

**EFFECTS OF SUBSTITUTING GROUNDNUT CAKE WITH ACACIA SEED  
KERNEL MEAL ON PERFORMANCE, HAEMATOLOGY, SERUM BIOCHEMICAL  
PARAMETERS AND ECONOMY OF PRODUCTION OF BROILERS.**

Oloredo, B. R.\*, A. R. Alade and O. P. Ajagbonna.

*Department Of Public Health And Animal Production, Usmanu Danfodiyo University, Sokoto,  
Nigeria.*

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**Target Audience:** Poultry farmers, livestock feed millers, poultry nutritionist.

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**ABSTRACT**

The study examined the effects of replacing groundnut cake (GNC) with *Acacia nilotica* seed kernel meal (ASKM) in the diets of broilers and the effects of such on performance characteristics, haematology and serum chemistry of the birds. ASKM was included in the diets at 0, 10 and 20% levels. 20% ASKM dietary level significantly ( $P < 0.05$ ) decreased body weight gain and feed intake. Broilers fed 10% ASKM had the highest feed intake and consequently gained more weight and had the best feed conversion ratio. Serum metabolites were not affected by the treatment except alkaline phosphatase and bilirubin that were significantly ( $P < 0.05$ ) lowered by 20% inclusion of ASKM. 20% ASKM significantly ( $P < 0.05$ ) increased the packed cell volume (pcv), haemoglobin (Hb) and red blood cell (RBC) of broilers. There were no significant ( $P > 0.05$ ) differences in the relative weight of organs of broilers fed graded levels of ASKM. This study suggests that broilers could be raised on a diet containing 10% ASKM, since the birds fed 10% ASKM had the lowest feed cost / kg (#) and highest total revenue (#) and economic efficiency.

**Key words:** Acacia seed kernel meal, broiler, production performance.

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**DESCRIPTION OF PROBLEM**

Most countries in the hot regions of the world have daily per capital animal protein consumption below that recommended by the Food and Agricultural Organisation (FAO) and the World Health Organisation (WHO) (1). In solving the animal protein crisis, the poultry industry occupies an advantageous position. Poultry is accepted by all and holds the key to bridging the animal protein gap in the third world countries (1). However, feed cost accounts for over 70% of the cost of raising commercial poultry in Nigeria. The logical step in overcoming high price of feeds is to direct efforts towards exploiting the possibility of utilizing non-conventional feed stuffs like acacia. *Acacia nilotica* is a deciduous tree belonging to the family mimosaceae. It is a valuable browse species in the arid and semi - arid savanna regions of the Nigeria where graminaceous feeds become low in quantity and quality during the season (2). Kumaresan *et al.* (3) reported that seeds of acacia alone, when crushed or made into

cakes are valuable animal feeds and that acacia seed kernels have 45.2% CP, 11.5% EE, 2.5% CF and 5.4% total ash. Information is lacking on the utilization of this by-product in poultry. This study is envisaged to highlight the nutritional potential of ASKM in the ration of broiler chicken on their performance characteristics, haematology and serum metabolites.

### MATERIALS AND METHODS

*Acacia nilotica* pods were collected from Usmanu Danfodiyo University, Sokoto Campus and along Garba Duba Road, Sokoto in January and February 1999. The pods were broken and seeds were removed. The seeds were sun-dried for about 6 days. The dried seeds were then ground and sieved or blown to remove the testa, while only the seed kernels were used for the experiment.

Three diets were formulated by replacing GNC at 0, 10 and 20% with ASKM in maize-groundnut cake based diet on weight-for-weight basis (Table 2). Thirty, 7 days-old Anak broiler chicks were randomly assigned to the three dietary treatments at the rate of ten chickens per treatment. Diets and water were offered *ad libitum*, food intake and body weight were measured weekly. The broiler chicks were accommodated in floor brooder pens replicated two times. Routine management and vaccination procedures were followed.

Table 1: Nutrient Composition of Ground nut Cake and *Acacia nilotica* seed kernel.

