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Utilisation of Blood, Chicken Offal and Fish Meal as Cockerels' Dietary Supplements

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ABSTRAK

Satu eksperimen dilakukan untuk mengkaji prestasi ayam jantan berusia 16-20 minggu yang diberi makan berasaskan tiga hampas biji benih berminyak iaitu hampas kacang tanah (GNC), GNC/bungkil isirung sawit, GNC/hampas biji kapas ditambahkan dengan empat sumber metionina dan lisina iaitu sumber minyak sintetik, serbuk darah (baja), serbuk ikan atau serbuk isi ayam dalam rawatan berfaktor 3 x 4. Hasil keputusan menunjukkan bahawa tambahan berat, makanan kepada nisbah pertambahan, nitrogen hati penahanan nitrogen dan lemak hati sama seperti SGPT tidak secara signifikannya (P<0.05) berbeza sama ada disebabkan oleh sumber protein tumbuhan atau bentuk metionina dan suplementasi metionina dan suplemantasi liasinina atau kedua-duanya. Walau bagaimanapun, nilai protein keseluruhan serum, SGOT, menunjukkan peratus dan lemak abdomen secara signifikannya (P>0.05) mendapat kesan daripada pengehadan makanan.

ABSTRACT

An experiment was undertaken to investigate the performance of 16-20 week-old cockerels fed diets based on three oil seed cakes viz. groundnut cake (GNC), GNC/Palm kernel cake, GNC/cotton seed cake supplemented with four sources of methionine and lysine viz. synthetic sources, blood meal, fish meal or chicken offal meal in 3 x 4 factorial treatment. The results indicated that weight gain, feed to gain ratio, nitrogen retention, liver nitrogen and liver fat as well as SGPT were not significantly (P<0.05) different either due to plant protein sources or methionine and lysine supplementation forms or both. However, the values for the serum total protein, SGOT, dressing percentage and abdominal fat were significantly (P>0.05) affected by dietary treatments.

INTRODUCTION

Although synthetic amino acids are expensive, results of a previous study (Nwokoro 1993) indicated that accurate supplementing of cockerel starter diets with crystalline methionine and lysine gave better performance and economy of feed conversion than blood meal, fish meal or chicken offal meal supplements. Another study (Nwokoro 1992) showed that supplementing diets of 8-16 weeks cockerels with any of the supplemental sources sustained optimal performance and economic feed conversion. The lysine levels, which were optimum for cockerels during 8-16 weeks of age, were found to be deficient during 16-20 weeks of age (Nwokoro 1998; Nwokoro and Bamgbose 1995). Thus, this experiment was initiated to complement the results of the earlier studies and to test the effect of supplementation of oil seed cake based diets with different sources of methionine and lysine on performance and serum metabolites of 16-20 week old cockerels.

MATERIALS AND METHODS

Experimental Birds and Management

A total of 600-day barred harco cockerels were used for the experiment. The birds were reared together on the same diet for seven weeks (diet A) and diet B for 8-15 weeks (Table 1).

At the end of the 15th week, 540 birds were selected and randomly distributed into 12 groups such that each group was replicated thrice. The twelve groups were fed to twelve diets (Table 2) which were formulated in a 3 x 4 factorial form such that three combinations of plant protein sources (GNC only, GNC/Palm kernel cake

TABLE 1
Composition of diets fed to cockerels aged 0-8 Weeks (Diet A) and 8-16 weeks (Diet B)

	Diets	
Ingredients	A	B
Maize	44.41	29.20
Maize offals	22.46	52.70
Groundnut cake	29.13	14.15
Bone meal	2.00	2.00
Oyster shell	1.00	1.00
Premix	0.25	0.25
Salt	0.25	0.25
DL- methionime	0.15	0.15
L-Lysine	0.35	0.35
Composition (on-as-fed basis)		
ME (Kcal/kg)	2650	2250
CP (%)	21.00	16.00
Methinime + Cystine	0.73	0.63
Lysine (%)	0.98	0.82

(expeller pressed) or GNC/cotton seed cake) were each supplemented with four major sources of M + L (synthetic, blood meal, fish meal or chicken offal meal) to bring dietary levels to the requirements as established previously (Nwokoro 1991). The PKC was expeller pressed type and gossypol levels were calculated as in Ikurior (1982) and Ikurior and Fetuga (1984). The birds were fed and housed in deep litter system partitioned with wire netting into pens (110 cm x 280 cm). Brooding was carried out in the bird's first 4 weeks of life. Vitamin-mineral supplements (anti-stress) were administered for the first four days of the chicks' arrival. In addition, the cockerels were vaccinated with New Castle Disease Vaccine (i/o) in the second day, Gumboro (second week) and Lasota (sixth week) in drinking water. Coccidiostats were administered between the 4th and 5th week, while drowning was carried out in the 8th week. In each of the Vaccines medication in drinking water, chickens are usually starved of water overnight before drugs were administered. The antistress drug was administered subsequently for 3 days. Feeders and drinkers were cleaned daily, and the experiment was terminated at the end of the 20th week.

