *et al*., 1990; Gavina, 1994; Ogunba and Abumoye, 1998), information on the effect of the dung when incorporated into artificial fish diets are scarce. Therefore, this study was carried out to replace the soybean meal with dry poultry manure meal in the diet of African catfish *C. gariepinus*.

Materials and Methods

Six Iso-nitrogenous diets (40% crude protein) were formulated and prepared. Soya bean meal in the control diet was substituted with dried poultry manure meal (of 28.6% crude protein) on protein-to-protein basis at 20%, 40%, 60%, 80% and 100% levels. The day-old poultry manure from caged layers was collected from a poultry farm in Ogun State, Nigeria. The manure was sun dried to about 10% moisture content (FAO, 1980) and was then ground to flour and the proximate composition was analyzed before being incorporated into diets at various levels in a completely randomized design experiment.

Fifteen fish were randomly stocked per aquarium in triplicate groups for each treatment and fed twice daily for 56 days at 5% body weight. Weighing of fish in each aquarium was carried out in batches every week and unfed feed was adjusted to accommodate the increase in body weight of the fish. Faeces and feed remnants were siphoned out everyday and the water toped up to maintain relatively uniform physicochemical parameters and to prevent fouling. Aeration was facilitated by using aerator pumps (Tecax 3000 model). Water temperature (°C) was monitored daily using mercury thermometer; dissolved oxygen (DO) was measured using Jenway DO meter model 9071 while the pH was measured using glass electrode pH meter (E520) metrolin model.

Three hundred *C. gariepinus* advanced fry of mean weight of 0.35 g were obtained from a commercial fish hatchery in Oyo State, Nigeria. The fish were first starved for 72 hours and later acclimated to assigned experimental diets for one week prior to the beginning of the actual feeding experiment. The experiment was conducted in 18 aquaria (40 x 90 x 60 cm). Water supply was from the University of Agriculture Abeokuta water system. The water for the experiment was therefore held in an outdoor tank for 72 hours to allow for oxidation of Chlorine used in water treatment.

At the beginning of the feeding trial, composite samples of ten whole fish were analyzed for proximate composition and a random sample of five fish per aquarium at the end of 56 days experimental period. Nitrogen content was determined by AOAC (1990) methods and the factor of 6.25 was used to convert the nitrogen to protein. Fat, fibre, ash and moisture content of the diets and composite fish samples were analyzed using AOAC (1990) method. Diet performance was evaluated on experimental fish according to Olivera *et al*. (1990). Statistical comparison of growth performance and protein utilization values were made by using analysis of variance (ANOVA) system (SAS, 1988).

Results

Fish in all experimental units became accustomed to the diets within the period of seven days of acclimation. Proximate analysis of experimental diets (Table 1) showed that moisture was the highest in diet PM5 with a value of 9.73% and the lowest in diet PM1 with a value of 8.13%. Crude protein content maintained almost equal value with slight variations. Fat and crude fibre contents maintained an inverse relationship to each other while ash content was directly proportional to the poultry meal inclusion value.

Carcass composition of *C. gariepinus* at the beginning and end of the feeding trial (Table 2) showed a decreasing trend of carcass protein from fish fed diet PM1 (62.60%) to PM3 (61.90%), then a rise in fish fed diet PM4 (62.50%) and then gradually decreasing thereafter in fish fed diet PM5 (61.5) and PM6 (60.50%). Fat contents also consistently decreased from fish fed diet PM1 to fish fed diet PM6. The summary of growth responses and nutrient utilization (Table 3) shows that fish fed diets PM1 and

Table 1. Composition of Experimental Diets (g/100 g diet) and proximate composition (%)

