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The Effects of Replacing Groundnut Cake with Rubber Seed Meal on the Haematological and Serological Indices of Broilers

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Abstract: In a study to evaluate the effect of substituting groundnut cake (GNC) with rubber seed meal (RSM) on the heamatological and serological profiles of broiler chickens, one hundred and fifty day-old broilers (Anak 2000) were randomly assigned to five dietary groups. The replacement levels were 0% (RSM) and 100% GNC for diet group A, 25% RSM and 75% GNC for diet group B, 50% RSM and 50% GNC for diet C, 75% RSM and 25% GNC for diet D and 100 RSM and 0% GNC for diet E. The diets were formulated for starter and finisher phases, and were isonitrogenous and isocaloric. After eight weeks of rearing, blood samples collected from nine randomly selected birds per diet group were analyzed for red blood cell counts (RBC), white blood cells (WBC), haemoglobin count (HB), packed cell volume (PCV), coagulation time (CT), and erythrocyte sedimentation rate (ESR) as well as serum protein contents. From the results of these indices, the following parameters were estimated: the mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concetration (MCHC). Results indicated that, with the exception of MCV, MCHC and coagulation time, all other haematological and serological parameters decreased with increasing levels of dietary RSM. Values obtained were, however, within safe margins. The results further indicated that birds fed diets with high RSM had superior MCV and MCHC compared to those on high GNC diets. It was concluded that improved processing of RSM to eliminate its anti-nutritional factors content may improve its feeding value, and make it a potentially useful feed ingredient in reducing feed costs in poultry in Nigeria without endangering the health of birds.

Key words: Groundnut cake, rubber seed meal, heamatological and serological profiles, broilers

Introduction

The rising prices of livestock feeds especially in Nigeria and the scarcity of conventional proteins and energy concentrates for the formulation of feeds have forced the animal scientists in Nigeria to search for attractive, cheaper and readily available protein and energy sources. These efforts have produced accumulating evidence that alternatives such as palm kernel cake, Bambara groundnut meal, pigeon pea meal, mango seed kernel meal and rubber seed meal can be used for feeding livestock, especially poultry, pigs and rabbits with encouraging results (Adeyemi *et al*., 2000).

Rubber seed are very abundant in the southern states of Nigeria where rubber is produced for domestic purposes and for export. The seeds are usually discarded. In recent years, however, a lot of attention has been drawn to rubber seed meal as a potential protein source for livestock, having been reported to have about 41% crude proteins (Igene and Oboh, 2004; Ugwuene and Abasie Kong, 2004). Information on the effects of feeding rubber seed meal on the haematological and serological profiles of the animals is, however, scanty (Akpodiete and Ologbodo, 1998; Nworgu *et al*., 1998). It has been noted that significant changes in the blood parameters can be used to assess both the pathological and nutritional status of individual animals (Akpodiete and Ologbodo, 1998). It has also been established that certain haematological factors can be associated with certain production traits (Mmereole, 2004). For example, high packed cell volume (PCV) and hemoglobin (Hb) contents are associated with high feed conversion efficiency (Miruka and Rawnsley, 1997), while high percentages of white blood cells (WBC), especially lymphocytes, are associated with the ability of the chicken to perform well under very stressful conditions. Consequently, the effects of any feed ingredient on the haematological indices of chickens are of immense assistance in deciding whether or not such a feed ingredient should be used as poultry feed stuff.

This study was therefore carried out to investigate the effects of replacing groundnut cake (GNC) with rubber seed meal (RSM) on the haematological serological indices of broiler chickens. It is envisaged that the outcome of this study will be used to make decisions as to whether or not rubber seed meal can be used in poultry diets.

Materials and Methods

This experiment was performed at the Poultry Unit of the Teaching and Research Farm, Delta State University, Asaba Campus, Asaba (60° 45' E and 60° 12'N), Nigeria.

