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EFFECTS OF PARTIAL REPLACEMENT OF SOYABEAN MEAL OR GROUNDNUT CAKE WITH SUNFLOWER SEED MEAL IN BROILER CHICKEN DIETS ON PERFORMANCE AND PLASMA METABOLITES

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ABSTRACT

160 unsexed Nera day old chicks were weighed and randomly divided into 8 experimental groups such that there were 2 replicates of 10 birds each per diet. Eight diets were formulated for the starter and finisher phases. The first four diets had groundnut cake as the protein source and were gradually replaced by sunflower meal (SFM) at the level of 0%, 25%, 50% and 75%. Diets 5-8 contained soyabean meal replaced progressively by SFM at 0%, 25%, 50% and 75%. The feed and water were given ad libitum and the experiment lasted eight weeks. Feed intake increased significantly ($P<0.05$) and linearly in the groundnut cake supplemented diets with increasing content of SFM at the starter phase. Feed intake ranged from 420g /week at 0% level of SFM supplementation to 520g /week at 75% level of SFM supplementation. However, body weight gains and feed efficiency were unaffected by the dietary treatments at both the starter and finisher phases. The same trend was paralleled in the soybean supplemented diets. The plasma metabolites were generally stable in the dietary treatments at both phases of production and values were within normal bench marks for poultry. There was a reduction ($P<0.05$)in plasma albumin in the birds on the starter phase of the groundnut cake supplemented diets and increasing the level of supplementation progressively depressed albumin content. In summary SFM can replace groundnut cake and soybean meal up to 75% level without negative effects on performance and production.

KEYWORDS: Sunflower seed meal, soyabean, groundnut cake, plasma metabolites.

Running Title: replacement of soyabean meal or groundnut cake with sunflower meal for broilers.

INTRODUCTION

High cost of feed ingredients and failed projections of economic returns to investment in livestock production have forced many farmers out of poultry production (Adetutu *et al.*, 2003). To remedy this situation, producers have to constantly look for alternative feed sources to replace the more expensive ingredients.

In Nigeria, commercial feed manufacturers are very conservative in their sourcing of energy and protein components of their feeds usually restricting energy to maize and the protein components always centred on soybeans meal, groundnut meal and fish meal among others.

An array of protein substitutes abound to satisfy the demand for alternative feed ingredients and sunflower meal and forage (Odunsi *et al.*, 1999) is a potential protein supplement high in nutritional value, free of anti-nutritional factors (Wan *et al.*, 1972; Sørensen, 1996) and useful in livestock rations (Smith, 1971). Sunflower meal (SFM) has been effectively used to replace 50% of soybean content in broiler rations (Clandinin, 1958).

With a reported crude protein content of 35% (Sørensen, 1996), SFM can partially replace soybean meal and when fortified with enzymes or amino acids can completely replace soybean meal in poultry rations.

Sunflower (*Helianthus annus)* is a wild growing plant in Nigeria but with climatic, soil requirements and yield very similar to maize can easily become a common seed and oil crop in the near future as its importance and potential become more recognised.

In this study, supplemental value of SFM as graded replacements for soybean meal and groundnut cake in broiler rations is evaluated.

MATERIALS AND METHODS

One hundred and sixty unsexed Nera day old chicks were weighed and randomly allocated to 8 experimental groups of 20 birds which were further subdivided into 2 replicates of 10 birds each. Eight starter (Table1) and finisher (Table 2) diets were formulated. The first four diets (T1-T4) for the starter and finisher phases had groundnut cake as the protein source and were gradually replaced by sunflower meal (SFM) at the level of 0%, 25%, 50% and 75%. Diets 5-8 contained soybean meal also gradually replaced by SFM at 0%, 25%, 50% and 75%. The sunflower inflorescence was harvested from sunflower stands planted at the University farm and left to stand until the seeds matured and were reasonably dry. The shrivelling petals were detached and the seeds removed and bulked for milling before mixing at the appropriate proportions with the other ingredients. The birds were housed for the first four starter weeks in battery brooder cages and transferred from the fifth finisher week to deep litter till the 8th week when the trial was terminated. Feed and water were given *ad libitum* and mean feed intake and body weight recorded weekly.

At the end of the starter period (5th week), blood was collected from five birds from each dietary group into heparinised tubes for plasma separation and subsequent analyses. The same procedure was repeated for another batch of five broilers each at the end of the eighth week. The plasma was analysed for inorganic phosphates, albumin, total protein, urea, creatinine and chlorides by standard colorimetric assays using Sigma kits (Sigma, 2000; Harris, 1995; Moss and Henderson, 1999).

The proximate analyses of the diets were carried out according to procedures established by AOAC (1990) and the

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Table 1. Gross Composition of Experimental rations (Starter Phase)

