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EFFECTS OF POULTRY OFFAL MEAL AND SOYABEAN MEAL MIXTURES ON THE PERFORMANCE AND CARCASS QUALITY OF BROILER CHICKS

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ABSTRACT

An experiment was conducted to test four different mixing ratios of soyabean meal (SBM) and poultry offal meal (POM) on the performance, histology and carcass evaluation of broiler chicks. The mixing ratios used in this study were (POM and SBM) 25:75, 50:50, 75:25, and 100:0. The experiment was conducted for 8 weeks.

Feed intake significantly increased as the proportion of (POM) increased up to 25%. Beyond this level, additional POM did not result in corresponding feed intake for the bird. Body weight gain varied positively with increasing POM proportion in the mixture and followed similar trend recorded for feed intake. Birds fed with 25% (POM) recorded the highest values 79.20g/bird/day and 37.7g/bird/day, respectively for feed intake and weight gain. The lowest feed intake and body weight gain values were observed for birds fed diets containing the highest POM proportion (75%). These values were 59.72g/bird/day and 22.22g/bird/day respectively. Feed conversion ratio was significantly affected ($P<0.05$) and inversely related to increasing levels of POM. The best feed gain (2.10) was recorded for birds fed 25:75 POM SBM mixtures. Nutrients retained by broiler chicks were significantly influenced by the different treatments. Protein retention was affected by increasing POM proportion in the mixture. However, further increase in POM proportion in the mixture above 75% led to significantly decreased protein retention.

Fat retention was significantly different among the various treatments and was directly related to increasing levels of poultry offal meal. The highest value recorded (77.98%) was obtained for broiler chicks fed 75:25 POM and SBM mixture. Crude protein, ether extract and ash determined for poultry offal meal were 55.60, 6.70 and 8.20%, respectively. Histological study conducted did not reveal any cellular abnormality for the various treatments. Mortality and carcass quality were not significantly affected by the dietary treatments. Cost per kilogram of the diets decreased in response to increasing levels of (POM). Best cost: benefit was obtained with 25:75 POM and SBM dietary mixture.

KEY WORDS: Poultry offal, soyabean meal, performance

INTRODUCTION

Recent advances in modern poultry production have further increased the competition for conventional feedstuffs between livestock industry, agricultural product-dependent industries (confectionery and distillers) and humans. Feed costs have continued to be the major determinant of profit in this industry accounting for between 70 and 80 % total cost of production [1]. The search for alternative feed ingredients has become a major research objective in Nigeria [2].

Presently, large quantities (156 000 metric tonnes/year) of poultry offal are wasted in Nigeria. In addition, these offals constitute a source of environmental hazards [3]. It has been reported that less than 5% of total numbers of slaughtered birds in the tropics is done in an organized dressing system [4]. Poultry offal is a source of protein, mineral and fat, which can be harnessed in feeding livestock [3]. Twenty percent (20%) dietary inclusion of poultry offal has been recommended for laying hens [5]. The use of this offal in poultry feeds will conserve the environment, reduce cost of production and increase savings on foreign exchange by reducing the volume of imported protein supplements [4].

This study investigated the merits of incorporating different mixing ratios of poultry offal meal and soyabean in the diets of broiler chicks. Poultry Offal Meal (POM) and Soya Bean Meal (SBM) has been used in various experiments in Nigeria, however, the idea of mixing these feedstuffs in an experiment to harness any positive synergism for poultry production has not been tested. SBM, a major source of plant protein in monogastric feeds in Nigeria is highly deficient in specific amino acids and expensive while POM, which is of animal origin is rich in essential amino acids (lysine, methionine and cystine) [3, 5] and cheap. The mixture of these feedstuffs is expected to improve the amino acid profile of the diet, improve nutrient bioavailability and body weight gains in broiler chicks. In addition, the cost of broiler production is also expected to reduce appreciably.

MATERIALS AND METHODS

One hundred (100) day old shaver broiler chicks (mixed sex) used for this study were purchased from Tuns Farm, Oshogbo, Nigeria. The birds were housed in electrically-heated battery brooder cages and were randomly allotted to four diets (Table 1) which was replicated five times (five birds per replicate). The diets consisted of substitution levels of POM for SBM at 0, 25, 50, and 75%. POM was collected from meat shops within Ilorin metropolis, Kwara state, Nigeria. The collected samples were washed to remove residual digesta, steam sterilized for 30 minutes, air-dried and milled with other feed ingredients. Feed and water were given *ad libitum*. Standard vaccination and medication were observed throughout the study. Feed intake and weight gain were recorded weekly.