	Diets					
Ingredients	PM1	PM2	PM3	PM4	PM5	PM6
Poultry manure	0.00	10.07	20.13	30.20	40.27	50.34
Soybean meal	35.71	28.57	21.43	14.29	7.14	0.00
Blood meal	12.60	13.02	13.40	13.87	14.30	14.72
Fish meal	17.36	17.36	17.36	17.36	17.36	17.36
Corn	25.48	22.13	18.58	15.43	12.08	8.73
Bone meal	2.50	2.50	2.50	2.50	2.50	2.50
Groundnut Oil	5.00	5.00	5.00	5.00	5.00	5.00
**Vitamin Premix	0.60	0.60	0.60	0.60	0.60	0.60
Oyster Shell	0.50	0.50	0.50	0.50	0.50	0.50
Salt	0.25	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00	100.00
Analysed composition						
Moisture (%)	8.31	8.13	9.20	9.25	9.73	9.25
Crude protein (%)	39.89	39.83	39.72	39.84	39.67	39.72
Crude fibre (%)	4.65	5.72	7.21	7.69	8.51	8.76
Fat (%)	6.21	6.08	5.50	5.37	4.99	5.71
Ash (%)	10.01	10.25	11.41	12.75	13.12	14.23
Nitrogen free extract (%)	30.93	30.00	26.96	25.10	23.98	24.33

**RADAR VIT. PREMIX supplies per 100 g diet. Palmitate (A) 1000 IU; cholecaciferol (D) 1000 IU; a- tocopherol acetate (E) 1.1 mg; Menadione (K) 0.2 mg; Thiamine (BI) 0.63 mg; Riboflavin (B2) 0.5 mg; panthothenic acid, 0.9 mg; Pyridoxine (B6) 0.15 mg; Cyanocobalamine (B12), 0.001 mg: Nicotinic acid 3.0 mg; Folic acid 0.1 mg; Choline 31.3 mg; Ascobic acid (C), 2.5 mg; Fe, 0.05 mg; Cu 0.25 mg Mn 6.0 mg; Co, 0.5 mg; Zn 5.0 mg; I, 0.2 mg; S, 0.02 mg.

Table 2. Carcass composition of *Clarias gariepinus* fed poultry manure meal based diets

		Diets					
	Initial Fish	PM1	PM2	PM3	PM4	PM5	PM6
Moisture(%)	7.85	8.01±0.22	8.25±0.18	8.80±0.21	9.25±0.28	8.99±0.14	8.10±0.27
Crude protein(%)	56.90	62.60±2.11	62.50±1.56	61.90±2.55	62.50±1.68	61.50±2.13	60.50±1.22
Fat (%)	6.00	6.81±0.11	6.67±0.02	6.61±0.06	6.25±0.06	6.21±0.12	6.15±0.08

Table 3. Growth and nutrient utilization of *Clarias gariepinus* fed poultry manure meal based diets

Parameters	Diets						SEM
	PM1	PM2	PM3	PM4	PM5	PM6	
Initial mean wt (g)	0.37	0.37	0.33	0.35	0.35	0.35	0.02
Final mean wt (g)	1.72^{a}	1.70^{a}	1.66^{b}	1.70^{a}	1.53^{c}	1.51^{c}	0.15
Mean weight gain(g)	1.35^{a}	1.33^{a}	1.33^{a}	1.35^{a}	1.18^{b}	1.16^{bc}	0.10
Mean weight gain (%)	364.86^{b}	359.46^{b}	403.03^{b}	385.71	337.14^{c}	331.43^{c}	7.23
Total feed intake (g)	2.57^{a}	2.58^{a}	2.52^{a}	2.56^{a}	2.43^{b}	2.44^{b}	0.06
[1]Feed conversion ratio	1.90^{c}	1.94^{b}	1.89^{c}	1.90^{c}	2.05^{ab}	2.10^{a}	0.04
[2]Specific growth rate (%/day)	3.66^{ab}	3.67^{ab}	3.70^{a}	3.79^{a}	3.55^{c}	3.51^{c}	0.12
[3]Feed conversion efficiency	52.53^{a}	51.55^{ab}	52.78^{a}	52.73^{a}	48.56^{b}	47.54^{c}	2.43
[4]Protein efficiency ratio	2.12^{b}	2.12^{b}	2.16^{a}	2.18^{a}	2.09^{b}	2.03^{b}	0.07
[5]Net protein utilization	39.35^{a}	39.20^{a}	37.97^{b}	39.20^{a}	36.87^{b}	34.26^{c}	0.45
Survival (%)	87^{a}	80^{b}	80^{b}	80^{b}	60^{c}	60^{c}	5.34

