

# EVALUATION OF POULTRY VISCERAL OFFAL MEAL AS A SUBSTITUTE FOR FISH MEAL IN GROWER PULLETS' DIETS

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## ABSTRACT

The effects of replacing fish meal (FM) with graded levels of poultry visceral offal meal (PVOM) in five grower pullets' diets were investigated in a 4 - week study using 200 Isa Brown pullets from 14 to 18 weeks of age. There were four replicates per test diet, with 10 birds per replicate. Diets A (control) contained 4% FM as the sole source of dietary animal protein. PVOM was included in diets B,C,D and E at the levels of 1.18, 2.37, 3.55 and 4.73% of the diets to supply 25,50,75 and 100% of animal protein supplied by 4% FM in the control diet A respectively. All the test diets were isocaloric (11.8MJ ME/kg) and isonitrogenous (16% CP). There was no significant effect ( $P > 0.05$ ) of replacing dietary FM with PVOM (on an equal protein basis) on the performance parameters measured. Birds fed on diets A,B,C,D and E had similar ( $P > 0.05$ ) mean daily weight gains of 14.16, 13.66, 14.65, 13.35 and 13.84g/b d respectively. The mean daily feed consumption values were 73.61, 73.27, 73.88, 72.10 and 71.76g/b d for the birds on diets A,B,C,D and E respectively while similar mean feed conversion ratios of 5.21, 5.45, 5.04, 5.42 and 5.21 were also recorded for the birds on diets A,B,C,D and E respectively. It is concluded that PVOM could replace FM completely on an equal protein basis in grower pullets' diets. Cost of feed per unit of weight gain was lower on the PVOM-based diet than on the FM-based diet.

**Keywords:** Poultry visceral offal meal, fish meal, protein, grower pullet, performance.

## INTRODUCTION

In developing countries like Nigeria, the cost of feeding animals, especially the monogastrics continues to escalate primarily in

response to the soaring cost of the conventional feed ingredients. This phenomenon is precipitated by under-production and importation of some feedstuffs coupled with the competition between man and farm animals for energy and protein concentrates. The use of agro-industrial by-products to substitute the scarce and expensive conventional feedstuffs towards reducing feed cost has been widely recognised (Eshiett and Ademosun, 1981; among others and Atteh and Ologbenla, 1993).

Poultry visceral offal (PVO) is a waste product from poultry eviscerating plants where it constitutes a nuisance if not properly disposed of. It is made up of the edible and inedible visceral offals namely large and small intestines and their contents, kidney, liver, heart, bile, oesophagus and proventriculus of eviscerated poultry birds, especially broiler finishers. Poultry offal meal (POM) and chicken offal meal (COM) have been produced in Nigeria by Udedibie *et al* (1988) and Nwokoro (1993) respectively from waste products similar to PVO. While POM has been used to replace groundnut cake in layers' and broiler finishers' diets (Udedibie *et al*, 1988), COM has been used along with fish meal and blood meal as sources of methionine and lysine in the starter diets of cockerels (Nwokoro, 1993). Fish meal is an ideal animal protein concentrate for the monogastrics by virtue of its excellent amino acid profile (Scott *et al*, 1982). However, it is not readily available in most developing countries (Offiong *et al*, 1982). The implication of importation is the escalating prices of compound feeds. Thus, there is need to convert the poultry eviscerating plant wastes into valuable protein supplements to reduce dependence on conventional protein concentrates such as fish meal thereby

lowering feed cost. There is a dearth of information on the feeding value of poultry visceral offal meal (PVOM), a derivative of PVO as an animal protein supplement in the diet of grower pullets. The present study evaluates PVOM as a substitute for (Danish) fish meal (FM) in the diets of growing pullets during 14 to 18 weeks of age.

## MATERIALS AND METHODS

**Production of PVOM:** The "wet rendering" method used by Nwokoro (1993) for producing COM was modified and used for processing PVO into PVOM as follows:

Fresh PVO was soaked in hot water initially at boiling point (100°C) in a 200-litre metal drum with its lid in which the volume of water was twice that of PVO until it cooled down naturally after 12 hours. This was followed by skimming of surface oil and draining of the parboiled PVO in a jute bag under hydraulic pressure to expel water and more oil. The drained PVO was sundried on concrete slab for 3 to 4 sunny days during which contaminants such as feathers and scales were removed manually. The dried PVO was then hammer-milled into its meal (PVOM) prior to storage in polystyrene bags in a room until needed for preparation of the test diets. The recovery rate of PVOM was 1 Kg dried weight from 10 Kg wet weight of PVO.

