

Original Research Article

EFFECT OF ~~SUPPLEMENTATION REPLACEMENT~~ OF SOYBEAN MEAL WITH *LEUCAENA LEUCOCEPHALA* LEAF MEAL ON PERFORMANCE, HAEMATOLOGY, CARCASS MEASURES AND ORGAN WEIGHT IN BROILER CHICKENS

ABSTRACT

This study was carried out to determine the effect of ~~supplementing replacing~~ soybean meal (SBM) with *Leucaena leucocephala* leaf meal (LLM) in the diet of broiler chickens. One hundred and fifty one-day-old broiler chicks were allotted into ~~five experimental~~ 5 treatments, each with three replicates and ten birds per replicate in a completely randomized design. The treatments were Diet 1 (control, without LLM ~~supplementation replacement~~) and Diets 2, 3, 4, and 5 where soybean meal (SBM) was replaced by 25%, 50%, 75%, and 100% of LLM, respectively. The feeding trial lasted for 8 weeks. ~~Supplementation Substitution~~ of SBM with LLM significantly ($P < 0.05$) influenced the performance of broiler starters, but not broiler finishers. Body weight gain of 907 g was obtained in birds on Diet 3 (50% LLM), while the least value of 530 g was obtained for Diet 5 with 100% LLM. Diet 3 had better FCR (2.66) than the other treatments. ~~Supplementation Substitution~~ of SBM with LLM did not significantly influence the haematological parameters except ESR concentration which was significantly ($P < 0.05$) affected. Organ weights were not affected by diet at the starter phase but at the finisher phase weights of organs were significantly ($P < 0.05$) reduced as the level of LLM in diet increased. Carcass parts were significantly ($P < 0.05$) reduced by dietary LLM at starter and finisher phases except for the back, drumstick, neck, head and shank that were not affected by LLM. Results of the study showed that LLM could be used to supplement SBM up to 50% in the diets of broiler ~~chickens~~ chickens to improve performance and without ~~detrimental~~ adverse effect on the birds.

Key words: *Leucaena leucocephala* leaf meal, Soybean meal, Performance, carcass, Broilers

1. INTRODUCTION

In the world, poultry meat is the only meat which cuts across all barriers of religion, race, tribe and age class. Poultry production in Nigeria has been one of the most popular enterprises among the small and medium scale farmers. However, feeding constitutes 70–80 % of production cost in poultry, (Idowu, 1999, Argentine Beef Packers, 2011). Commercial feedstuff accounts for 60-85% of the cost (Fajimi *et al.*, 1993; Opara, 1996; Tewe *et al.*, 2002; Khan *et al.*, 2010). The bulk of the feed cost arises from protein concentrates such as fish meal, soybean meal and groundnut cake (Opara, 1996), whose prices continue to soar and ~~becoming become~~ uneconomical to use them in poultry feeds (Esonu *et al.*, 2001). This trend has compelled researchers in developing countries to direct research efforts at developing unconventional feedstuffs such as leaf meals with particular reference to protein substitutes. These unconventional feed stuffs become important if poultry production will become economical. Similarly, in order to ensure a sustainable and profitable supply of broiler meat, there is also a need to minimize the prevailing exorbitant cost of feeds and maximize profits. This stipulates the urgent need to intensify the search for alternative and unconventional feedstuffs, such that can substitute or can supplement protein concentrates at a certain level with comparable quality such feed resources should also be locally-available, cheap, and free from competitive large-scale demands (Fasuyi, 2000)^[s1]. Therefore, the objective of this study was to determine the effect of supplementing soybean meal with *Leucaena leucocephala* leaf meal (LLM) on growth, haematological parameters, carcass characteristics and organ weight of broiler chickens.

2.0 MATERIALS AND METHOD

2.1 Experimental Site

The trial was conducted at the Teaching and Research Farm Livestock Section of The Federal University of Technology, Akure, Nigeria. A total of 200 day – old Abor ~~Acar~~ acres chicks was purchased from Zarm farms, Km 20, Offa, Kwara State out of which 150 birds were used for the experiment; with 5 treatments, 3 replicates and 10 birds per replicate. All the feed ingredients were purchased from K2 feed mill along Oyemekun Road, Akure, while leaf meal ~~were was~~ picked from the pruned branches within the university community. These leaves were subjected to hot water treatment for 10 minutes, thereafter the hot water was drained and the leaves air – dried to ensure complete removal of moisture. The dried leaves were then milled using hammer mill.