Nutrient	GNC	ANSK
% DM Basis		
Moisture	6.4	5.5
Crude protein	45.0	45.2
Ash	5.51	5.4
Crude fibre	3.81	2.5
Ether extract	9.16	11.5
Nitrogen-free extract	36.52	35.5
Metabolisable energy (mj/kj)	10.59	11.10
Calcium	0.2	1.19
Phosphorus	0.6	7.18

Blood was sampled terminally from four (two per replicate) over-night fasted broilers per treatment. Haematological specimens were collected in EDTA-anticoagulant-treated bottles while serum chemistry samples were collected without anti-coagulant. Packed cell volume (PCV), red blood cell (RBC), white blood cell (WBC) and haemoglobin were determined using Wintrobe's micro-haematocrit, improved Neubauer haemocytometer and cyanomethaemoglobin method, respectively. Mean corpuscular volume (MCV), mean corpuscular haemoglobin concentration (MCHC), were computed according to (4).

Table 2: Composition of Broiler Starter Diets

Ingredients	Diets		
	1	2	3
Accia seed kernel meal	-	10.00	20.00
Ground nut cake	2600	16.00	6.00
Maize	49.10	49.10	49.10
Wheat offal	15.00	15.00	15.00
Blood meal	3.00	3.00	3.00
Fish meal	3.00	3.00	3.00
Bone meal	0.80	0.80	0.80
Oyster meal	2.50	2.50	2.50
Vit/min premix <sup>a</sup>	0.30	0.30	0.30
Salt	0.30	0.30	0.30
Total	100.00	100.00	100.00
Calculated			
Crude Protein %	22.85	22.91	23.01
Metabolizable energy (mj/kg)	10.59	10.61	10.70

<sup>a</sup>Vitamin-mineral premix provides per milligram diet: Vitamin A, 20,000 iu; vitamin D3, 4,000 iu; vitamin E, 20 iu; vitamin K, 12.00 mg; vitamin B, 12.00 mg; nicotinic acid, 5000 mg; pantothenic acid 22.00 mg; vitamin B, 3.00mg; folic acid: 1.00mg; vitamin B12, 0.02mg; choline chloride, 500.00mg; antioxidant, 250mg; cu:4.00mg; I:2.40mg; CO, 0.40mg; Se, 0.20mg.

The data were subjected to analysis of variance as outlined by (6). Treatment means were separated using Duncan's Multiple Range Test (7).

## RESULTS AND DISCUSSION

### Performance Characteristics

Average treatment values of weight gained, feed intake and feed conversion ratio are presented in Tale 3. Body weight gain and feed intake of broilers fed on the diet containing 10% ASKM were significantly ( $P < 0.05$ ) higher than those of broilers fed on the diet containing 20% ASKM and the control diets. It is well known that under normal

condition, weight gain is highly dependent on the amount of protein consumed and on the quality of the protein. The improvement in weight gain and feed efficiency of broilers fed 10% ASKM could be attributable to the higher feed intake of the chicks. Yusuf, Adamu and Igwebike *et al*. (8 9 and 19) have also indicated good growth performance when ASKM was fed to poultry, ruminants and rabbits respectively.

Results of this experiment showed that 10% ASKM gave the highest feed intake, feed conversion ratio and body weight gain but was however, depressed at 20% of ASKM in the diet. Kumaresam *et al*. (3) reported that because of their high tannin content, the pods are used by leather tanners. Birds fed 20% ASKM has the poorest feed /gain ratio. This is in agreement with the work of (11) that reduction in the digestibility of ASKM was due

to the tannin content. And tannin has been known to inhibit protein absorption. Therefore the poor body weight gain of the broilers could be due to the poor digestibility and absorption of diet with 20% ASKM and consequently the poor feed/gain ratio.

Table 3: Composition of Broiler Finisher Diet

Ingredient %	DIETS		
	1	2	3
Acacia seed kernel meal	-	10.00	20.00
Groundnut cake	20.00	10.00	-
Maize	58.10	58.10	58.10
Wheat offal	15.00	15.00	15.00
Blood meal	1.50	1.50	1.50
Fish meal	1.50	1.50	1.50
Oyster shell	2.50	2.50	2.50
Bone meal	0.80	0.80	0.80
Vit-min premixa	0.30	0.30	0.30
Salt	0.30	0.30	0.30
<b>Total</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>
Calculated			
Crude protein	18.00	18.10	18.15
Metabolizable energy (mj/kj)	11.72	11.80	11.92

<sup>a</sup>Vitamin-mineral premix provides per milligram diet: Vitamin A, 20,000 iu; vitamin D3, 4,000 iu; vitamin E, 20 iu; vitamin K, 12.00 mg; vitamin B, 12.00 mg; nicotinic acid, 5000 mg; pantothenic acid 22.00 mg; vitamin B, 3.00mg; folic acid: 1.00mg; vitamin B12, 0.02mg; choline chloride, 500.00mg; antioxidant, 250mg; cu:4.00mg; I,2.40mg; CO, 0.40mg; Se, 0.20mg.

