EFFECTS OF BLOOD MEAL, CHICKEN OFFAL MEAL AND FISH MEAL AS SOURCES OF METHIONINE AND LYSINE IN STARTER COCKERELS DIETS

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ABSTRACT

The effects were studied of using combinations of plant protein sources, GNC, Palm Kernel cake, and cotton and seed cake diets, supplemented with 4 sources of methionine (M) and Lysine (L), synthetic M+L, blood meal + M, fish meal, or chicken offal meal (COM) in 8-Week 3 x 4 factorial experiment with starter cockerels. Sources of M and L did not affect mean daily gain of the birds but significant differences ($P<0.05$) were observed in feed intke, feed per gain ratio, protein efficiency ratio (PER), nitrogen retention (NR) as well as economy of feed conversion. Maximum weight, best feed conversion ratio, PER and economy of feed conversion were observed in the M+L dietary group followed by those on blood meal + M supplementary group where maximum NR was observed. The least response values (except NR) were obtained in the COM group. This study indicated that starter cockerels (0-8 weeks) fed diets supplemented with synthetic methionine and lysine gave the most optional performance.

Keywords: **Cockerels, performance, blood meal, chicken offal meal, fish meal, methionine and lysine.**

INTRODUCTION

Nutritionists have made numerous attempts to device adequate poultry rations by the use of vegetable products as the sole source of proteins. Many studies have been conducted with diets based chiefly on maize and groundnut cake (GNC). The work on broilers (Olomu and Offiong, 1980), pullet chickens (Chhillar *et al.*, 1971; Wethli *et al.*, 1975) and on cockerel starters (Nwokoro and Tewe, 1992; Nwokoro, 1992) have demonstrated that such diets were deficient in methionine and lysine. Similarly, studies at University of Ibadan (Okosun, 1987) using cotton seed cake and palm kernel cake to replace part of GNC in cockerel starter diets have shown that deficiencies of these plant proteins should be supplemented with fish meals, or lysine and methionine. Thus, the present study was designed to examine the effect of using blood meal, fish meal or chicken offal meal in oil sed cake based diets as sources of M+L on the performance of cockerel starters.

MATERIALS AND METHODS

Most of the materials utilised for this study with the exception of chicken offal meal and premix were obtained from Livestock Feed Limited (A Division of Pfizer Nig. Ltd.). The chicken offal meal obtained and processed as described below.

Method of processing of chicken offal meal

In the preparation of the chicken offal meal utilized in this study, the broiler chicken entails (gut content inclusive) obtained from

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the days broiler processing at ZARTECH Agric. Industries, Ibadan, Nigeria were used. The major processes involved were cleaning and cooking, cooling and drying, milling and storage.

(i) Cleaning and Cooking :The intestines from the days processing, collected between 16.00 hours and 18.00 hours were cleaned of chicken processing residues, and washed with water to remove dirth. Then transferred into "half-drums" where the "wet rendering" method was applied. This entailed cooking the intestines at a temperature of about 150°C for 3 to 4 hours before the materials were ready for further processing.

(ii) Cooking and drying : After cooking, the "broth" is left overnight to cool off. At the end of which a substantial proportion of the liquid especially oil float at the top of the materials. It is then partially defatted by decanting which involved scooping off the oil at the top level and further pressed gently to expel more oil. Then, the materials were partially fried to reduce the moisture content until a brownish colour was obtained. The weight of the material is taken and 2.5% of the weight measure of salt (NaCl) is added and worked up immediately so as serve as preservative. Consequently, the materials were further sundried (at 30-35C) until about 90% dry matter obtained.

(iii) Milling and Storage : At the end of the drying phase, the chicken offal materials were ground using a hammer mill with screen size 1/32". Then, the product stored in air tight bags before use.

Experimental Design

A total of 360 Harco cockerels at day old were used. They were randomly distributed into 12 lots of 30 birds per treatment. Each treatment was further sub-divided into two replicate groups. The birds were fed and watered *ad libitum*.

Twelve diets were formulated in 3 x 4 factorial dietary treatments such that three combinations of plant protein sources (GNC only, GNC/Palm kernel cake or GNC/cotton seed cake), were supplemented with four major sources of M and L (synthetic, blood meal, fish meal or chicken offal meal) to bring dietary levels to the requirements as established previously (Nwokoro and Tewe, 1992; Nwokoro, 1992). The PKC and CSC replaced 66.6% of GNC in their combinations: protein for protein (Table 1).