During the third week of the 8-week study, protein and fat nutrient retention were carried out for 72 hours.

$$\textit{Nutrient Retention} = \frac{(\textit{Nutrient consumed} - \textit{Nutrient voided in feaces}) \times 100.}{\textit{Nutrient consumed}}$$

At the end of eight weeks, four (4) birds per diet were slaughtered by head decapitation, de-feathered, eviscerated and relative weights of the organs and commercial parts were recorded.

Following carcass analysis, the liver, kidney, cardiac and breast muscles were quickly dissected out, freed from any adhering fat, blotted free of blood and preserved in 10% formalin solution. The tissues were trimmed, fixed for 24 hrs, embedded in wax, sectioned at 5-6µm with a microton, and stained with haematozylin and eosin. Histological study was thereafter conducted to observe any tissue damage and cellular architectural defect in the organs collected [6].

At the end of the study, a cost/ benefit analysis was conducted to determine marginal cost and marginal revenue accruable as a result of the use of the various mixtures.

Marginal Cost /kg flesh (MC) = Cost of Feed (COF)/ Total Weight (TW)
Marginal revenue/kg flesh (MR) = Cost of 1kg broiler /MC

Proximate composition of the feed and (POM) were determined using standard methods [7]. Data collected from the study were subjected to analysis of variance test using the model of completely randomized design model [8]. Differences among treatment means were separated using Duncan Multiple Range test [9] and significance was accepted at 5% level, $p<0.05$.

RESULTS

Average daily feed intake recorded was different for all the diets (Table 2). Birds fed 25:75 POM and SBM mixture consumed more feeds (79.2g/bird/day) than birds offered the other diets. Feed intake was inversely related to the level of substitution of POM. Birds fed 75:25 POM and SBM mixture recorded the lowest average daily feed intake (59. 7g/bird/day).

The average daily weight gain was significantly affected by the dietary treatments (Table 2). The trend of variability was similar to the observation reported for feed intake, meaning that there was faster weight gain in the treatment with highest feed intake. Broiler chicks fed 25% POM gained more weight (37.7g/bird/day) than birds fed the other diets. The lowest daily weight gain was recorded for birds fed 75:25 POM and SBM mixture (22.2g/bird/day). Feed gain ratio was inversely related to increasing level of dietary POM. Broiler chicks fed 25:75 POM and SBM mixture had a feed:gain of 2.1 while the lowest feed: gain was recorded for birds fed 75:25 POM and SBM dietary mixture (2.7).

There was no mortality recorded throughout the period of experiment. Nutrients retained by broilers were influenced by the various diets fed (Table 2). Nitrogen retention was highest (78.3%) when broiler chicks were fed 25:75 while fat retention was highest at 75:25 POM and SBM mixture.

Relative weights of organs and commercial cuts of broilers were not influenced ($P<0.05$) by the various dietary treatments (Table 3). Histology of the organs examined did not reveal any

aberration from normal cellular structures and integrity. It was cheaper ($p<0.05$) to raise broiler using POM as compared to soyabean meal (Table3).The best cost benefit ratio was realized at 25:75 POM and SBM dietary mixture. This mixture resulted in relatively high return to marginal revenue and consequently was profitable.

DISCUSSION

The crude protein content of POM obtained in the study was different from some previous reports [3]. This difference may be due to component variations in the poultry offals collected associated with location, and method of slaughtering used. However, the recorded values observed in this study were similar to some other reports [5].

Feed intake was recorded to be inversely related to the increasing levels of POM in the mixture. Feed intake observed for broilers fed 75% POM tended to suggest that lower levels only may be synergistically beneficial. Birds have been known to eat in order to satisfy energy requirement [10]. The high fat content of the POM may have increased the energy density of the feed, reduced feed intake and consequently weight gain[11]. Birds fed high energy diets will achieve satiation earlier with less feed. Fat retention varied directly with increasing levels of POM in the mixture. This observation may have induced a feed back post-ingestion reduction of feed intake [12].

Body weight gain followed a similar trend to feed intake. The decreased weight gain at higher POM level was partly due to low feed intake while POM SBM dietary mixtures of 25:75 and 50:50 suggests a positively higher bioavailability and synergistic utilization of amino acids. Poultry offal meal has been reported to be rich in lysine, methionine and cystine [5] while soyabean is a poor source of methionine [3, 5, 11]. Dietary mixture of POM and SBM at 25:75 tended to have resulted in complementary balance of amino acid reflected in the corresponding body weight gain. This result corroborates an earlier report on the use of POM for laying hens [5].

Poultry offal meal did not have adverse effect on the health of broilers since record of mortality was not affected by the various mixtures. Specific organs of chicks fed POM did not have pathological changes attributable to the treatments [13]. POM (if well processed) can be mixed with SBM without the fear of mortality that could result from pathogenic infestation. The gastrointestinal tract of poultry is highly susceptible to various pathogenic strains of organism such as *Eimeria spp* and has been known to be transmitted in recycled offals [12, 13]. Although various dietary mixtures of POM and SBM used in this study had effects on feed intake, weight gain and other economic parameters, however, no marked effect was noticed in the commercial cuts of the carcass.