	Groundnut cake based diets				Soyabean meal based diets			
Ingredients	T1 (0% SFM)	T2 (25% SFM)	T3 (50% SFM)	T4 (75% SFM)	T5 (0% SFM)	TG (25% SFM)	T7 (50% SFM)	T8 (75% SFM)
Maize	53.5	47.1	38	28.1	52.24	46.1	36.5	29.00
Groundnut cake	27.6	20	14.00	5.2	-	-	-	-
Sunflower meal	-	14.00	28.1	45.1	-	14	27	39.7
Soyabean meal	-	-	-	-	28.86	21.00	14.00	7.00
Fish meal	3.00	3.00	3.00	3.00	3.00	3.00	4.8	5.7
Blood meal	3.00	3.00	4.00	5.7	3	3	4.8	5.7
Dried Brewers' grains	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Bone meal	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Oyster shell	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Palm oil	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Salt (NaCl)	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Pre mix*	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Methionine	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Lysine	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Proximate Analysis (% DM)								
Dry Matter (%)	92.57	93.13	91.88	92.72	91.88	91.19	91.99	91.87
Crude protein	22.23	21.43	22.96	21.32	22.51	21.46	23.91	23.91
Crude fibre	4.66	4.34	4.49	4.27	6.00	7.00	8.00	5.00
Ash	3.91	3.48	3.82	3.36	6.00	8.2	7.2	8.4
Ether extract	1.97	3.49	2.70	2.96	3.50	2.60	2.30	1.30
Moisture	7.43	6.87	8.12	7.28	8.12	8.81	8.01	8.13
Nitrogen free extracts	59.7	60.41	57.91	60.81	54.87	51.93	49.98	53.26
Metabolizable energy (Kcal kg^{-1})	3103	3220	3126	3190	2822	2859	2847	2882

**Premix supplied per kg diet. Vit A, 10,000 I.U; Vit D3, 2,000 I.U; Vit.E, 2.5 I.U; Vit K, 2.0mg; Vit B1, 60mg; Vit B2.5.mg; Cal Panthothenate 4.0g; Biotin 20mg; Vit B12, 8.0mg; Folic acid, 0.40g; Choline chloride, 120g; Zinc bacitracin, 8.0g; manganese 40.0g; Iron, 20.08g; Zinc 18.0g; Copper 0.30g; Iodine, 0.62g; Cobalt, 0.09g; selenium, 0.04g;*

Table 2: Gross Composition of Broiler finisher diets.

	Groundnut cake based diets				Soybean meal based diets			
Ingredients	T1 (0% SFM)	T2 (25% SFM)	T3 (50% SFM)	T4 (75% SFM)	T5 (0% SFM)	T6 (25% SFM)	T7 (50% SFM)	T8 (75% SFM)
Maize	64.56	57	51.4	45	61.15	56.82	51.07	45.37
Groundnut cake	16.89	15.5	10.00	5.35	-	-	-	-
Sunflower meal	-	10.35	20.85	31.30	-	10.53	21.13	31.00
Soybean meal	-	-	-	-	22.3	15.4	10.05	5.28
Blood meal	5.00	3.60	4.20	4.80	3.00	3.70	4.20	4.80
Dried Brewers' grains	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50
Bone meal	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Oyster shell	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Palm oil	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Salt (NaCl)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Pre mix	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Methionine	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Lysine	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Proximate Analysis (% DM)								
Dry Matter (%)	92.89	92.58	91.88	92.08	90.52	89.24	89.71	90.06
Crude protein	18.11	17.55	19.73	17.67	19.38	19.71	19.71	19.86
Crude fibre	5.40	7.90	6.06	7.42	7.20	7.80	10.40	6.60
Ash	3.99	5.08	3.52	7.10	6.90	7.20	7.20	7.70
Ether extract	1.06	1.06	2.69	3.26	3.20	2.10	3.00	2.50
Moisture	7.11	7.42	8.12	7.92	9.48	10.76	10.29	9.94
Nitrogen free extracts	63.33	60.99	59.88	58.63	53.96	52.43	49.4	54.80
Metabolizable energy (Kcal kg^{-1})	3040	2901	3076	2931	2894	2762	2728	2829

Premix supplied per kg diet: Vit A, 10,000 I.U; Vit D3, 2,000 I.U; Vit.E, 2.5 I.U; Vit K, 2.0mg; Vit B1, 60mg; Vit B2.5.mg; Cal Panthothenate 4.0g; Biotin 20mg; Vit B12, 8.0mg; Folic acid, 0.40g; Choline chloride, 120g; Zinc bacitracin, 8.0g; manganese 48.0g; Iron, 30.08g; Zinc 18.0g; Copper 0.30g; Iodine, 0.62g; Cobalt, 0.09g; selenium, 0.04g;

results were analysed by analysis of variance (ANOVA) and means compared by the Duncan's multiple range test (Daniel, 1995).

RESULTS

The results of the proximate analyses of the starter and finisher diets are displayed in Tables 1 and 2 respectively. The diets as compounded satisfied the nutrient requirements of broiler chickens in the starter and finisher phases as recommended by Olluyemi and Roberts (2000). However, the soybean based diets had higher crude fibre than the groundnut cake based diets with the crude fibre level increasing with increase in SFM content. The results of the performance indices are summarized in Table 3 for the groundnut cake

Table 3: Effects of partial replacement of groundnut cake with sunflower seed meal on growth performance in broiler chickens

	Groundnut cake based diets				
Parameters	T1 (0% SFM)	T2 (25% SFM)	T3 (50% SFM)	T4 (75% SFM)	SEM
Initial body weight (g)	82.0	89.0	83.0	85.0	1.09
Final body weight(Kg)	1.26	1.33	1.48	1.30	0.15
Feed Intake (g/bird/day)	60.0^{a}	70.08^{b}	71.46^{b}	74.4^{b}	1.57
Body weight gain (g/bird/day)	24.0	23.6	25.56	22.33	2.12
Feed Conversion Efficiency	2.5	3.23	2.84	3.35	0.46
Daily protein intake (g)	12.0	13.32	15.00	14.13	0.47
Protein Efficiency Ratio (PER)	2.0	1.77	1.70	1.58	0.29

^{a,b} Means in the same row with different superscripts are significantly different ($P<0.05$)

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