A total of 150 day-old Anak 2000 broilers procured from Xantech Hatcheries in Sapele, Delta State, Nigeria, were randomly assigned to five dietary groups in which groundnut cake (GNC) was replaced at varying levels

Table 1: Percentage Composition of the Broiler Starter Diets (23% CP)

	Experimental Diets: Levels of Dietary RSM (%)				
Ingredients	A:0	B:25	C:50	D:75	E:100
Maize	47.8	46.52	47.24	47.00	47.75
GNC	34.95	26.22	17.50	8.74	0.00
RSM	0.00	10.00	18.00	27.40	35.00
Soya bean cake	5.00	5.00	5.00	5.00	5.00
Oil	3.70	3.70	3.70	3.70	3.70
Beni seed	5.00	5.00	5.00	5.00	5.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Salt	0.30	0.31	0.31	0.31	0.30
Vit. Premix	0.25	0.25	0.25	0.25	0.25
Total Calculated analysis	100	100	100	100	100
ME (kcal/kg)	2800	2809	2010	2801	2802

GNC = Groudnut cake; RSM = Rubber seed meal; ME = Metablizable energy.

with rubber seed meal (RSM) as follows:
A = 0% RSM and 100% GNC
B = 25% RSM and 75% GNC
C = 50% RSM and 50% GNC
D = 75% RSM and 25% GNC
E = 100% RSM and 0% GNC

Two dietary types, one for the starter phase (23% crude protein (CP) and 2900kcal/kg metabolizable energy (ME)) and the other for the finisher phase (20% CP and 2300 kcal/kg ME) of production, were formulated (Tables 1 and 2). The test diets in each phase were formulated to be isocaloric and isonitrogenous.

Each treatment group consisted of thirty birds, divided into three replicates of ten birds each.

Prior to the arrival of birds, the brooding/growing house was disinfected and demarcated into five experimented units corresponding to the five dietary test groups. The birds were weighed on arrival to obtain their initial body weights and at weekly intervals thereafter. The experiment was terminated at the end of eight weeks.

Blood samples collected from the wing veins of three birds in each treatment group at the end of eight weeks of feeding were sent to the Essence Diagnostic Laboratory in Asaba, Nigeria for the determination of the blood parameters and serum proteins. Parameters determined included packed cell volume (PCV), red blood cell counts (RBC), hemoglobin concentration (Hb), white blood cell counts (WBC), erythrocyte sedimentation rate (ESR), blood coagulation time (CT) and serum proteins. From these parameters, mean corpuscular volume (MCV) and mean corpuscular haemoglobin concentration (MCHC) were calculated using the method of Schalm *et al.* (1975). All data collected were analyzed using the modified S.A.S. (2000) computer software.

Results and Discussion

Table 3 presents the nutrient analysis of rubber seed meal (RSM). Its protein content was 34.10%, thus confirming its status as a high - protein feedstuff. The heamatological and the serological indices of the broiler

Table 2: Percentage Composition of the Broiler Finisher Diets (20%CP)

	Experimental Diets: Levels of Dietary RSM (%)				
Ingredients	A:0	B:25	C:50	D:75	E:100
Maize	60.75	60.00	59.50	58.87	58.25
GNC	30.50	23.00	15.25	7.63	0.00
RSM	0.00	8.25	16.50	24.75	33.00
Beni seed	5.00	5.00	5.00	5.00	5.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Salt	0.50	0.50	0.50	0.50	0.50
Vit. Premix	0.25	0.25	0.25	0.25	0.25
Total Calculated analysis	100	100	100	100	100
ME (kcal/kg)	3005	3009	3009	3005	3010

GNC= Groudnut cake; RSM= Rubber seed meal; ME= Metablizable energy

Table 3: Nutrient Composition of Rubber Seed Meal

Nutrient	Composition (%)
Protein	34.10
Fat	10.12
Fibre	4.40
Ash	3.10
Calcium	0.20
Energy (Heat) (kcal/kg)	2520