2.2 Experimental Diet

The experiment involved the use of five (5) diets prepared in the nutrition laboratory of the Department of the department of Animal Production and Health, Federal University of Technology, Akure of which the basal composition shown in Table 1. diet 1 (control) had no leaf meal while Diets 2,3,4 and 5 had their SBM content replaced by LLM at 25 %, 50 %, 75 % and 100 %, respectively.

2.3 Sample Collection, Carcass measure, Organ Measure and Chemical analysis

The proximate composition was determined according to the method of AOAC, [?]. Blood samples were ~~collected~~ randomly collected from three chicks at four weeks and eight weeks from each pen through the jugular vein. Carcass measure and Organ weight, three birds were randomly selected, weighed and The birds were hung using chicken shackles, stunned and sacrificed by severing the jugular vein and then defeathered using moderately warm water, carcass parts and organs were weighed and their weight expressed as percent of body weight to determine the effect of the experimental diets on the cut parts.

2.4 Statistical Analysis

Data were analysed by the one-way analysis of variance procedure appropriate for completely randomized design, with a factorial arrangement using the general linear models (GLM) procedures of SAS [?]. Means were further separated using Duncan Multiple Range test.

3.0 RESULTS AND DISCUSSION

Gross composition (g/100gmDM) ~~used~~ of experimental diet used for the study is as presented in Table 1 and 2.

Table 1: Gross Composition of the Starter Diets (g/100gm) ~~of experimental diets~~

	Diets				
	1	2	3	4	5
	Inclusion rate of LLM used to replace SBM				
	0 LLM	25% LLM	50% LLM	75% LLM	100% LLM
Ingredients (%)					
Maize	55.35	52.18	49.01	47.25	44.06
Wheat Offal	1.00	1.00	1.00	1.00	1.00
Soybean meal	15.00	11.16	7.50	3.75	0.00
Leucaena leaf meal	0.00	6.08	12.16	18.24	24.32
Groundnut cake	15.00	15.00	15.00	15.00	15.00
Brewers' dry grain	5.00	5.00	5.00	5.00	5.00
Fish meal	5.00	5.00	5.00	5.00	5.00

Bone meal	1.50	1.50	1.50	1.50	1.50
Oyster shell	1.00	1.00	1.00	1.00	1.00
Broiler premix	0.25	0.25	0.25	0.25	0.25
Methionine – DL	0.25	0.25	0.30	0.33	0.35
L – Lysine	0.15	0.27	0.38	0.50	0.62
Salt	0.50	0.50	0.50	0.50	0.50
Vegetable oil	0.00	0.70	1.40	1.70	2.40
Total	100.0	100.0	100.0	100.0	100.0

76 CALCULATED NUTRIENT CONTENT

77	Crude Protein (%)	23.95	23.65	23.36	23.03	22.74
78	M.E (Kcal / kg)	2915	2878	2840	2802	2764
79	Calcium (%)	1.312	1.316	1.320	1.323	1.327
80	Available Phosphorus	0.486	0.467	0.448	0.419	0.400
81	Lysine	1.221	1.221	1.211	1.208	1.207
82	Methionine	0.640	0.632	0.634	0.634	0.692

83 ME = ~~Methabolisable~~ Metabolisable Energy (Kcal / kg), D1 = Control Diet, D2 – D5 = Diet with LLM, LLM = *Leucaena leucocephala*
84 leaf meal

85 Table 2: Gross Composition of the Finisher Diets (g/100gm) ~~of experimental diets~~

	Diets				
	1	2	3	4	5
	Inclusion rate of LLM used to replace SBM				
Ingredients	0 LLM	25% LLM	50% LLM	75% LLM	100% LLM
Maize	51	48.85	46.7	44.55	42.4
Wheat Offal	9	9	9	9	9
Soybean meal	14	10.5	7	3.5	0
Leucaena leaf meal	0	5.65	11.3	16.95	22.6
Groundnut cake	14	14	14	14	14
Brewers' dry grain	5	5	5	5	5
Bone meal	2.5	2.5	2.5	2.5	2.5
Limestone	1	1	1	1	1
Broiler premix	0.5	0.5	0.5	0.5	0.5
Methionine – DL	0.3	0.3	0.3	0.3	0.3
L – Lysine	0.2	0.2	0.2	0.2	0.2

Salt	0.5	0.5	0.5	0.5	0.5
Vegetable oil	2	2	2	2	2
Total	100.0	100.0	100.0	100.0	100.0