#### Haematology and Serum Biochemistry

Blood variables of broilers fed graded levels of ASKM are presented in tables 4 and 5. Broilers fed 20% ASKM had significantly higher ( $P < 0.05$ ) value of PCV, Hb and RBC than broilers fed 10% ASKM and control diet but significantly lower ( $P < 0.05$ ) values of WBC. However, there were no significant differences in the serum metabolites of broilers except ALP, conbillirubin and total billirubin that were significantly ( $P < 0.05$ ) lowered by 20% inclusion of ASKM.

Blood is an important index of physiological, pathological and nutritional status in the organism. Highly significant ( $P < 0.01$ ) values of PCV, Hb and RBC in broilers fed 20% ASKM than the group fed GNC treatment evinced the nutritional superiority of ASKM, since the parameters had positive or negative correlation with nutritional quality of the diet and performance of the birds (12, 13). Leveille and Sanberllah (13, 14) also reported that high total protein recorded in their experiment could be explained by the high dietary protein. Those studies indicated that dramatic alterations could be found in levels of serum constituents within a short period of time. It was reported by (14, 15) that when evaluating plasma protein concentration, the effects of age, diet and disease must be considered. The birds fed 20% ASKM had significantly higher PCV, Hb, RBC and

Table 4: Performance Characteristics of Broilers Fed Experimental Diets

Parameters	Diets			SEM
	1	2	3	
Initial body weight (g)	95.00	95.00	94.00	
Final body weight (kg)	1.28a	1.46b	1.23a	
Feed intake (g/day/bird)	82.16a	95.78b	82.32a	1.8*
Body weight gain (g/day/bird)	24.64a	.95b	23.26a	3.2*
Feed conversion ratio	3.33 <sup>a</sup>	3.19 <sup>b</sup>	3.54 <sup>a</sup>	1.1*

a, b = Treatment means without common superscripts on the same row are significantly different ( $P < 0.05$ ). \*Significant treatment differences ( $P < 0.05$ ).

Table 5: Haematological Parameters of Broilers Fed Experimental Diets.

Parameters	DIETS			SEM
	1	2	3	
Packed cell volume (%)	25a	22.5b	28c	4.5
Haemoglobin (g/100ml)	8.3a	8.45a	9.35b	1.6
White blood cell (10 <sup>3</sup> /ml)	15.05a	13.3b	12.3c	1.2
Red blood cell (10 <sup>6</sup> /ml)	1.24a	1.26a	1.6b	1.1

\*Significant treatment mean ( $P < 0.05$ ) a, b, c, = means without common superscripts on the same row are significantly different ( $P < 0.05$ ).

lowered WBC, ALP and total bilirubin. These indicate the superior protein quality of ASKM. The relatively good amino acid composition of ASKM (3) suffices to explain the better protein nutrition of broiler fed ASKM than GNC as shown by their performance characteristics and blood variable. The ASKM diet had a better quality protein than GNC (Table 9), because ASKM was a good protein supplement, supplying high amounts of the amino acids - lysine and methionine, as well as the minerals P, Ca, K and Na.

#### Organ Weights.

Most of the visceral organs and intestinal tract measurements were within reported ranges (15, 16, 17, 18) showing no influence of the sources and levels of the test ingredient (Table 7). This means that feeding ASKM poses no serious consequences on organ functions and development. Nevertheless, heavier values of organs most probably represent hypertrophy (19, 20 and 21).

Therefore, it seems that ASKM does not have a specific effect on the weights of the digestive tract and visceral organs of broiler chickens.