In the 20th week, blood samples were collected and pooled on replicate bases. To obtain the serum, the bloods after 24 hours were centrifuged at 480xg to obtain the serum. Samples were labelled and preserved at -10°C prior to analysis and subsequent thawing for analysis was done at room temperature. The serum total protein, SGOT and SGPT were analysed using Gelson and Ackerman (1975) procedures.

A nitrogen balance trial was carried out in the 20th week in which two chickens from each replicate were placed for compartment (36 cm x 36 cm) in Metabolism cages. Then Experimental diets were offered *ad libitum* for one week duration: the first four days for adjustments and the remaining 3 days for daily collection of records of feed intake and droppings. The latter was collected in metal trays fitted under each tier, which were initially cleaned, covered with aluminium foil and sprayed with 1% boric acid solution. The faecal samples were oven-dried for 72 hours at 50°C before analysis. The proximate composition of test ingredients and feed, faecal and liver samples were analyzed using the A.O.A.C (1980) method.

Carcass Analysis

Two cockerels per replicate in the 20th week were selected, wet plucked, eviscerated and dressing percentage computed. The liver with gall bladder removed was sampled, oven dried at 55°C for 3 days and at 105°C for 24 hours before analysis for nitrogen and fat. Dressed

TABLE 2
Gross composition of experimental diets

Protein Supplement	Groundnut Cake (GNC) Based Diets				GNC/Palm Kernel Cake Based Diets				GNC/Cotton Seed Cake (CSC) Based Diets			
Diets	1	2	3	4	5	6	7	8	9	10	11	12
Amino Acid Supplement Ingredients	M+L	BM+M	FM	COM	M+L	BM+M	FM	COM	M+L	BM+M	FM	COM
Maize	22.59	22.59	22.59	22.59	22.59	22.59	22.59	22.59	22.59	22.59	22.59	22.59
Maize Offals	58.25	56.98	56.47	55.54	47.09	45.45	44.73	43.53	55.57	55.54	55.15	54.41
Groundnut Cake (GNC)	15.40	15.40	15.40	15.40	8.75	8.75	8.75	8.75	5.42	5.42	5.42	5.42
Palm Kernel Cake (PKC)	-	-	-	-	17.78	17.78	17.78	17.78	-	-	-	-
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 (Growers)	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	0.25	0.25	0.25	0.25	0.05	0.25	0.25	0.25	0.13
DL-Methionine (M)	0.13	0.11	-	-	0.13	0.09	-	-	0.11	0.11	-	-
L-Lysine (L)	0.13	-	-	-	0.16	-	-	-	0.10	-	-	-
Blood Meal (BM)	-	1.42	-	-	-	1.84	-	-	-	1.14	-	
Fish Meal (FM)	-	-	2.04	-	-	-	2.65	-	-	-	1.63	-
Chicken Offal Meal (COM)	-	-	-	3.12	-	-	-	4.05	-	-	-	2.49
CALCULATED COMPOSITION												
Crude Protein (%)	16.00	17.57	17.69	18.12	16.00	16.40	16.50	17.09	16.00	17.18	17.28	17.62
Metabolisme Energy (kcl/g)	2.25	2.25	2.27	2.27	2.25	2.26	2.28	2.27	2.25	2.31	2.32	2.32
DL-Methionine + Cystine (%)	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63
L-Lysine (%)	0.77	0.77	0.74	0.72	0.77	0.77	0.74	0.69	0.77	0.77	0.74	0.72
Cost/kg Diet (N)	1.84	1.55	1.57	1.61	1.61	1.44	1.69	1.41	1.49	1.91	1.41	1.38
TOTAL GOSSYPOL (%)	-	-	-	-	-	-	-	-	0.085	0.085	0.085	0.085
FREE GOSSYPOL (%)	-	-	-	-	-	-	-	-	0.0046	0.0046	0.0046	0.0046
DETERMINED COMPOSITION												
Ether extract (%)	3.41	3.59	3.89	5.55	4.22	4.46	4.60	4.99	3.81	3.94	9.96	4.80

carcasses were frozen for one week, thawed, manually deboned and ratio of flesh to bone was determined.

Statistical Analysis

The data obtained from the experiment were subjected to analysis of variance and significance of difference of means was determined (Steel and Torrie 1980).

RESULTS

Data on performance characteristics of cockerels reared on various dietary regimes are presented in Tables 3 and 4. These indices were not significantly ($P>0.05$) affected by dietary treatments.