86 CALCULATED NUTRIENT CONTENT

87	Crude Protein	21.73	21.52	21.30	21.06	20.81
88	M.E (Kcal / kg)	2967.65	2939.49	2911.99	2900.02	289368
89	Calcium	1.44	1.44	1.44	1.44	1.44
90	Available Phosphorus	0.54	0.53	0.51	0.50	0.48
91	Lysine	1.01	1.02	1.01	1.01	1.00
92	Methionine	0.50	0.50	0.46	0.43	0.41

93 ME = ~~Methabolisable~~ Metabolisable Energy (Kcal / kg), D1 = Control Diet, D2 – D5 = Diet with LLM, LLM = *Leucaena leucocephala*
94 leaf meal

95 Performance characteristics

96 ~~Supplementation~~ Substitution of SBM with LLM significantly ($P < 0.05$) reduced the performance of
97 broiler starters, but had no significant effect on finisher birds.

98 This suggests that high inclusion level of LLM may not support growth performance of this species of
99 animal at starter phase due to the presence of anti-nutritional factors such as mimosine. Essentially
100 anti-nutrients have been reported to be capable of retarding growth (Martinez *et al.*, 1995) and
101 lowering the digestibility and absorption of dietary nutrients (Putztai *et al.*, 1995). The FCR observed
102 in all the treatments indicated that high level of inclusion of LLM affects feed utilization.

103 **Table 3: Performance of broilers fed *Leucaena* leaf meal ~~supplemented~~ experimental diets**

	Diets						
Phase/Parameters	OLLM	25LLM	50LLM	75LLM	100LLM	SEM	P-value
Day 0-28							
Feed intake, g/b	1404 ^a	1357 ^a	1280 ^a	1046 ^{eb}	853 ^c	61.4	<0.0004
Body weight gain, g/b	819 ^a	588 ^b	491 ^c	333 ^d	238 ^e	17.4	0.0001
Feed Conversion ratio	1.72 ^{ed}	2.31 ^d	2.61 ^{cb}	3.12 ^b	3.58 ^a	0.11	<0.0001
Day 29-56							
Feed intake, g/b	2599	2568	2344	2098	2229	123.2	0.0687
Body weight gain, g/b	980	887	907	730	553	105.1	0.0975
Feed Conversion ratio	2.67	2.92	2.66	3.16	4.05	0.35	0.0985

104 *a, b, c, d, e means along the same row with dissimilar superscripts differs significantly ($p < 0.05$)*

105 LLM = *Leucaena leucocephala* leaf meal, SEM- Standard error of the; T1 – Control (without LLM), T2 –25% LLM, T3 –
106 50% LLM, T4 – 75% LLM, T5 – 100% LLM.

107

Organ weight

Organ weights were not affected by diet at the starter phase but at the finisher phase weights of organs were significantly ($P<0.05$) reduced as the level of LLM in diet increased. (Table 4)

Table 4: Effect of Leucaena Leaf meal Supplementationsubstitution on Organ Weight in broiler chickens

Phase/Parameters	Diets					SEM	P-Value
	OLLM	25LLM	50LLM	75LLM	100LLM		
Day 0-28							
Live weight	847.25 ^a	609.53 ^{cb}	611.43 ^b	450.03 ^{db}	391.67 ^{ed}	42.70	0.0002
Dress weight	750.45 ^a	547.08 ^{cb}	559.37 ^b	421.28 ^{db}	360.80 ^{ed}	37.10	0.0002
Eviscerated weight	626.30 ^a	432.83 ^{cb}	435.88 ^b	304.65 ^{db}	270.85 ^{ed}	32.95	0.0001
Liver	16.65 ^a	13.32 ^{ab}	13.85 ^{ab}	10.40 ^b	11.08 ^{cb}	0.95	0.0064
Kidney	4.97 ^a	3.58 ^{ab}	4.57 ^{ab}	2.98 ^a	2.72 ^b	0.49	0.0328
Heart	4.92 ^a	3.03 ^{ab}	3.40 ^{ab}	2.33 ^b	2.08 ^{cb}	0.51	0.0197
Pancreas	2.47	2.13	2.43	1.97	1.73	0.19	0.0886
Spleen	0.92 ^a	0.92 ^a	0.92 ^a	0.53 ^b	0.57 ^{ab}	0.08	0.0110
Gizzard	20.47 ^a	14.32 ^b	13.93 ^{cb}	13.40 ^{db}	10.28 ^{eb}	1.06	0.0007
Proventriculus.	5.13 ^a	4.18 ^{ab}	3.55 ^{ab}	3.07 ^b	2.32 ^{eb}	0.43	0.0092
Day 29-56							
Live weight	1925 ^a	1821 ^a	1805 ^a	1646 ^b	1642 ^b	65.1	0.0484
Dress weight	1796 ^a	1688 ^a	1654 ^a	1463 ^{ab}	1479 ^{ac}	60.0	0.0109
Eviscerated weight	1504 ^a	1421 ^a	1408 ^a	1250 ^{ab}	1213 ^{ac}	48.8	0.0082
Liver	37.02	38.36	40.45	35.43	34.19	2.24	0.3674
Kidney	5.74	6.24	7.83	7.73	9.31	1.09	0.2295
Heart	7.23	8.53	7.82	6.97	6.96	0.50	0.1981
Lungs	10.98	12.26	9.97	9.14	9.29	0.79	0.0915
Pancreas	3.71	3.68	3.36	3.48	3.63	0.32	0.9283
Spleen	2.62	2.83	2.68	2.55	2.33	0.22	0.6442
Gizzard	32.20	30.90	35.05	29.95	32.58	1.74	0.3557
Proventriculus	7.93	9.66	8.18	7.04	7.26	0.59	0.0691

