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RESEARCH ARTICLE

Performance, Carcass Characteristics and Haematological indices of Cockerel Chickens fed Diets Containing Graded Level of Raw *Gmelina arborea* Seed Meal

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ABSTRACT

A 56-day feeding trial was conducted on 160 (one hundred and sixty) one week old Cockerel chickens to evaluate the effects of graded level of raw Gmelina arborea seed meal (as replacement for Soybean and Palm kernel cake in their feed) on growth performance, carcass characteristics and haematological indices of Cockerel Chickens. Four diets containing 0%, 10%, 20% and 30% inclusion level of Gmelina arborea seed meal (GASM) were formulated and the birds were randomly allotted to four dietary treatments (T1, T2, T3 and T4) in a completely randomized design after brooding for the first week of life with compounded commercial feed to allow the birds to attain some level of immunity. Each treatment was replicated four times with each treatment containing 40 (forty) birds and to each replicate 10 (ten) birds were assigned each. Water and feed were supplied ad-libitum. At the end of the feeding trial, results indicated that carcass, organs and haematological indices were significantly ($P<0.05$) affected. Significant increase ($P<0.05$) in performance, carcass characteristics and haematological indices were noticed up to 10% inclusion level of GASM while the values of the parameters measured started diminishing from 20% inclusion level of GASM and there were further decline in the values of the parameter measured at 30% inclusion level of GASM except the white blood cell count which has an inverse relationship with increasing level of GASM in the experimental diets and this has been attributed to protective function of White Blood Cell (WBC) against invasion by foreign organism or substance. It was also observed that as the inclusion level of GASM increases in the experimental diets, average feed consumed by the cockerels decreases, this is due to the increase in concentration of Anti-nutritive factors such as Phytase present in GASM which invariably affects its concentration in the experimental diets.

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INTRODUCTION

Poultry industry being one of the most organized one has the potential to solve the malnutrition and unemployment problems augment rural economy in Nigeria today, but in recent years there has been reduction in both the quality and quantity of products from this industry, this is not unconnected with the competition between Mankind and animal for the available conventional feedstuff especially the monogastric animals (Quershi,1980). This problem has exacerbated the high cost of feeding and consequently of the animal products (Adeleye,F.O and Adebiyi, B.A 1990). Hence there is a need for a suitable feeding package which will employ diversified non-conventional resources exactly matching the need of the poultry and feeding of animals. *Gmelina arborea* seed meal (GASM) was proposed for this work because of its high nutritional composition and little utilization by humans. The tree is usually planted as garden and avenue tree growing in villages, Agricultural land, waste land and Community lands. Both fruit and seed have been identified among the non conventional seeds and fruits that could be good source of nutrient for livestock (Ogundun, 2001). It is fast growing trees which prefer most fertile valleys with750-4500mm of rainfall. The tree attains a moderate to large height up to30m with

girth of 1.2m to 4m (Ogundun, 2001). Raw *Gmelina arborea* seed contains 16.2% crude protein, 35% Ether extracts, 61.82% crude fibre, 57.5% ADF, 78.9% NDF and 26.9% hemicelluloses respectively (Ogundun, 2001). A major constraint to the use of GASM in poultry feedstuff is the presence of toxic and anti-nutritional constituents which have adverse effects on bird's performance by decreasing the overall nutritional qualities in form of loss of appetite, reduction in dry matter intake and protein digestibility. Several anti-nutritional factors such as Phytotoxin, Tannin, Tartaric acid or benzoic butyric acid are found in raw GASM (Little E, L, Jnr, 1993). These anti-nutritional factors when present in feed exert effects that are contrary to optimum nutrient utilization. Anti-nutritional factors posses the ability to diminish animal productivity and may also cause toxicity during periods of scarcity or confinement when the feed rich in these substances are consumed by animals in large quantities (Little E, L Jnr, 1993) The objective of the present study was to establish the replacement value of raw *Gmelina arborea* seed for soybean meal protein and palm kernel cake fibre in Cockerel chickens diets using performance, carcass characteristics and haematological indices as response criteria.

MATERIALS AND METHODS

Processing of *Gmelina arborea* seed

The fruits were sourced from the tree's plantation (located in Federal College of Wildlife Management New-Bussa, Niger State, Nigeria) after maturity and dropping naturally. The collected fruits were opened to harvest the seeds and the harvested seeds were soaked in water for four days and air-dried in order to reduce or eliminate the anti-nutritional factors and not to alter its chemical composition. The seeds were cleaned off dirts and were grounded in hammer mill into smaller particles before being included in poultry feed at graded level to form the experimental feed samples.

Experimental diets

Four experimental diets were formulated using raw GASM as the test ingredients to replace Soybean meal protein and palm kernel cake fibre at 0, 10, 20 and 30% in Cockerel chickens' diets and were termed T1, T2, T3, and T4 respectively. The experimental diets and calculated percentage crude protein and metabolizable energy (Kcal/Kg) are shown in Table 1. The diets were compounded by weighing the components separately and mixing them thoroughly to achieve uniform distribution of the components. The ingredients used in the formulation of the diets includes: maize, soybean meal, raw *Gmelina arborea* seed meal, palm kernel cake, 72% fishmeal, Chick premix, lysine, methionine and salt.