Cockerels on diet 1 (M + L) gained at a lower rate than those on others. Those on diets 3 (FM) and 12 (COM) recorded the best gains followed by those on diets 9, 8 and 6 (BM + M). These differences were however not consistent with dietary regimes.

Results of the factor effect of plant protein sources (PPS) (that is ignoring methionine and lysine supplemental sources) and methionine and lysine supplemental forms (MLSF) and ignoring PPS on performance characteristics are shown in Table 4. The parameters were not significantly ($P>0.05$) affected by dietary treatments. The PPS indicated that GNC/CSC based diets gave the best weight gain, feed conversion ratio, nitrogen retention and lowest feed consumption. Those for other groups were similar and MLSF show that birds on COM based diets recorded the best gains. Feed consumption was highest in birds on BM + M, M + L and PM while the lowest intake was recorded in the COM group where the best feed conversion ratio was obtained.

Although nitrogen retention was efficient in all the dietary groups, the highest retention was obtained in M + L group followed by those on FM. The experiment had no effect on mortality.

Table 5 shows the effects of dietary treatments on some serum metabolites, carcass characteristics, liver nitrogen and fat content of cockerels. The factor effects of PPS and MLSF on these parameters are presented in Table 6. Apart from serum total protein, SGOT, dressing percentage and abdominal fat, other indices were not significantly ($P>0.05$) affected by dietary treatments. The least SGOT activity was obtained in diet 2 where the highest concentration of serum total protein and optimal dressing percentage were recorded.

Parameters for the PPS (Table 6) were not significantly affected by dietary treatment. The effect of MLSF (ignoring PPS) revealed that with the exception of the abdominal fat, all other parameters were not significantly ($P>0.05$) different.

DISCUSSION

The weight gains were generally high irrespective of the dietary treatments. This might not be unexpected as supplementation was to meet requirement level. In addition, it may also be due to the high fat accretion as indicated by abdominal fat recorded.

In the diets where animal protein was used as supplements, where dietary proteins were more than the recommended 16% (Okosun 1987), the bird performed optimally. This might be an indication that at the age range of experimental birds, they were able to adjust to the disproportionate amount of other amino acids. This is contrary to that reported previously (Nwokoro 1993) in starter cockerels.

The results of the feed consumption show that birds on COM supplemented group consumed least feed, which was also the group where maximum weight gain and abdominal fat were recorded. The higher dietary fat may have contributed to lower feed intake leading to better efficiency of meeting energy requirement. Similarly, this higher crude fat in diet may have contributed to higher abdominal fat for the COM diets, as a previous report (Olomu and Baracos 1990) show that the dietary level of lipids has a direct relationship with body lipid accretion. That weight gains, feed intake including feed per gain ratio of cottonseed cake (CSC) based diets (Tables 3 and 4) were similar to others without CSC is an indicative of sub lethal level of the free gossypol in the diets (9, 10. 11, 12). Also, the dietary level of 0.0046% is less than the tolerance level (0.01% or 100%) recommended by Ikurior and Fetuga (1984).

The carcass dressing percentage and flesh to bone ratio appear to support the view that diets were adequate irrespective of dietary treatments as the values recorded are within the range reported (Okosun and Tewe 1987; Nwokoro and Bamgbose 1995; Nwokoro and Tewe 1997).

TABLE 3
Performance characteristics of 16-20 week old cockerels fed varying forms of methionine and lysine supplemented diets

	Diet (amino acids supplemental form- %Diet)											
	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)
Daily Weight Gain (g)	17.98 (1.252)	19.98 (2.301)	21.11 (1.792)	19.68 (2.011)	19.42 (2.661)	20.12 (3.550)	18.54 (0.572)	20.68 (2.092)	20.72 (2.222)	18.49 (2.901)	19.22 (0.552)	21.81 (0.550)
Daily feed consumption (g/bird)	102.52 (5.112)	102.11 (14.400)	100.01 (1.040)	101.82 (3.521)	99.78 (3.092)	102.38 (11.121)	100.19 (4.811)	100.96 (5.000)	98.92 (4.820)	101.33 (1.293)	100.18 (12.001)	93.64 (3.178)
Feed/gain ratio	5.70	5.11	4.74	5.17	5.14	5.09	5.40	4.88	4.77	5.48	5.21	4.29
Nitrogen retention	69.97 (2.431)	72.85 (0.221)	71.73 (2.468)	67.98 (1.928)	73.00 (2.861)	68.51 (2.861)	67.51 (3.010)	72.34 (8.420)	72.11 (7.681)	69.23 (0.679)	73.11 (4.972)	70.92 (102.10)
Total Mortality	3.33	0	0	0	0	0	0	0	0	0	0	3.33

( ) ± Standard error or mean

TABLE 4
Performance characteristics of 16-20 week old cockerels fed varying forms of methionine and lysine supplemental or plant protein diets