Nitrogen balance trial were carried out at the 8th week. The proximate composition of test ingredients and feed samples were analysed using the A.O.A.C. (1980) method.

During the experimental period, records were kept on daily mortality. Feed consumption and body weights were determined weekly.

The prevailing market prices of feed ingredients and the live chickens at the termination of the study were used for the assessment of economy of feed conversion.

At the conclusion of the experiment, the data were subjected to analysis of variance and the significance of differences were determined by applying Duncan's multiple range test (Steel and Torrie, 1980).

RESULTS

The performance indices of the cockerels fed varying forms of M and L suplemental diets are summarized in Table 3. The Table 4 summarized the effects of plant protein sources (ignoring M and L supplemented forms (MSLF) and MSLF (ignoring plant protein sources (PPS) on performance of the birds.

Analysis of variance indicated that PPS had no effect on mean daily weight gain. The feed consumption and feed per gain ratio were significantly ($P<0.05$) influenced by PPS. Feed consumption was lowered on the GNC, and GNC/PKC based diets in comparison with that of CSC. The same was however most depressed in the GNC/PKC dietary group. Nitrogen retention and PER were not significantly ($P>0.05$) affected by PPS.

TABLE 1 GROSS COMPOSITION OF EXPERIMENTAL DIETS

PROTEIN SUPPLEMENTS BASED DIETS	GROUNDNUT CAKE (GNC) BASED DIETS				GNC/PALM KERNEL CAKE BASED DIETS				GNC/COTTON SEED CAKE (CSC)			
DIETS	1	2	3	4	5	6	7	8	9	10	11	12
INGREDIENTS	M+L	RM+M	FM	COM	AMINO ACID SUPPLEMENT M+L	BM+M	FM	COM	M+L	BM+M	FM	COM
Maize	47.00	47.00	47.00	47.00	47.00	47.00	47.00	47.00	47.00	47.00	47.00	47.00
Maize Offals	19.95	16.39	14.00	12.25	8.91	4.90	3.40	1.00	18.35	14.29	13.75	11.25
Groundnut cake (GNC)	29.00	29.00	29.00	29.00	22.33	22.33	22.33	22.33	19.00	19.00	19.00	19.00
Palm kernel cake (PKC)	-	-	-	-	17.77	17.77	17.77	17.77	-	-	-	-
Cotton seed cake (CSC)	-	-	-	-	-	-	-	-	11.71	11.71	11.71	11.71
Bone Meal	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Oyster Shell	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Premix (Starters)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Salt (Nacl)	0.25	0.25	0.25	0.01	0.25	0.25	0.25	0.01	0.25	0.25	0.25	0.01
DL-Methionine (M)	0.20	0.14	-	-	0.13	0.10	-	-	0.13	0.10	-	-
L-lysine (L)	0.35	-	-	-	0.36	-	-	-	0.31	-	-	-
Blood Meal (BM)	-	3.97	-	-	-	4.40	-	-	-	4.40	-	-
Fish Meal	-	-	5.60	-	-	-	6.00	-	-	-	5.00	-
Chicken Offal Meal (COM)	-	-	-	8.50	-	-	-	9.00	-	-	-	7.79
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
CALCULATED COMPOSITION:												
Crude Protein (%)	21.00	23.51	24.01	25.10	21.00	22.64	23.00	24.05	21.00	24.08	24.00	25.00
Metabolizable energy (Kcal/g)	2.65	2.70	2.69	2.70	2.65	2.70	2.71	2.71	2.65	2.67	2.68	2.67
DL-methionine+Cystine (% diet)	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73
L-lysine (% of diet)	0.98	0.98	0.95	0.94	0.98	0.98	0.94	0.89	0.98	0.98	0.95	0.93
Total Gossypol	-	-	-	-	-	-	-	-	0.085	0.085	0.085	0.085
Free Gossypol	-	-	-	-	-	-	-	-	0.005	0.005	0.005	0.005
DETERMINED COMPOSITION												
Crude Protein (%)	20.91	23.68	23.85	24.71	21.29	22.63	22.73	23.73	21.01	23.46	23.48	24.45
Ether Extract (%)	3.51	3.69	3.98	4.55	4.62	4.46	4.60	4.99	3.89	3.94	3.96	4.70
Crude Fibre (%)	5.12	5.01	4.84	4.96	6.49	5.48	5.24	5.48	5.75	5.64	5.49	3.65