Table 6: Serum Metabolites of Broilers Fed Experimental Diets

Parameters	DIETS			SEM
	1	2	3	
Glutamate	14.5	12.1	12.5	14 NS
Oxaloacetate				
Transaminase (IU/L)				
Glutamate	9.0	12.0	6.0	2.5 NS
pyruvate				
transaminase (IU/L)				
Albumin (gm/dl)	1.5	1.6	1.7	1.4 NS
Globulin (g/dl)	1.9	2.0	1.8	1.1 NS
Total proteins (gm/dl)	3.4 <sup>a</sup>	3.6 <sup>b</sup>	3.55 <sup>c</sup>	1.7
Alkaline	124.2 <sup>a</sup>	51.8 <sup>b</sup>	96.6 <sup>c</sup>	4.5
phosphatase (iu/L)				
Con-billirubin (gm/dl)	0.14 <sup>a</sup>	0.59 <sup>b</sup>	0.48 <sup>c</sup>	1.5

abc = means without common superscripts on the same row are significantly different ( $P < 0.05$ )

NS = No significant treatment difference ( $P < 0.05$ )

= significant treatment difference ( $P < 0.05$ )

Table 7: Visceral and Intestinal measurements of Broilers fed experimental diets

Organs	DIETS			SEM
	2	3		
Thigh	17.77	16.85	17.95	1.2 NS
Drum stick	15.60	17.46	17.73	1.3 NS
Breast	20.59	19.16	17.71	3.5 NS
Wing	11.39	12.13	13.02	1.6 NS
Liver	2.40	4.06	3.34	2.5 NS
Heart	0.48	0.54	0.69	1.0 NS
Gizzard	2.32	2.96	2.96	
0.002 NS				
Spleen	0.08	0.8	0.11	0.001 NS
Small intestine	4.48	3.72	4.67	1.0 NS
Caeca	1.45	0.63	1.92	1.2 NS
Abdominal fa	2.0	1.22	1.42	0.20 NS
Pancerease	0.29	0.27	0.29	0.001 NS

NS = No significant treatment difference ( $P < 0.05$ )

Table 8: Input-output analysis and economic efficiency of dietary treatment (per bird).

	DIETS		
	1	2	3
<b>Economic Parameters</b>			
Day old chick (#)	80.00	80.00	80.00
Feed intake (kg)	4.025	4.693	4.033
Price/kg feed (#)	22.37	20.67	18.90
Feed cost (#)	90.03	97.00	76.00
Vet. Miscellaneous (#)	20.00	20.00	20.00
Total cost chicken (#)	190.03	197.00	1.234
Ave. body weight (kg)	1.275	1.463	1.234
Actual body weight gained (kg)	1.180	1.368	1.140
Feed cost/body weight (#)	76.29	70.91	66.85
Feed cost/kg (#)	64.65	51.83	58.64
Total Revenue (#)	191.25	219.46	185.10
Net Revenue (#)	1.22	22.45	9.10
Economic efficiency	0.0064	0.1023	0.049

Table 9. Amino acids Composition (g/16g M) of Acacia seed kernel and Groundnut cake.

Amino acid	Acacia <sup>a</sup>	CNC <sup>b</sup>
Lysine	6.07	3.60
Methionine	6.66	1.40
Cystein	5.03	1.50
<b>Arginine</b>	<b>9.89</b>	<b>12.40</b>
Tryptophan	N.D	0.97
Histidine	3.63	2.40
Isoleucine	3.45	3.60
Leucine	3.37	6.4
Phenylalanine	4.03	4.90
Tyrosine	2.96	3.80
Valine	3.86	4.6
Alanine	4.12	3.90
Aspartic acid	9.08	11.60
Glutamic acid	14.34	19.30
Proline	5.53	4.50
Serine	4.67	4.92

<sup>a</sup> = (3), <sup>b</sup> = (22)

### **Economics of Production.**

The economics of production as presented in table 5 shows that the least feed cost/kg live weight gain was obtained from broilers fed on ASKM diets followed by birds fed on GNC diet. That these diets also resulted in higher net revenues and economics efficiencies, shows that they were better than GNC diets. This study therefore suggests that broilers could be profitably raised on a diet containing 10% ASKM since the birds fed 10% ASKM had the lowest feed cost/kg (#) and highest total revenue (#), net revenue (#) and economic efficiency.

### **CONCLUSION AND APPLICATIONS**

This study revealed the potentials of ASKM in the nutrition of broilers. In conclusion, utilization of ASKM at level more than 10% does not support growth performance of broiler chickens. Haematological and Serum metabolites were not adversely affected and high PCV, Hb and RBC observed in birds fed 20% ASKM confirmed that ASKM has a better protein quality compared to groundnut cake, but its high tannin content is a negative factor. The high cost of poultry feed particularly the protein supplements could be solved in this country with the vast, readily available acacia trees in Savannah Communities.

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