a, b, c, d, e means along the same row with dissimilar superscripts differs significantly ($p<0.05$)
 LLM = *Leucaena leucocephala* leaf meal, SEM- Standard error of the; T1 – Control (without LLM),
 T2 –25% LLM, T3 – 50% LLM, T4 – 75% LLM, T5 – 100% LLM.

Haematological Indices

Supplementation of SBM with LLM did not significantly influence the haematological parameters except ESR concentration which was significantly ($P<0.05$) affected at the finisher phase. According

to Oyawoye and Ogunkunle (1998), haematological components of blood are valuable in monitoring feed toxicity especially with feed constituents that affect the formulation of blood. Leucaena contains mimosine, and since LLM ~~supplementation-substitution~~ did not affect the haematological variables, it is therefore likely that the mimosine factor had no effect on those variables except ESR concentration.

Table 5: Effect of Leucaena Leaf meal ~~substitution~~Supplementation on Haematological Indices indices in broiler chickens

Phase/Parameters	Diets						P-Value
	OLLM	25LLM	50LLM	75LLM	100LLM	SEM	
Day 0-28							
ESR	1.50	1.67	1.67	2.00	1.50	0.21	0.4809
PCV	32.33	31.67	32.00	30.00	32.67	0.87	0.2917
RBC	247.00	238.00	243.50	202.17	254.17	17.75	0.3309
HB	10.73	10.50	10.63	9.93	10.85	0.29	0.2755
MCHC	33.20	33.15	33.23	33.11	33.21	0.04	0.2306
MCH	0.44	0.46	0.44	0.50	0.43	0.02	0.3214
MCV	13.27	13.80	13.33	15.10	13.06	0.70	0.3130
LYM	59.50	57.83	58.50	59.00	57.17	1.84	0.9019
NEU	24.83	25.33	26.33	23.33	25.50	1.02	0.3750
MONO	12.83	13.83	12.17	14.67	14.33	1.12	0.5049
BOS	2.17	2.00	2.17	2.00	2.00	0.11	0.5801
EOS	1.00	1.00	1.00	1.00	100	0.00	
Day 29-56							
ESR	3.75 ^a	2.58 ^d	2.83 ^c	2.83 ^c	3.33 ^b	0.23	0.0283
PCV	25.67	27.58	27.25	27.17	26.42	0.51	0.1269
RBC	163.17	182.17	178.83	176.42	167.08	6.82	0.3028
HB	8.53	9.16	9.06	9.03	8.77	0.17	0.1230
MCHC	33.21	33.21	33.24	33.22	33.19	0.03	0.6498
MCH	0.54	0.51	0.51	0.52	0.53	0.01	0.4065
MCV	16.12	15.34	15.49	15.56	15.90	0.30	0.3859
LYM	58.08	58.58	58.50	59.33	59.00	0.72	0.7770
NEU	25.33	24.17	24.67	24.50	24.17	0.42	0.3317
MONO	13.58	14.17	13.83	13.33	13.67	0.86	0.9682
BOS	2.17	2.17	2.00	2.17	2.17	0.10	0.6896
EOS	0.92	0.92	1.00	0.67	0.92	0.12	0.3882

a, b, c means along the same row with dissimilar superscripts are significantly different (p<0.05)

SEM standard error of mean, ESR = Erythrocyte sedimentation rate, MCV =Mean cell volume, PCV = packed cell volume, LYM = Lymphocytes, RBC = Red blood cell, NEU = Neutrophils, HB = Haemoglobin, MONO = Monocytes,

MCHC =Mean cell haemoglobin concentration, BOS = Basophilis, MCH = Mean cell haemoglobin, EOS = Eosinophils.