TABLE 2. NUTRIENT COMPOSITION OF EXPERIMENTAL INGREDIENTS (PERCENT)

Ingredients	Dry matter	Crude protein	Ether extract	Crude fibre	Total ash	Lysine	Methionine	Cystine
Yellow Maize	89.00	9.74	3.98	2.05	1.30	0.24	0.19	0.15
Maize Offals	81.00	11.98	1.50	8.00	4.60	0.40	0.15	0.23
Groundnut cake	91.67	47.97	5.56	9.57	6.05	1.49	0.47	0.69
Palm kernel cake	89.90	17.98	7.02	10.69	9.91	0.64	0.37	0.29
Cotton seed cake	92.52	41.06	5.85	14.10	6.13	1.59	0.58	0.64
Fish meal	92.10	65.14	5.43	0.96	19.38	4.79	1.81	0.59
Blood meal	92.10	80.90	2.13	1.80	4.50	7.15	0.58	0.60
Chicken offal meal	89.72	59.90	11.56	4.60	9.76	1.97	0.68	0.46

The MSLF had no significance on mean daily gain. The data indicated that COM supplemented diets gave the least weights followed by those fed fish meal (FM) supplemented diet, while maximum weights were obtained from the synthetic M + L supplemented diet. MSLF significantly ($P<0.05$) influenced feed intake, with the group on FM diet recording the highest feed intake. The best feed to gain ratio and PER were observed in group on M + L supplemented diet.

In all the performance parameters measured, significant interaction between PPS x MSLF was only observed in feed consumption.

The results of the nitrogen balance study (Table 3) indicated that maximum nitrogen retention (%) was obtained on GNC, BM + M diet (diet 2). This was followed by GNC/PKM M + L (diet 5) while the lowest NR (64.10%) was observed in GNC/FM diet. The trend for the MSLF factor showed that the BM + M group recorded the highest followed by the M+L, with the least retention observed in the FM group.

Economy of feed conversion (Table 5) showed remarkable differences, ($P<0.05$) in the feed cost per kg live weight, revenue less feed cost, and revenue to feed cost among groups on the different MSLF. In general, the highest feed cost and feed cost per kg live weight were recorded in the FM diet followed by those on the COM diet. Same trend was also observed in the revenue estimates. The least feed cost and feed cost per kg live weight, and highest revenue per feed cost were recorded on birds fed BM + M diet. But M+L dietary group gave the highest revenue, as well as revenue less feed cost.

DISCUSSION

The results of this trial have shown that the PPS had no significant ($P>0.05$) effects on weight gain, PER or NR on the treatment groups. The depressed feed intake of the group on GNC/PKC based diet could be due to PKC which had previously been reported to affect feed intake due to its grittiness, dryness and low polatability (Njike, 1979; Oyenuga, 1968).