Parameters	Plant Protein Sources				M And L Supplemental Forms (% Of Diet)				
	GNC Only	GNC/PKC	GNC/CSC	S.E. of X (±)	M+L	BM+M	FM	COM	S.C. of X (±)
Daily Weight Gain (g)	19.688	19.690	20.060	0.2142	19.373	19.530	19.623	20.723	0.6159
Daily feed consumption (g/bird)	101.615	100.828	98.518	1.6097	100.407	101.940	100.127	98.807	1.2876
Feed/gain ratio	5.180	5.128	4.938	0.1274	5.203	5.227	4.117	4.780	0.2066
Nitrogen retention	70.633	70.340	71.343	0.5158	71.693	70.197	70.783	70.413	0.6603
Total Mortality	3.33	0	3.33	0	3.33	0	0	3.33	-

TABLE 5
Serum metabolics, carcass characteristics and liver nitrogen and liver fat of 16-20 week old cockerels fed varying forms of methionine and lysine supplemental diets

	Diet (amino acids supplemental form- %Diet)											
	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)
Serum Total Protein	6.24^{a} (0.021)	8.24^{b} (0.112)	6.11^{a} (0.032)	5.76^{a} (0.066)	5.76^{a} (0.111)	6.81^{ab} (0.012)	5.92^{a} (0.211)	5.82^{ab} (0.006)	6.82^{ab} (0.040)	4.92^{c} (0.041)	5.98^{a} (0.080)	6.22^{a} (0.000)
SGOT (SF Unit/ML)	96.10^{ab} (10.010)	94.00^{b} (4.222)	97.50^{a} (3.021)	98.50^{a} (0.982)	97.92^{a} (0.001)	100.01^{a} (8.421)	97.00^{a} (2.222)	98.38^{a} (3.222)	98.32^{a} (3.221)	101.62^{a} (1.282)	95.92^{ab} (2.000)	97.38^{a} (1.892)
SGPT (SG Unit/ML)	39.84 (1.520)	38.11 (3.021)	40.21 (2.928)	40.71 (3.011)	40.11 (1.001)	37.35 (0.098)	38.75 (0.062)	39.75 (2.970)	38.92 (2.222)	39.82 (2.221)	40.21 (0.111)	37.92 (3.212)
Dressing Percentage (%)	70.52^{a}	71.22^{a}	68.52^{b}	72.11^{a}	70.92^{a}	67.98^{b}	66.97^{b}	69.88^{ab}	70.82^{a}	71.22^{a}	69.32^{b}	70.34^{a}
Abdominal Fat (g)	2.80^{a}	6.70^{b}	9.30^{b}	10.30^{b}	3.34^{a}	6.92^{b}	6.78^{b}	8.88^{b}	5.20^{a}	5.60^{ab}	6.21^{b}	9.32^{b}
Flesh to bone ratio	4.01	3.87	3.89	4.19	4.09	3.21	3.61	3.98	4.11	3.45	4.01	
Liver Nitrogen (%)	9.98	9.22	9.72	9.34	10.01	9.45	9.82	9.86	9.68	9.63	9.59	
Liver fat (%)	9.50	11.18	12.60	13.42	15.52	13.14	11.68	11.86	9.78	11.86	12.10	10.38

abc means on the same row with same superior superscript or without superscript are not significantly (P>0.05) different.

TABLE 6
Serum metabolites, carcass characteristics liver nitrogen and liver fat of the cockerels fed various forms of diets abc within M and L supplemental forms, means on the same row with same superscript or no superscript are not significantly (P>0.05) different

Parameters	Plant Protein Sources				M And L Supplemental Forms (% Of Diet)				
	GNC Only	GNC/PKC	GNC/CSC	S.E. of X (±)	M+L	BM+M	FM	COM	S.C. of X (±)
Serum Total Protein	6.633	6.078	5.985	0.3504	6.273	6.717	6.003	5.933	0.3553
SGOT (SF Unit/ML)	96.525	98.328	98.310	1.0352	97.447	98.543	96.807	98.087	0.7572
SGPT (SG Unit/ML)	39.718	38.990	39.218	0.3724	39.623	38.427	39.723	39.460	0.5974
Dressing Percentage (%)	70.593	68.938	70.425	0.9109	70.753	70.140	68.270	70.0777	1.1807
Abdominal Fat (g)	7.275	6.480	6.583	0.4323	3.780^{a}	6.407^{b}	7.430^{b}	9.500^{c}	2.3777
Flesh to bone ratio	3.935	3.775	3.888	0.0822	4.047	4.070	3.510	3.837	0.2595
Liver Nitrogen (%)	9.705	9.655	9.690	0.0257	9.700	9.890	9.433	9.710	0.1883
Liver fat (%)	11.675	12.300	11.030	0.6350	10.600	12.060	12.127	11.887	0.7195

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