chicken fed the various test diets are presented in Table 4. With the exception of MCV, MCH and coagulation time, all other haematological and serological indices tended to decrease as greater proportions of RSM were incorporated into the diets. PCV for diet A (33.55%) was significantly ($P<0.05$) higher than those for the other levels of RSM inclusion (diet B = 29.05%; C = 30.45% and E = 32.35%). In the same vein, the RBC in diet A ($2.7x10^6/mm^3$) was significantly ($p<0.05$) higher than in all other levels of GNC substitution. The Hb (11.09g/dl), MCH (41.07 pg) ESR (5.02 mm), WBC ($19.47X10^3/CM^3$) and the serum protein (4.95g/dl) were significantly ($P<0.05$) higher in diet A than in the other dietary groups. These results are in agreement with observations by Babatunde and Pond (1988) that rats fed RSM had lowered PCV values due, perhaps, to the presence of haemolytic factors. Although most of the parameters measured in this study were significantly ($P<0.05$) lower as more GNC was replaced with RSM, the values were still within normal ranges reported for broilers (Campbell, 1995; Mmereole, 2004). The decreases observed in the blood indices as more RSM was included in the diets may have been due to effects of traces of anti-nutritional factors present in RSM. It is envisaged that further processing of RSM through heating or fermentation may completely eliminate such anti-nutritional factors and enhance its nutritional quality. MCV generally tended to increase ($P < 0.05$) as the proportion of RSM in the diets increased (Table 4). Highest MCV was obtained in diet E (147.27 fl) with 100% RSM. MCV is an important trait which determines the cell size of erythrocytes and is therefore an important factor in determining the ability of birds to withstand prolonged oxygen starvation (Miruka and Rawnsley, 1997).

Table 4: The Haematological and Serological Indices of the Experimental Chickens

	Dietary Groups				
Indices	A	B	C	D	E
RBC (mm^3 x 10^6)	2.70±0.04[a]	2.62±0.04[a]	2.52±0.04[c]	2.38±0.03[c]	2.29±0.02[c]
PCV (%)	33.55±0.64[a]	29.05±0.65[c]	30.50±0.52[b]	32.45±0.42[a]	32.35±0.02[a]
Hb (g1100)	11.09±0.21[a]	9.80±0.23[b]	9.43±0.08[c]	8.23±0.20[d]	8.80±0.17[cd]
Coagulation Time (s)	177.80±1.55[d]	184.50±1.97[c]	189.60±1.78[b]	190.60±1.31[b]	193.10±1.03[a]
ESR (mm/3hr)	5.50±0.05[a]	4.41±0.12[b]	4.19±0.13[c]	4.21±0.17[c]	4.03±0.11d
MCV (fl)	124.26±1.35[c]	110.88±1.23[e]	121.03±1.09[d]	136.34±1.95[b]	141.27±1.98[a]
MCH (pg)	41.07±1.05[a]	37.40±1.53[b]	37.42±1.21[b]	34.48±1.08[c]	34.06±1.21[c]
MCHC (%)	33.10±1.09[a]	33.73±1.52[a]	30.91±0.95[b]	25.36±0.89[c]	24.11±0.58[d]
WBC ($mm^3/10^3$)	19.47±0.45[a]	19.08±0.45[a]	18.50±0.22[b]	18.39±0.30[b]	17.92±0.19[c]
Serum Protein (g/d)	4.95±0.15[a]	4.05±0.13[b]	3.73±0.13[cd]	3.53±0.11[d]	3.26±0.27[d]

[a,b,c] Means with different superscripts in the same row are significantly different (P<0.05). A = 0% RSM, 100% GNC; B = 25% RSM, 75% GNC; C = 50% RSM, 50% GNC; D = 75% RSM, 25% GNC; E = 100 RSM, 0% GNC.

Serum proteins and WBC levels in the blood were significantly depressed as more RBC was included in the diets beyond 0% and 25% respectively. This implies that feeding over 25% RSM in broiler diets without further processing for prolonged periods may be detrimental to broilers since these two factors are involved in the formation of immunoglobins responsible for the development of antibodies. Prolonged feeding of RSM in this form therefore will pose health hazards to such birds when challenged with infections.

Conclusion: Since the RSM has shown great promise as a possible substitute for GNC, what is necessary now is to improve the processing methods in such a way that all traces of anti nutritional and haemolytic factors which are capable of distorting the haematological parameters are eliminated. This done, rubber seeds that are abundant in the southern states of Nigeria can be gathered and utilized at little costs thus reducing costs of feeds due to highly priced GNC.

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