**Experimental diets:** There were five test diets. Diet A (control) contained 4% Danish fish meal as sole source of animal protein. (Table 1). PVOM was included at graded levels of 1.18, 2.37, 3.55 and 4.73% in diets B, C, D and E respectively to supply 25, 50, 75 and 100% dietary animal protein supplied by 4% fish meal in diet A. The substitution of FM with PVOM was based on the crude protein (CP) contents of 56 and 65% for PVOM and FM respectively. Metabolisable energy (ME) for PVOM was not determined but the value for poultry by-product meal (2910 kcal/kg), which is similar to the test ingredient was assumed for it after Scot *et al* (1982). Hence, all diets were isonitrogenous (16% CP) and isocaloric (11.8MJ ME/kg).

**Experimental animals and their**

**management:** Two hundred and forty day-old pullet chicks of Isa Brown commercial strain were brooded and reared for 6 and 8 weeks respectively in 12 deep litter pens, with 20 birds per pen and floor space of 0.09m<sup>2</sup> per bird until 14 weeks of age. Adequate warmth and light were provided. The birds were fed *ad libitum* on commercial starter and grower pullet diets for 6 and 8 weeks respectively. The recommended vaccinations against Newcastle, Gumboro and Fowl pox diseases were given. Coccidiostat (Amprolium alternated with Duocoxin) was administered twice orally at 4 and 8 weeks of age while the birds were dewormed at 13 weeks of age. Other standard brooding and rearing management practices on the deep litter as described by Oluyemi and Roberts (1979) were also followed.

At 14 weeks of age, 200 birds were selected after weighing individually and they were divided into twenty groups of similar initial body weights, with ten birds making up a replicate. The five test diets (Table 1) were randomly allocated to the groups and each diet had four replicates.

The grower pullets were quartered in two-tier battery cage placed inside an open-sided poultry house. Birds per replicate were housed in twos per cage compartment measuring 30x38x43cm for breadth, length and height respectively. A feeding trough was used to serve feed for birds in each replicate while a water trough was used for two adjacent replicates. Test diets and drinking water were provided *ad libitum* during the study period that lasted 4 weeks. The water troughs were washed daily before fresh water was served.

**Measurement of performance parameters:** The initial and final body weights of individual birds at 14th and 18th weeks of age were measured respectively to compute the average daily weight gain. Feed intake was also measured weekly to calculate the average daily feed intake. From the records of live weight gain and feed intake, feed conversion ratio was determined.

**Feed Cost Analysis:** The cost of the test diets was computed using current market

POULTRY VISCERAL OFFAL MEAL FOR GROWER PULLETS

TABLE 1: COMPOSITION OF THE GROWER PULLET DIETS (g/100g DM)

Ingredients	Price (N/kg) <sup>b</sup>	TEST DIETS				
		A	B	C	D	E
Maize	3.50	40.00	40.00	40.00	40.00	40.00
Groundnut cake	13.00	10.42	10.42	10.42	10.42	10.42
Fish meal	34.00	4.00	3.00	2.00	1.00	-
PVOM <sup>c</sup>	16.50 <sup>d</sup>	-	1.18	2.37	3.55	4.73
Maize offals	1.20	42.58	42.40	42.21	42.03	41.85
Bone meal	1.20	1.50	1.50	1.50	1.50	1.50
Oyster shell	0.80	1.00	1.00	1.00	1.00	1.00
Salt (NaCl)	3.20	0.25	0.25	0.25	0.25	0.25
Premix <sup>a</sup>	112.00	0.25	0.25	0.25	0.25	0.25
<b>Total:</b>		100.00	100.00	100.00	100.00	100.00
<b>CALCULATED PROXIMATE ANALYSIS:</b>						
Crude protein (%)		16.00	15.98	15.96	15.93	15.91
ME(MJ/Kg)		11.78	11.79	11.79	11.80	11.80
Crude Fibre (%)		6.46	6.46	6.46	6.48	6.46
Calcium (%)		1.18	1.16	1.14	1.12	1.10
Available Phosphorus (%)		0.43	0.43	0.43	0.42	0.42

