POULTRY OFFAL MEAL AS A PROTEIN SUPPLEMENT FOR LAYING HENS AND FINISHER BROILERS

A.B.I. UDEDIBIE, G. ANYANWU, U.I. UKPAI and A.J. OYET

Federal University of Technology, Owerri

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ABSTRACT

Two experiments were conducted to determine the value of poultry offal meal (POM) as a protein supplement for layers and finisher broilers, respectively, at dietary levels of 0, 10, 15 and 20%. In the layer experiment, body weights of layers increased with increasing dietary levels of POM. Treatments effects on feed intakes were not significant but egg production as well as feed efficiency were significantly ($P < 0.05$) improved by POM.

In the broiler experiment, feed intake, growth rate, feed efficiency ad weights of livers were significantly ($P < 0.05$) higher at 15 and 20% POM dietary levels. Abdominal fat became significantly ($P < 0.05$) higher as from 10% POM dietary level.

Poultry offal meal (POM), the processed edible and inedible parts of poultry (viscera, feathers, beaks, blood, discarded eggs and dead birds), used in this study contained (on dry matter basis) crude protein 56.4%, crude fat 20.9%, total ash 7.7%, crude fibre 4.6%, metabolizable energy 3.18kcal/gm.

Key Words: Poultry offal meal; protein; layers, broilers.

INTRODUCTION

Poultry offal meal (POM) is made up of the edible and inedible parts (heads, viscera, feathers, beaks, blood, discarded eggs and dead birds) collected from poultry slaughter house, washed to remove the gut contents in some cases and further processed by "wet-rendering method" as described by Neelakantan (1973). Until recently, very little is heard about this by-product of poultry processing, particularly in the tropics, since less than 5% of the total slaughtering of broilers or table birds, is done through organized dressing systems (Daghir, 1975). In the United States, where it is common as a recycling product of poultry industry, it has been described as a valuable feed-supplement for household pets (Morris, 1946), hogs (Khale and Gray, 1957), poultry (Potter and Fuller, 1967; Jackson and Fulton, 1971; Narahari *et al* ., 1981). Potter and Fuller (1967) described POM as having the physical characteristics that make it satisfactory for mixing into poultry diets, although the final product may vary in chemical composition as a result of variations in proportions of the starting materials. It is this factor that is responsible for the variations in performance of birds, fed POM from different locations (Daghir, 1975; McNaughton *et al* , 1977).

With the emergence of large scale poultry industries in Nigeria within the last few years, and the declining availability of

protein concentrates, there is need to recycle the so-called poultry wastes into valuable products for livestock industry. Recent report on the POM from Avutu (Udedibie *et al* , 1987) has shown that the material is a valuable dietary protein supplement for pigs. This study was therefore conducted to determine its value as a protein supplement for laying hens and finishing broilers.

MATERIALS AND METHODS

The POM used for the study was obtained from the Imo Modern Poultry (Nigeria) Ltd., Avutu in Imo State of Nigeria. Its method of production has previously been reported (Udedibie *et al* ., 1987).

The POM and GNC used in the trials were chemically analyzed for components indicated in table 1 by standard methods (AOAC, 1970).

Table 1
Chemical composition of POM and GNC used in the study (g/100g dry matter)

Parameters	POM*	GNC
Dry matter (%)	90.00	95.42
Crude protein	56.40	44.81
Ether extract	20.90	7.22
Crude fibre	4.60	2.52
Total ash	7.70	6.70
Lysine	2.01	1.84
Methionine	0.70	0.62
Methionine + Cystine	2.65	1.60
Arginine	3.52	5.36
Threonine	2.51	1.62
**ME, Kcal/g DM	3.18	2.82

* Analyses as done for Imo Modern Poultry (Nig.) Ltd.
** ME calculated
POM = Poultry offals meal
GNC = Groundnut cake

Experiment 1

Eighty hyline layers, in their 9th month of laying life, were divided into four groups of 20 birds each, and randomly assigned to four treatment diets. Each treatment group; was further sub- divided into five replicates of four birds each, and, each replicate housed in a cage. Four diets (Table 2) were compounded such that POM at four dietary levels, 0, 10, 15 and 20%, replaced 0, 60, 80 and 100% GNC respectively in the diets.

Birds were weighed at the start of the experiment and every two weeks, thereafter. Water and feed were provided *ad libitum*,

for the 16-week duration of the trial. Daily feed intake and weekly egg production, egg weights and body weight changes, were recorded. The data collected were subjected to analysis of variance (Snedecor and Cochran, 1967).