Experimental design and management of experimental birds

A total of 200, one day old Harco Cockerel chicks were sourced from a reputable farm in Ibadan, Oyo State, Nigeria and were brooded together for one week using commercial chick marsh from a reputable company, this is to allow the birds to build up certain level of immunity before the introduction of GASM into their diet. After the first week of brooding, 160 (one hundred and sixty) out of the chicks were randomly allotted into four treatments of 40 (forty) birds per treatment and each treatment replicated four times with each replicate consisting of ten birds per replicate. The birds were given water and test diets ad-libitum from 2nd to 9th week in a deep litter pen. Necessary vaccination and medication were administered as the need arises and as when due.

RESULTS

On the 56th day of the trial, two chickens per replicate were randomly selected and the selected chickens were weighed, slaughtered, dressed, re-weighed, eviscerated and re-weighed again. They were later into thigh, back, drumstick, shank, wings, head, neck and breast. All the visceral organs were also weighed after evisceration and the results obtained were analyzed using ANOVA (2) method and the means were separated using Duncan's (3) multiple range test. The result obtained from the performance and carcass analyses are shown in Tables 3 and 4.

DISCUSSION

The result on growth performance shown on Table 3 revealed that birds fed diets containing 10% inclusion

Table 1: Gross and proximate composition of the experimental diets

	Treatments			
Ingredients	T_1 (0%GASM)	T_2 (10% GASM)	T_3 (20% GASM)	T_4 (30% GASM)
Maize.	55.0	55.0	55.0	55.0
Gmelina arborea seed meal	0.0	10.0	20.0	30.0
Soybean meal	20.0	13.5	7.10	0.65
Palm kernel cake	11.0	7.45	3.90	0.35
Fishmeal	5.0	5.00	5.00	5.00
Groundnut cake	6.0	6.00	6.00	6.00
Bone meal	2.0	2.00	2.00	2.00
Lysine	0.2	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Vitamin Premix	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Total (Kg)	100	100	100	100
Calculated Analysis				
Crude Protein (%)	20.09	20.23	20.11	19.69
Metabolizable Energy (Kcal/Kg)	2900	2928	2906	2893

Table 2: Proximate Composition (% Dry Matter) of Raw *Gmelina arborea* seed meal

Dry matter	89.72
Crude protein	14.51
Ether extract	1.62
Ash content	12.89
NFE	57.49
NDF	65.86
ADF	42.38
Gross Energy (Kcal/Kg)	2980

level of raw Gmelina arborea seed meal (GASM) had the highest value of growth performance (621g) while those fed with diets containing 30% inclusion level of GASM had the lowest value of growth performance (425g). there was no significant difference (P>0.05) in the growth performance of birds fed diets containing 10% and 20% inclusion level of GASM, while those fed with diet containing 30% inclusion level differs significantly (P<0.05). This might be attributed to the increase in feed intake by birds in treatments 2 and 3 as shown on Table 3. From the results it was observed that the rate of feed intake decreases as the as the level of inclusion level of GASM increases in the diets this might be attributed to increase in the concentration of anti-nutritional factors in the diets as the inclusion level of GASM increases in the diets. Also it was observed in Table 4 that birds fed diets containing 10% inclusion level of GASM had the highest live weight, eviscerated weight and dressing percentage which are: 713g, 650g and 91.2% respectively as opposed to birds in treatment 4 which had the lowest values which are: 518g, 380g and 87.8% respectively. This same trend was also observed in the weight of the cut parts such as head, neck, back, drumstick, back, etc. The size of the liver in treatment 4 was observed to be highest and this might be due to increase the activity of the liver in detoxifying the increased level of anti-nutritional factors in the diet. Packed cell volume (PCV), Hemoglobin Concentration (Hb) and Red blood cell count (RBC) were highest in birds fed diets containing 10% inclusion level of GASM and lowest in those fed diets containing 30% inclusion level of GASM. The white blood cell count was highest in birds fed diets containing 30% inclusion level of GASM with the value of $12.4x10^6$ $mm^3$and lowest in birds fed diets containing 10 % inclusion level of GASM with the value of $11.0x10^6mm^3$. The reverse in this trend can be due to the activity of white blood cell in protecting the body against foreign invasion by increasing their number to fight against foreign bodies which in this case are the anti-nutritional factors present in *Gmelina arborea* seed meal. From Table 3 it was observed that the efficiency of feed utilization were highest in treatments 2 and 3 with 0.21 as their values and lowest in treatment 4 having a value of 0.18. Also the Feed Conversion Ratio (FCR) was lowest in treatments 2 and 3 having 4.84 as their value and highest in treatment 4 (T4) having 5.49 as its value.

Conclusion

In summary, Cockerel chickens fed diets containing raw Gmelina arborea seed meal (GASM) performed

Table 3: Growth Performance of Cockerel Chickens fed the experimental diets.