<sup>a</sup>Premix contains per Kg diet: Vit A: (41666.67 Lu); vit D<sub>2</sub>: (12500 i.u); Vit E:(33.33 i.u); Vit K:(8.33mg); Vit B<sub>1</sub>:(8.33mg); Vit B<sub>2</sub>:(22.92mg); Vit B<sub>6</sub>:(5.00mg); Vit B<sub>12</sub>:(0.05mg); Biotin:(0.125mg); Niacin:(41.67mg); Pantothenic acid:(29.17mg); Folic acid:(2.5mg); Choline Chloride:(3083.33mg); Vit C:(41.66mg); Iron:(250mg); Magnesium:(416.67mg); Copper:(33.33mg); Zinc:(208.33mg); Cobalt:(1.88mg); Iodine:(8.33mg); Selenium:(0.417mg); Antioxidant:(25mg); Calcium carbonate D.S. (10.42g).

<sup>b</sup>Central Bank of Nigeria, January 1994 Exchange rates: \$1 = 21; 1 = 32. <sup>c</sup>PVOM = Poultry Visceral Offal Meal.

<sup>d</sup>Determined as sum of expenditures incurred on purchase and transportation of raw PVO, fuel, (e.g. firewood), labour used in the processing stage and milling of sundried PVOM divided by the quantity (kg) of PVOM produced.

prices of the feed ingredients at the time of the experiment (Table 1).

**Chemical and Statistical Analyses:** Samples of the test ingredient (PVOM) and test diets were analysed for their proximate fractions (Table 2) according to the methods of AOAC (1990). Data on performance parameters were subjected to analysis of variance for a completely randomised design. Duncan's Multiple Range Test was also used to compare and separate the means of the test diets (Steel and Torrie, 1980).

## RESULTS AND DISCUSSION

Table 2 shows the determined chemical composition of PVOM and the test diets. The calculated and determined crude protein contents of the experimental diets were similar thereby confirming the crude protein contents of 56 and 65% for PVOM and FM respectively. The dietary protein level of the

diets (Tables 1&2) was within the range recommended for birds aged 14 to 18 weeks by Scot *et al* (1982) and NRC (1984).

The determined crude protein for PVOM agrees closely with 56.4% reported for POM by Udedibie *et al* (1988). This is not expected in view of the differences in the processing methods and the component of the starting raw materials used by the respective authors. Skurray and Carroll (1978) observed differences in the chemical composition of hard and soft offal meat meals produced from different starting raw materials (offals) by the same "dry rendering" method. On the other hand, the crude protein of 59.9% reported for COM by Nwokoro (1993) is higher than those for POM and PVOM. It is pertinent to reiterate that Nwokoro (1993)'s "wet rendering" method was modified presently.

Differences in the chemical composition such as crude protein, fat, etc. of the meals

TABLE 2: DETERMINED PROXIMATE COMPOSITIONS OF PVOM AND EXPERIMENTAL GROWER PULLETS' DIETS

Proximate Fraction (%)	TEST DIETS					
	PVOM	A	B	C	D	E
Dry matter	94.00	94.25	93.17	94.12	94.07	93.93
Crude Protein	56.00	15.55	15.90	14.84	15.97	15.55
Crude Fibre	0.35	7.94	7.67	8.58	7.98	7.59
Ether Extract	13.50	7.34	6.44	6.71	6.15	5.45
Ash	5.11	8.40	8.26	8.12	7.98	7.84
Estimated Metabolisable Energy (ME MJ/Kg)	-	10.89	10.79	11.73	11.48	10.91

TABLE 3: PERFORMANCE CHARACTERISTICS OF GROWER PULLETS FED THE EXPERIMENTAL DIETS (14TH-18TH WEEKS)