Table 2
Composition of the treatment diets (Experiment 1)

Ingredients (%)	*Dietary levels of POM (%)* 0	10	15	20
Maize	50.0	50.0	50.0	50.0
Groundnut cake	25.0	10.0	5.0	—
POM	—	10.0	15.0	20.0
Palm kernel cake	2.0	2.0	2.0	2.0
Wheat bran	10.0	10.0	10.0	10.0
*Mineral/Vitamin premix	5.0	5.0	5.0	5.0
Limestone	4.0	4.0	4.0	4.0
Bone meal	4.0	4.0	4.0	4.0
+*Chemical Analysis*				
Crude protein	17.25	17.05	17.20	18.15
Ether extract	5.02	6.18	7.70	8.14
Crude fibre	4.42	4.62	4.65	4.60
Calcium	3.94	4.00	4.12	4.21
Phosphorus	0.45	0.52	0.54	0.54
Methionine (calc.)	0.28	0.31	0.31	0.31
Lysine (cal.)	0.88	0.86	0.88	0.88
Calc. ME (Kcal/g DM)	2.74	2.82	2.86	2.88

* Guaranteed analysis: Crude protein, 9%; cimmon salt, 3%; calcium, 18%; phosphorus, 5%; methionine, 0.9%; lysine, 1.1%. To provide the following per kg of diet: Vit. A, 10,000 i.u.; vit. D3, 1500 i.u.; vit. E3, i.u.; vit K, 2mg; riboflavin; 3mg; panthothenic acid, 6mg; niacin, 15mg; vit. B12, 8mg; choline, 350mg; folic acid; 4mg; mangenese, 56mg; iodine.

Experiment 2

One hundred and twenty broiler chicks of Hubbard breed, aged seven weeks, which had been reared on conventional starter and grower diets, were used to determine the effect of POM on broiler finisher birds. The birds were divided into four groups of 30 each and these were further divided into 10 replicates of three birds each. Each of the three birds of a replicate, was differently marked for each identification. Replicate groups were similar in weight and each replicate was housed in a cage. Four broiler finisher test diets (Table 3) were made, such that POM was incorporated at four dietary levels, 0, 10, 15 and 20%, replacing 0, 50, 73

and 100% of the GNC respectively.

Birds were weighed at the start of the experiment and weekly thereafter. Water and feed were provided *ad libitum*. The experiment lasted for five weeks.

At the end of the experimental period, the birds were deprived of food but not water for 18 hours. Six birds were randomly selected from each treatment group, sacrificed and eviscerated. The internal organs, liver, gizzard, heart and the abdominal fat, were weighed.

The data collected were subjected to analysis of variance (Snedecor and Cochran, 1967).

Table 3
Composition of the Treatment Diets (Experiment 2)

Ingredients (%)	*Dietary levels of POM (%)* 0	10	15	20
Maize	60.0	60.0	60.0	60.0
Groundut cake	30.0	15.0	8.0	—
POM	—	10.0	15.0	—
Palm kernel cake	—	2.0	2.0	3.0
Wheat bran	5.0	8.0	10.0	12.0
Premix*	5.0	5.0	5.0	5.0
+*Chemical Analysis*				
Crude protein	19.65	19.60	19.75	19.65
Crude fibre	3.74	4.40	4.66	4.78
Crude fat	5.12	6.36	7.17	8.25
Calcium	1.03	1.02	1.10	1.13
Phosphorus	0.64	0.62	0.68	0.67
Methionine (calc.)	0.34	0.34	0.35	0.35
Lysine (calc.)	0.86	0.86	0.87	0.88
Calc. ME (Kcal/g DM)	2.87	2.87	2.92	2.96

* To provide the following per kg of diet: Vit.A, 10,000 iu; vit. D3, 2,000 iu; vit. E, iu; vit. K, 2.24mg; vit. B12, 0.01mg; riboflavin, 5.5mg; panthotenic acid, 10mg; nicotinic acid, 25mg; choline, 350mg; folic acid, 1mg; manganese, 56mg; iodine, 1mg; iron, 20mg; copper, 10mg; zinc, 50mg; cobbalt, 1.25mg.

RESULTS AND DISCUSSION

Chemical composition of the POM

The chemical composition of the POM used is shown in table 1. The POM contained the necessary nutrients at comparatively high levels, even though it was processed at a temperature that would be considered too high for certain essential amino acids (Carpenter *et al* ., 1962; McNaughton *et al* ., 1977). The composition of the POM (table 1) compares very

favourably with that reported by Narahari *et al* (1981) for similar product in India. Although the POM appeared low in methionine in relation to its content of other essential amino acids, the performance of the birds on the POM based diets (as will be observed later) did not indicate a need for methionine supplementation of the diets. The high energy value could be due to its high fat content.