Parameters	T_1 (0%GASM)	T_2 (10%GASM)	T_3 (20%GASM)	T_4 (30%GASM)	SEM
Average initial body weight (g)	90.0^a	92.0^{ab}	91.0^a	93.0^{ab}	0.01
Average final body weight (g)	660^a	713^{ab}	708^{ab}	518^b	24.4
Average weight gain (g)	570^a	621^{ab}	617^{ab}	425^b	21.2
Average daily weight gain (g)	10.2^a	11.1^{ab}	11.0^{ab}	7.6^b	0.42
Average daily feed intake (g)	50.5^a	53.7^{ab}	52.6^{ab}	41.7^b	0.04
Efficiency of Feed Utilization	0.20^a	0.21^{ab}	0.21^{ab}	0.18^b	0.06
Food Conversion Ratio	4.95^a	4.84^{ab}	4.84^{ab}	5.49^b	0.07

*Means with the same superscript on the same horizontal rows are not significantly different (P>0.05) while means with different superscript on the same horizontal rows are significantly different (P<0.05).

Table 4: Carcass characteristics of Cockerel chickens fed experimental diets

Parameters	T_1 (0% GASM)	T_2 (10% GASM)	T_3 (20% GASM)	T_4 (30%GASM)	SEM
Live weight (g)	660^a	713^{ab}	708^{ab}	518^b	27.45
Eviscerated weight (g)	590^a	650^{ab}	645^{ab}	455^b	23.76
Dressing percent (%)	89.4^a	91.2^{ab}	91.1^{ab}	87.8^b	4.97
Cut parts					
Head (g)	17.1^a	18.9^{ab}	18.4^{ab}	15.9^b	3.46
Neck (g)	30.0^a	38.7^{ab}	37.3^{ab}	28.8^b	4.54
Back (g)	80.1^a	83.6^{ab}	82.9^{ab}	77.2^b	3.99
Drumstick (g)	68.3^a	70.8^{ab}	70.2ab	64.3^b	2.98
Thigh (g)	59.6^a	64.7^{ab}	63.9^{ab}	56.4^b	2.69
Shank (g)	31.4^a	35.6^{ab}	34.9^{ab}	27.7^b	2.87
Wings (g)	54.8^a	58.3^{ab}	57.7^{ab}	43.5^b	1.63
Organs weight					
Heart (g)	3.20^a	4.90^{ab}	4.60^{ab}	3.80^b	1.32
Kidney (g)	4.20^a	6.80^{ab}	6.70^{ab}	7.10^b	0.09
Lungs (g)	5.70^a	4.80^{ab}	4.30^b	4.20^b	0.07
Liver (g)	15.6^a	16.4^a	18.7^{ab}	19.8^b	3.78
Gizzard (g)	26.8^a	48.6^{ab}	45.2^{ab}	33.7^b	2.53
Spleen (g)	0.80^a	1.20^{ab}	1.60^b	1.60^b	0.08
Bursa of fabricious (g)	1.20^a	2.30^{ab}	1.10^b	1.10^b	0.76

Means with the same superscript on the same horizontal rows are not significantly different (P>0.05) while means with different superscript on the same horizontal rows are significantly different (P<0.05).

Table 5: Haematological indices of Cockerel Chickens fed diets containing graded level of raw *Gmelina arborea* seed meal (GASM).

Parameters	T_1 (0%GASM)	T_2 (10%GASM)	T_3 (20%GASM)	T_4 (30%GASM)	SEM
PCV (%)	29.0^{a}	31.0^{a}	29.0^{a}	26.0^{ab}	0.26
Hb Conc (g/dl)	9.70^{a}	9.40^{a}	8.90^{ab}	7.40^{b}	0.32
RBCx10^6 mm^3	2.60^{a}	2.75^{a}	2.83^{ab}	1.91^{b}	0.34
WBCx$10^6$$mm^3$	10.7^{a}	11.0^{a}	11.8^{ab}	12.4^{b}	0.07
MCH (pg)	39.2^{a}	36.8^{ab}	35.0^{ab}	32.5^{b}	0.82
MCHC g/dl	30.1^{a}	32.2^{ab}	29.4^{a}	31.1^{b}	0.09
MCV (fl)	115.5^{a}	110.5^{a}	105.7^{ab}	120.6^{b}	14.7

Means with the same superscript on the same horizontal rows are not significantly different (P>0.05) while means with different superscript on the same horizontal rows are significantly different (P<0.05).

optimally at 10% inclusion level. Decrease in feed intake and performance were observed as the as the inclusion level of raw GASM increases in the diet of the birds. It was therefore concluded that Cockerel chickens preformed best at 10% inclusion level in their diet. The reduction in feed intake as the inclusion level increases might be due to the increase in the increase in the concentration of anti-nutritional factors in the feed. It is therefore recommended that raw GASM can be added to Cockerel's feed at 10% inclusion rate and further research should be carried out on how to remove or reduce the level of anti-nutritional factors in *Gmelina arborea* seed.

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