NOTE: values without common superscripts in horizontal rows are significantly different (P<0.005)
SEM = Standard error of the mean.
[1]Feed conversion ratio = weight of feed/ fish wet weight gain.
[2]Specific growth rate = $\log_e W_2 – \log_e W_1 /T_2 - T_1$ X 100. Where:
W_2 = weight of fish at time T_1. W_2 = weight of fish at time T_2
[3]Feed conversion efficiency = Fish wet weight gain / weight of feed X 100
[4]Protein efficiency ratio = Mean weight gain / protein consumed.
[5]Net protein utilization = $N_b – N_a / N_i$ X 100. Where:
N_b = body nitrogen at the end of the test
N_a = body nitrogen at the beginning of the test
N_I = amount of nitrogen ingested.

PM4 had the highest final mean weight; although they were not significantly better (P>0.05) than fish fed diet PM2. However, there was a slight decrease in fish fed diets PM3 and a sharp significant (P<0.05) one in fish fed diets PM5 and PM6. Feed conversion ratio (FCR) was the best in fish fed diet PM3 but not significantly the better (P>0.05) than fish fed diet PM1 and PM4. The feed intake was statistically similar (P>0.05) in fish fed diets PM1 to PM4 but significantly the lowest (P<0.05) in fish fed diets PM5 and PM6. Apparent net protein utilization (APP-NPU) was the highest in fish fed diet PM4 and the lowest significantly (P<0.05) in fish fed diet PM6. Percentage survival was significantly the higher (P<0.05) in fish fed diet PM1 and the lowest in fish fed diets PM5 and PM6, respectively.

Discussion

From this trial, it is apparent that dried poultry manure can replace up to 60% of soybean meal without any adverse effect on growth and nutrient utilization of *C. gariepinus* advanced fry. The performance exhibited by fish fed 60% might be due to the fact that soybean, being a legume contains anti-nutritional factors which inhibit the activities of protein digesting enzymes. Therefore, if not well treated can still affect its utilization by fish (Faris and Singh, 1990; Osho, 1993).

Furthermore, the quality of diet with increasing poultry manure up to 60% might have been improved by the amount of animal protein (Fish meal and blood meal) (Table 1) which might have covered up the effect of the limiting essential amino acids in poultry meal which are according to Aduku (1993), methonine, cystine and tryptophan. This is further buttressed by Coche (1990) arguing that the quality of a fish diet is greatly determined by the amount of fishmeal in such diet.

The proximate composition of feed which contained higher proportion of dried poultry manure meal had higher levels of fibre and ash content. This was probably due to the fact that poultry manure contains higher percentage of fibre when compared to that of soyabean meal (Aduku, 1993). The same goes for the fat contents which were higher in diets containing higher levels of soybean meal.

It is interesting to note that better growth and nutrient utilization were achieved at relatively high inclusion level of poultry manure meal compared to low incorporation of the test ingredient. This could be due to the better performance and utilization of the diets in spite of high fibre levels. Lovell (1989) opined that the fibre probably reduced the passage rate of the diet in the digestive tract and increased digestion. Falaye (1998) also recorded higher growth and nutrient utilization in *Oreochromis niloticus* as the fibre levels of diets increased. Moreover, Lovell (1989) stated that the fibre probably reduced the passage rate of the diet in digestive tract and thereby increasing digestion.

The superior growth and nutrient utilization resulting from the use of dried poultry manure in place of soybean meal has economic significance considering that the latter has become expensive, being competed for as food by man and livestock in many developing countries including Nigeria. This is important in aquaculture particularly as the cost of fish feed currently accounts for 40% to 70% of the variable costs of fish farming ventures (Ghallagher, 1994). Therefore, poultry manure which has hitherto been discarded as a waste will no doubt supply dietary need in fish rearing.

On the basis of appreciable growth and nutrient utilization achieved with poultry manure meal in this feeding trial, it is suggested that soybean meal in feeds formulated for *C. gariepinus* may be replaced up to 60% with dried poultry manure meal, the level that gave optimal fish performance and nutrient utilization.

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