Experiment 1

The performance of the layers on POM diets, is presented in table 4. Birds on POM diets added significantly ($P<0.05$) more weights by the end of the trial. Feed intakes as well as the egg weights were not affected by treatments. Hen-day egg production and efficiency of feed utilization were, however, significantly ($P<0.05$) improved by the POM.

The increased body weights of the birds on the POM diets agree with earlier report (Jackson and Fulton, 1971). Although this study did not terminate in slaughter to examine the internal organs and abdominal fats, it was likely that the greater increase in body weights was due to laying on of more fat by those birds that were on the POM diets. Dietary fat intake of those birds were higher than that of those on the control diet (table 2). A similar observation had earlier been made for broilers (Narahari *et al* ., 1981). The effect of increased body fat in layers is decreased egg production. This, however, was not apparent throughout the duration of this trial.

The superior performance of the birds on the POM diets in egg production was, however, meaningful. POM used in the trial had higher levels of most of the essential amino acids relative to groundnut cake, which served as control protein supplement. Even the level of the most limiting amino acid in the POM, methionine, was higher than it was in the groundnut cake. It is therefore likely that even though the total protein intakes of the birds were about the same, the birds on the POM diets received proteins with better amino acid profile.

Experiment 2

The results of this study are shown in table 5. The feed intakes of the birds increased with increasing levels of dietary POM. The increase in feed intakes became significant ($P<0.05$) at 20% dietary level. Body weight gains followed a similar trend and became significant ($P<0.05$) at 15% POM dietary level. Feed efficiency also became significantly ($P<0.05$) improved at 15 and 20% POM dietary levels. The weights of the hearts and gizzards were not affected by treatments, but the weights of the livers and the abdominal fats increased with increasing dietary levels of the POM. The weights of the livers became significantly ($P<0.05$) different from the 15% POM dietary level but increase in weights of the abdominal fats, became significant ($P<0.05$) at 10% POM dietary level. High body fat may lead to death due to fatty liver syndrome. However, no mortality due to such nutritional anomaly was observed during the trial.

The data generated from this study have shown that POM could be incorporated up to 20% dietary level for finishing broilers. The results confirm the findings of earlier studies in the United States (Jackson and Fulton, 1971) and India (Narahari *et al* , 1981). The high body fat of the birds cannot totally be credited to low methionine intake as earlier suggested (Potter and Fuller, 1967); McNaughton *et al* ., 1977). The higher dietary fat intakes seemed to have contributed more to the high body fat, since deficiency in dietary methionine intake was similar for all the diets (Table 2). As has been stated in experiment 1 above, the general superior performance of the birds

on POM diets, must have arisen from the superior amino acid profile of the proteins of the POM diets.

It is therefore conclusive that POM is a good protein concentrate for both layers and broilers, and, its production in the country should he highly encouraged.

Table 4
Effect of POM on the performance of laying hens

Parameters	*Dietary levels of POM* 0	10	15	20	s.e.m.
Body weight change (g)	70.[a]	150.0	170.0	160.0	4.21
Feed intake (g/day)	80.8	78.9	79.1	80.2	0.24
Hen-day egg production (%)	60.9[a]	64.4	66.8	65.3	0.78
Egg weights (g)	57.1	55.3	56.2	56.2	0.09
Feed efficiency (kg feed/kg egg)	2.36[a]	2.12	2.11	2.19	0.003

[a] Means within rows with superscript are different from others ($P < 0.05$).
SEM = standard error of estimate.

Table 5
Effect of POM on the performance of finisher broilers

Parameters	*Diety levels of POM (%)* 0	10	15	20	s.e.m.
Feed intake (g/day)	96.4[a]	98.8[a]	107.4[a]	113.0[b]	3.04
Body weight gain (g/day)	26.5[a]	28.4[a]	31.3[b]	34.1[b]	0.74
Feed efficiency (kg feed/kg gain)	3.64[a]	3.51[a]	3.23[b]	3.31[b]	0.06
Internal organs: (% of body weight)					
Heart	0.56	0.56	0.57	0.56	
Gizzard	1.93	1.96	1.96	1.87	0.02
Liver	1.85[a]	1.90[ab]	1.94[b]	1.97[b]	0.02
Abdominal fat	2.03[a]	2.36[b]	2.38[b]	2.51[b]	0.04

[a,b] Means along the same rows with different superscripts are different ($P < 0.05$).
SEM = standard error of estimate.

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