Parameters	TEST DIETS <sup>a</sup>					SEM
	A	B	C	D	E	
Mean body weight gain (g/bird/d)	14.16	13.66	14.65	13.35	13.84	0.66
Mean feed intake (g/bird/d)	73.61	73.27	73.88	72.10	71.76	0.84
Feed conversion ratio	5.21	5.45	5.04	5.42	5.21	0.23
Mortality (%)	0.00	0.00	0.00	0.00	0.00	0.00
<b>COST OF PRODUCTION</b>						
Feed cost/g diet (kobo)	0.493	0.478	0.464	0.449	0.434	
Feed cost/g live wt. gain (k)	2.57	2.61	2.34	2.43	2.26	

<sup>a</sup>Mean values bearing no superscript are not significantly different ( $P > 0.05$ ).

(POM, COM and PVOM) may also be attributable to other factors such as age, breed and type of poultry birds from which the raw offals are derived as well as the component parts of the offals.

Live performance characteristics of the grower pullets are summarised in Table 3. There were no significant ( $P > 0.05$ ) differences in the mean daily weight gain, feed consumption and feed conversion ratio of the birds fed on the respective diets. With the exception of the birds on diet D which had mean daily weight gain of about 13g/b d, those on other diets recorded about 14g/b d. These values are higher than those reported by Eshiett and Ademosun (1981) and Scott *et al* (1982) for B-Hyline commercial hybrid pullets (8-20 weeks of age) and White Leghorn pullets (14-18 weeks) respectively. However, the growth rates observed presently are

comparable with the values ranging from 12.51 to 13.78g/bd reported by Aina (1990) for Isa Brown cockerels (13-20 weeks) in his study in which maize was replaced with sundried cassava peel meal. The similarity ( $P > 0.05$ ) in the growth performance of birds on all diets in this study is an indication that the quality of PVOM protein is not inferior to that of FM. This finding further corroborates the earlier observation of Nwokoro (1993) in his study wherein blood meal, COM and FM were used as sources of methionine and lysine in the diets for starter cockerels up to 8 weeks of age. It is also evident in the studies conducted by Udedibie *et al* (1988) and Salami and Oyewole (Unpublished) that the quality of protein in POM and PVOM is superior to that of groundnut cake and comparable to that of fish meal respectively.

The mean daily feed intake ranged from

## POULTRY VISCERAL OFFAL MEAL FOR GROWER PULLETS

71.76 (for birds on diet E) to 73.88g/b d (for birds on diet C). It is well known that, within a certain limit, birds fed *ad libitum* eat to satisfy their energy requirements (Hill and Dansky, 1954). Thus, the similarity ( $P > 0.05$ ) in voluntary feed intake of birds confirms that the test diets were uniform in their calorie contents and there was no negative effect of PVOM on feed intake. The values of feed intake observed presently are higher than those (63 to 66g/b d) quoted by Scott *et al* (1982), but similar to those (75g/b d) given by Oluyemi and Roberts (1979) and Eshiett and Ademosun (1981) for the birds on cassava peel meal-substituted diets (69.12 to 72.74g/b d). The mean values of feed conversion ratio in this study ranged from 5.04 to 5.45. These values are comparable with 5.74 for the pullets on the control diet (Eshiett and Ademosun, 1981) but slightly inferior to the value (3.9 to 4.4) given by Scott *et al* (1982) for White Leghorn pullets of similar age under temperate condition.

No mortality was recorded for birds on the test diets, thus indicating the safety of PVOM as a feed ingredient. This observation is in agreement with the earlier ones by Udedibie *et al* (1988), Nwokoro, (1993) and Salami and Oyewole (Unpublished).

The cost of producing a gram of feed decreased as level of substitution increased (Table 3). Also, the cost of feed required per unit of weight gain by birds fed diet E was lower than that of birds receiving diet A (control). The reduction in feed cost obtained in this study is in agreement with the reports of similar studies (Ologhobo and Oyewole, 1987; Aina, 1990; Esonu and Udedibie, 1993 and Atteh and Ologbenla, 1993).

Conclusively, data from this study show that PVOM is a cheaper and complete substitute for fish meal and its use should be strongly encouraged in grower pullet diets. It is safe and could reduce the problems of disposal and environmental pollution in poultry eviscerating plants in Nigeria and elsewhere.

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