The highest growth response was obtained in

TABLE 3. PERFORMANCE CHARACTERISTICS OF COCKEREL STARTERS FED VARYING FORMS OF METHIONINE AND LYSINE SUPPLEMENTED DIETS

	Diets (amino acids supplemental form												
	1(M+L)	2(BM+M)	3(FM)	4(COM)	5(M+L)	6(BM+M)	7(FM)	8(COM)	9(M+L)	10(BM+M)	11(FM)	12(COM)	SEM
Daily Weight gain (g)	11.02^{ab} (0.33)	10.90^{ab} (0.45)	10.63^{ab} (0.72)	9.78^{b} (0.67)	11.03^{ab} (0.11)	10.67^{ab} (0.12)	10.45^{ab} (0.00)	10.45^{ab} (0.45)	11.35^{a} (0.38)	11.34^{ab} (0.00)	10.63^{ab} (0.27)	10.98^{ab} (0.98)	0.513
Daily feed consumption (g/bird)	34.59^{ab} (1.30)	34.56^{ab} (0.27)	39.23^{cf} (1.22)	34.68^{ab} (1.23)	29.61^{d} (0.07)	33.43^{b} (0.19)	35.52^{abe} (0.31)	34.75^{abe} (0.09)	37.52^{ace} (0.94)	37.93^{cef} (0.21)	37.09^{ace} (1.25)	40.57^{f} (2.76)	2.908
Feed/gain ratio (feed/g gain)	3.14^{abc} (0.03)	3.17^{abc} (0.17)	3.71^{a} (0.14)	3.56^{ab} (0.12)	2.69^{c} (0.04)	3.17^{abc} (0.35)	3.40^{ab} (0.03)	3.33^{ab} (0.15)	3.04^{bc} (0.02)	3.35^{ab} (0.02)	3.49^{ab} (0.15)	3.49^{ab} (0.03)	0.273
Protein efficiency ratio (g gain/g protein intake)	1.52^{a} (0.01)	1.35^{abc} (0.07)	1.13^{cd} (0.04)	1.13^{d} (0.04)	1.77^{e} (0.04)	1.42^{ab} (0.16)	1.28^{bcd} (0.01)	1.25^{bcd} (0.06)	1.55^{a} (0.04)	1.25^{bcd} (0.01)	1.20^{bcd} (0.02)	1.10^{d} (0.10)	0.203
Nitrogen retention (%)	68.61 (4.61)	86.85 (1.70)	64.10 (5.50)	82.65 (2.13)	84.34 (1.94)	75.83 (1.80)	71.27 (6.38)	74.72 (3.74)	77.87 (2.58)	81.04 (3.44)	71.93 (6.80)	82.15 (2.50)	6.324
Mortality (%)	3.34	3.34	0	0	0	0	0	0	0	0	3.34	0	1.511

abcdef Means on the same row with different superscripts aare significantly ($P<0.05$) different.
( ) ± standard deviation.

TABLE 4: PERFORMANCE CHARACTERISTICS OF COCKEREL STARTERS FED VARYING FORMS CF METHIONINE AND LYSINE SUPPLEMENTED DIETS

Parameters	Plant Protein Sources				Amino Acids supplemental forms				
	GNC ONLY	GNC/ PKC	GNC/ CSC	SEM	M+L	BM+M	FM	COM	SEM
Daily weight gain (g)	10.58	10.59	11.20	0.355	11.30[a]	10.89[ab]	10.57[ab]	10.40[b]	0.396
Daily feed consumption (g/bird)	35.76[a]	33.33[a]	38.27[b]	2.470	33.91[a]	35.31[ab]	37.28[c]	36.67[bc]	1.501
Feed/gain ratio	3.39[a]	3.08[b]	3.27[ab]	0.156	3.02[a]	3.21[ab]	3.37[b]	3.38[b]	0.169
Protein efficiency ratio	1.26	1.43	1.28	0.087	1.61[a]	1.34[b]	1.20[b]	1.16[b]	0.204
Nitrogen retention (%)	76.55	76.54	78.25	0.984	76.94[a]	82.57[b]	69.10[c]	79.84[ab]	5.515

abc Within plant protein sources, or methionine and lysine supplementation forms, means in the same row with the same superscript or no superscripts are not significantly ($P > 0.05$) different.

TABLE 5 ECONOMY OF FEED CONVERSION OF COCKEREL STARTERS FED VARYING FORMS OF METHIONINE AND LYSINE SUPPLEMENTED DIETS

	Diets (amino acid supplemental form												
	1(M+L)	2(BM+M)	3(FM)	4(COM)	5(M+L)	6(BM+M)	7(FM)	8(COM)	9(M+L)	10(BM+M)	11(FM)	12(COM)	SEM
Total feed consumed (kg/ bird)	1.94^{ab} (0.08)	1.94^{ab} (0.02)	2.20^{cg} (0.07)	1.94^{ab} (0.07)	1.66^{d} (0.01)	1.87^{b} (0.01)	1.99^{abef} (0.02)	1.95^{abe} (0.01)	2.10^{efg} (0.05)	2.13^{cgf} (0.02)	2.08^{befg} (0.07)	2.27^{c} (0.04)	0.163
Feed cost (₦)	4.64^{ab}	4.20^{b}	5.75^{c}	4.71^{ad}	3.66^{e}	3.74^{e}	4.98^{d}	4.48^{ab}	4.44^{ab}	4.12^{b}	4.79^{cd}	4.95^{d}	0.576
Feed cost/kg live weight	7.03^{ad} (0.06)	6.42^{ab} (0.29)	9.00^{c} (0.28)	8.01^{cd} (0.26)	5.55^{b} (0.10)	5.90^{b} (0.59)	7.91^{d} (0.08)	7.17^{ad} (0.31)	6.30^{ab} (0.08)	6.06^{ab} (0.04)	7.54^{c} (0.09)	7.63^{d} (0.78)	1.026
Gross revenue less feed cost (₦)	8.56^{ab} (0.22)	8.90^{ab} (0.53)	7.06^{b} (0.62)	7.09^{b} (0.63)	9.54^{a} (0.21)	9.06^{ab} (1.22)	7.62^{b} (0.05)	8.03^{ab} (0.52)	9.94^{a} (0.67)	9.48^{a} (0.03)	7.92^{ab} (0.14)	8.15^{ab} (1.19)	0.957
Revenue/feed cost	1.82^{afg} (0.03)	2.12^{befg} (0.14)	1.23^{c} (0.07)	1.50^{ac} (0.08)	2.61^{d} (0.07)	2.43^{de} (0.34)	1.54^{ac} (0.03)	1.80^{abf} (0.13)	2.18^{defg} (0.04)	2.31^{deg} (0.03)	1.66^{abc} (0.03)	1.65^{abc} (0.27)	0.422