Carcass Characteristics

Carcass parts were significantly ($P<0.05$) reduced by dietary LLM at starter and finisher phases except for the back, drumstick, neck, head and shank that were not significantly affected .

Table 6: Effect of Leucaena Leaf meal Supplementation substitution on Carcass characteristics in broiler chickens

Phase/Parameters	Diets						P-Value
	OLLM	25LLM	50LLM	75LLM	100LLM	SEM	
Day 0-28							
Live weight	847.25 ^a	609.53 ^{cb}	611.43 ^b	450.03 ^{db}	391.67 ^{ed}	42.70	0.0002
Dressed weight	750.45 ^a	547.08 ^{cb}	559.37 ^b	421.28 ^{db}	360.80 ^{ed}	37.10	0.0002
Eviscerated weight	626.30 ^a	432.83 ^{cb}	435.88 ^b	304.65 ^{db}	270.85 ^{ed}	32.95	0.0001
Back	126.10 ^a	99.92 ^a	82.83 ^a	64.65 ^{ba}	51.13 ^{ca}	12.20	0.0106
Chest	165.97 ^a	108.38 ^c	111.35 ^{bc}	66.48 ^{bc}	59.10 ^{ed}	10.46	0.0002
Drum Stick	72.67 ^a	48.72 ^{cb}	51.85 ^b	35.87 ^{dbc}	29.72 ^{ebcd}	4.35	0.0004
Thigh'	83.05 ^a	58.23 ^a	53.38 ^{ab}	43.62 ^{abc}	35.83 ^{acd}	6.21	0.0031
Wing	63.32 ^a	45.72 ^c	50.08 ^{bc}	34.57 ^{cd}	31.27 ^{ecd}	2.84	<0.0001
Neck	37.52 ^a	23.90 ^b	24.75 ^{bc}	16.93 ^{bd}	15.43 ^{bc}	2.12	0.0002
Head	24.30 ^a	20.10 ^a	19.08 ^{ab}	17.07 ^{ac}	15.58 ^{ad}	0.96	0.0008
Shank	36.05 ^a	29.00 ^a	25.22 ^{ab}	21.33 ^{bc}	19.12 ^{bd}	1.65	0.0002
Day 29-56							
Live weight	1925 ^a	1820 ^a	1805 ^a	1646 ^b	1642 ^b	65.1	0.0484
Dressed weight	1795 ^a	1688 ^a	1654 ^a	1463 ^{ab}	1479 ^c	60.0	0.0109
Eviscerated weight	1504 ^a	1421 ^a	1408 ^a	1250 ^b	1212 ^c	48.8	0.0082
Back	323	526	283	242	241	109	0.3788
Chest	376 ^a	318 ^a	327 ^a	262 ^b	284 ^b	18.3	0.0120
Drum Stick	182	166	175	175	163	11.5	0.7521
Thigh'	190	179	181	162	164	8.75	0.2089
Wing	150 ^a	150 ^a	149 ^a	134 ^b	130 ^b	4.80	0.0295
Neck	74.0	64.7	65.1	59.8	59.5	5.83	0.4457
Head	46.6	44.1	45.3	43.2	44.3	1.44	0.5536
Shank	82.5	77.8	81.5	76.0	74.9	3.23	0.4243

a, b, c means along the same row with dissimilar superscripts are significantly different ($p<0.05$)

LLM = *Leucaena leucocephala* leaf meal, SEM - standard error of the mean; T1 – Control (without LLM), T2 –25% LLM, T3 – 50% LLM, T4 – 75% LLM, T5 – 100% LLM.

4.0 CONCLUSION

The study revealed that broiler finishers fed up to 50% *L. leucocephala* leaf meal-based diets compared favourably in performance with those fed the control diet performed better than those on the control. By implication Therefore, up to about 50% supplementation replacement of LLM soybean meal for with soybean meal LLM (diet 13) had beneficial effects in terms of improved performance of the birds as the bird fed on D3 (diet with LLM 50%) had better feed conversion ratio (FCR) than the control diet could be used to formulate broiler finishers diets without adverse effects on their performance.

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