The cost/benefit ratio analysis (cost of feed to raise 1kg broiler flesh) showed that cost per kilogram of feed was inversely related to increasing dietary levels of POM in the mixture. Generally, there was marginal cost reduction (about $3.5) as the POM levels in the mixture increased. It was cheaper to incorporate POM in broiler chick feeds. However, reduced feed intake and growth depression at higher POM inclusion level may have masked this advantage and resulted in poor benefit to production [3, 5, 11, 13]. Dietary mixture of POM and SBM at

25:75 had the best balance of effects in terms of cost, profitability and other performance parameters considered in this study.

CONCLUSION

Poultry offal meal can be profitably mixed with SBM in broiler diets. Dietary mixture of 25:75 POM and SBM was found optimum. At this level, risk of depressed feed intake and growth reduction were not recorded. The use of POM in poultry production will reduce marginal cost of production and the menace of improper offal disposal that is a contributing source of environmental pollution in Nigeria. In an on-farm situation, incorporation of a carcass rendering unit to recycle poultry offals may help in reducing cost pressure of protein feedstuffs in broiler farms.

Table 1: Composition of Experimental Diets (g/100g feed)

Item	Diets			
	1	2	3	4
Basal Ingredients*+	77.00	77.00	77.00	77.00
Poultry offal meal**	0.00	5.75	11.50	17.25
Soyabean Meal	23.00	17.25	11.50	5.70
Total	100.00	100.00	100.00	100.00
Analyzed nutrient (%)				
Crude Protein	23.90±0.15	24.45±0.28	24.50±0.16	24.62±0.11
Ether Extract	4.75±0.23	5.19±0.40	5.74±0.12	5.99±0.27

** Analyzed nutrients (%) Crude protein, 55.60; Ether Extract, 6.70; Ash, 8.20

* contained (kg); Maize, 55.35; Groundnut Cake, 17.30; Bone meal, 2.50; Oyster shell, 1.2; salt 0.3; Vitamin/mineral premix, 0.25; Methionine, 0.1; Lysine, 0.1.

+ Contain (/Kg):-

Retinol, $4x10^6$ i.u; Cholecalciferol, $1.2x10^6$ i,u; αTocopherol, 3200 i.u. Menadione, 800 mg; Riboflavin, 2200 mg; Thiamin, 3200mg; Niacin, 400 mg; Pyridoxine, 480 mg; Calcium pantothenate, 2800 mg; Folate 240 mg; Choline choride, $2x10^5$ mg; Biotin, 12 mg; Se. 40 mg; Mn, 32000 Cu, 3200 mg; Zn, $2x10^5$ mg; Co, 180 mg; I, 800 mg; Mg, 400 mg.

Table 2: Effects of Poultry offal meal/Soyabean Mixture on the performance of Broiler chicks.

Item	Diets				
	1	2	3	4	SEM
Daily feed intake (g/bird/day)	62.37[a]	79.20[c]	69.91[b]	59.72[a]	2.50
Daily weight gain (g/bird/day)	25.50[b]	37.70[c]	27.97[b]	22.22[a]	2.85
Feed:gain	2.44[b]	2.10[a]	2.49[b]	2.69[c]	0.11
Mortality (%)	0	0	0	0	NS
Protein retention (%)	76.54[a]	78.27[a]	78.23[a]	71.37[b]	2.53
Fat retention (%)	70.92[a]	71.98[a]	71.03[a]	77.98[b]	3.45
Cost/kg feed (₦)	23.70	22.00	20.83	21.80	NS
Cost:benefit ratio*	1.64[a]	1.74[b]	1.73[b]	1.70[b]	0.04

*Marginal revenue for each kg of broiler. a,b,c, values within the same row having the same superscripts are different ($P<0.05$)

NS Not significant

Table 3: Effects of Poultry offal meal/Soyabean Mixture on the relative weights of Organs and primal cuts of Broilers (g/100g body weight)*

Item	Diets			
	1	2	3	4
Dressing percentage (%)	74.59	76.45	76.31	74.60
Wings	8.64	8.85	8.67	8.61
Thigh	10.74	10.97	10.75	10.60
Drumstick	11.38	11.65	11.51	11.61
Keel	11.44	11.41	11.50	11.58
Back	14.10	14.20	14.10	14.15
Intestine	17.10	17.07	17.06	17.08
Gizzard	3.56	3.75	3.65	3.60
Liver	2.22	2.39	2.29	2.20
Heart	0.50	0.50	0.52	0.54

* All values recorded were not significantly different (P>0.05)

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