abcdefg Means on the same row with different superscripts are significantly ($P<0.05$) different.
( ) ± standard deviation

TABLE 6 ECONOMY OF FEED CONVERSION OF COCKEREL STARTERS FED VARYING FORMS OF METHIONINE AND LYSINE SUPPLEMENTS

Parameters	Plant Protein Sources				Amino acids supplemental forms				
	GNC/ CMLY	GNC/ PKC	GNC/ CSC	SEM	M+L	BM+M	FM	COM	SEM
Total feed consumed (kg/bird)	2.01	1.87	2.15	0.140	1.90	1.98	2.09	2.05	0.084
Feed cost (₦)	4.83	4.22	4.58	0.307	4.25	4.02	5.17	4.71	0.454
Feed cost/kg live weight	7.62	6.63	6.88	0.515	6.29^{a}	6.13^{a}	8.15^{b}	7.60^{ab}	0.989
Gross revenue less feed cost	7.90	8.56	8.87	0.495	9.35^{a}	9.15^{b}	7.53^{b}	7.76^{b}	0.935
Revenue/feed cost	1.60	2.10	1.95	0.213	2.21^{a}	2.29^{a}	1.48^{b}	1.65^{ab}	0.403

ab within plant protein sources, or methionine and lysine supplemental forms, means in the same row with same superscript or no superscript are not significantly ($P>0.05$) different.

the group supplemented with synthetic M+L, followed by those on BM+M diets, while the least response was observed in the COM group. This highest growth response recorded in the synthetic M+L dietary group is in line with our previous observations (Nwokoro and Tewe, 1992; Nwokoro, 1992) that plant protein diet is capable of supporting better growth when accurately supplemented with M and L than with animal protein sources.

Performance trend in case of M+L and plant proteins relatively changed with forms of supplementation. This is not in agreement with that recommended by Scott (1973), McDonald *et al.* (1981) and Ogbuinya (1989) that fish meal is the best as amino acids supplement in the diets of young birds whose demand for protein and indispensable amino acids is particularly high. The insignificant ($P > 0.05$) variation in growth indices, feed consumption and PER between FM and COM were similar to that reported previously in other stock (Romoser, 1955; Fuller, 1956; Gerry, 1956; Wiseman *et al.*, 1958) that poultry offal meal is a valuable ingredient in chicken diets with growth promoting properties similar to those of fish meal, but contrary to that observed (Ndifon, 1987) in albino rat that fish meal based diets enhanced better performance than chicken offal meal.

The supplementation of basal diets with FM resulted in highest feed consumption followed by COM while the least value was obtained in the M+L diet. Reason for this trend is not very clear, but general amino acid in balance resulting from higher protein intake is suspected. Since there was a significant PPS x MLSF it may be that at protein levels beyond the optimal (21%), there may be a disproportionate amount of other essential amino acids other than M and L under investigation.

Mortality record of 3.34% each in diets 1, 2, 3, and 11 are within the range normally experienced in poultry production (Nesheim *et al.*, 1979; Oluyemi and Roberts, 1979).

Although same dietary levels of M and L were fed to birds, there was significant effects on monetary returns. The economic parameters considered under the conditions of this study justified supplementing cockerel starter diets with synthetic amino acid(s) especially methionine as a commercially viable option for optimal production of starter cockerels in the tropics.

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