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Animal Science

Biochemical Responses of Cockerel to Graded Levels of Cowpea Testa as Replacement for Groundnut Cake

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ABSTRACT [ENGLISH/ANGLAIS]

Cowpea Testa Meal (CTM) has been reported to be a cheaper alternative to Ground nut cake (GNC) in poultry nutrition but it contains some anti-nutritional factors. The effect of replacing GNC with CTM in the diets of cockerel starters on their serum metabolites and electrolytes was therefore investigated. One hundred and fifty (150) day old Harco strain of cockerels were randomly allotted into five dietary groups of thirty chicks each with three replicates in a completely randomised design. Five isocaloric and isonitrogenous diets were formulated with CTM replacing GNC at 0%, 25%, 50%, 75% and 100% graded levels. Dietary treatment started at fourth week of life. The experiment lasted seven weeks at the end of which blood samples were collected from the birds for serum biochemical analysis. Parameters investigated were Total protein (TP), Albumin, Globulin, Blood Urea Nitrogen(BUN), creatinine, bilirubin, Alanine Transaminase(ALT), Aspartate Transaminase (AST) and Alkaline Phosphatase (ALP). Others were serum electrolytes such as K^+, Na^+, Cl^- and HCO_3^-. TP, AST and all serum electrolytes investigated were not significantly ($p > 0.05$) affected by the treatment. However, serum albumin, BUN, creatinine, bilirubin, ALT and ALP were significantly ($p < 0.05$) affected by the treatment compared to those in control group. It can therefore be concluded from the results that CTM can be used to replace GNC in the diets of cockerel starters preferably at 25% and 50% substitution levels without any negative effect on the serum metabolites and electrolytes concentrations.

Keywords: Anti-nutritional factor, cockerel starters, cowpea testa meal, groundnut cake, serum electrolytes, serum metabolites

RÉSUMÉ [FRANÇAIS/FRENCH]

Niébé Testa repas (CTM) a été signalé à être une alternative moins chère à gâteau aux noix sol (GNC) dans l'alimentation des volailles, mais il contient quelques facteurs anti-nutritionnels. L'effet de remplacer GNC avec CTM dans l'alimentation des démarreurs coq sur leurs métabolites du sérum et des électrolytes a donc été étudié. Cent cinquante (150) jours souche ancienne Harco de coqs ont été aléatoirement attribués en cinq groupes alimentaires de trente poussins chacun avec trois répétitions dans un dispositif complètement aléatoire. Cinq régimes isocalorique et isoazotés ont été formulés avec CTM remplaçant GNC à 0%, 25%, 50%, 75% et 100% des niveaux classés. Le traitement alimentaire a commencé à la quatrième semaine de l'expérience de vie.L a duré sept semaines à la fin de laquelle des échantillons de sang ont été collectées à partir des oiseaux pour analyse biochimique sérique. Paramètres étudiés étaient la protéine totale (TP), albumine, globuline, l'urée sanguine (BUN), créatinine, bilirubine, l'alanine Tranaminate (ALT), aspartate Transaminate (AST) et alcalines Phosphatate (ALP). D'autres ont été électrolytes sériques tels que K +, Na +, Cl-et HCO3-. TP, AST et tous les électrolytes sériques étudiés n'ont pas été significativement (p> 0,05) affectées par le traitement. Toutefois, l'albumine sérique, BUN, créatinine, bilirubine, ALT et ALP ont été significativement (p <0,05) affectée par le traitement par rapport à ceux du groupe contrôle. Il peut donc être conclu à partir des résultats que CTM peut être utilisé pour remplacer GNC dans l'alimentation des démarreurs coq de préférence à 25% et taux de substitution de 50% sans aucun effet négatif sur le sérum et les concentrations de métabolites d'électrolytes.

Mots-clés: Anti-nutritionnels facteur, démarreurs Coquelet, niébé testa farine, tourteaux d'arachide, les électrolytes sériques, des métabolites sériques

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INTRODUCTION

Cockerels, are known to be by-products of pullets' hatchery operations and they are usually discarded in advanced countries because they take longer time to reach marketable body weight even with good diets. However, in Nigeria and most African countries, cockerels are being reared by farmers who cannot afford to go into broilers production [1]. Cockerels grow slowly but they can utilize high fibre diets better than layers and broilers.

Cowpea otherwise known as "beans", *Vigna unguiculata*, is very popular among households in Africa and is widely grown as a leguminous crop in Nigeria. The testa covering the cotyledons of the bean is usually removed during the processing and this by-product can be fed to the ruminants [2].

Incorporation of cowpea testa meal (CTM) into poultry production has been previously investigated [1, 3, 4]. However, with the presence of antinutritional factors notably tannins and trypsin in CTM at 5.30mg/g and 12.40mg/g respectively (as reported by Sonaiya and Olori[4]), there is paucity of information on the physiological responses of these cockerel starters to the inclusion of CTM in their diets.

This experiment therefore investigated the serum biochemical profile of the birds fed with graded levels of CTM as replacement for peanut cake.

MATERIALS AND METHODS

One hundred and fifty (150) day old cockerels of Harco strain purchased from a reputable hatchery were used for this study. They were randomly allotted into five dietary groups of thirty (30) birds each with three replicates in a completely randomised design. CTM was used to substitute Groundnut cake (GNC) at 0%, 25%, 50%, 75% and 100% graded level on weight for weight basis. The experimental diets were isocaloric and isonitrogenous.

Birds Management

The experiment was carried out at the Teaching and Research Farm of Bowen University,Iwo, Nigeria. The birds were brooded for four weeks and fed commercially available chick mash for the first two weeks of age. They were later exposed to the experimental diets from the third week till the eleventh week. The birds were given feed and water *ad libitum* throughout the duration of the study and other management practices (such as vaccination, medication and welfare ethics) were strictly observed.

The proximate analysis of the CTM and GNC was carried out with the procedure of A.O.A.C [5].

Collection of Blood Samples

Blood samples were collected from the birds at eleventh week of age. This was done at the wing web with sterilised micro syringe into a set of labelled and sterilised dry glass tubes free of anti-coagulant for serum separation which was done immediately after collection.

Na^+ and K^+ concentrations were determined with flame photometry while HCO^{3-} and Cl^- concentrations were determined according to A.O.A.C [5].

Total serum protein (TP) was determined with the use of Biuret method earlier described by Reinhold [6]. Albumin was determined with the use of Bromocresol Green method as earlier described by Peters *et* al. [7].Serum urea was determined with the use of urease method and creatinine by Folin-Wu filtrate methods as described by Toro and Ackerman [8].

Alanine Transaminase (ALT), Aspartate Transaminase (AST) and Alkaline Phosphatase (ALP) activities were determined with the use of Spectrophotometric methods as earlier described by Rej and Holder[9].

The comparative data of the proximate composition of CTM and GNC is shown in Table 1

Table 1: This table shows the proximate composition of Cowpea Testa Meal (CTM) and Groundnut Cake (GNC)

Proximate Component	CTM	GNC
Dry matter (%)	93.60	92.50
Crude Protein	29.50	44.80
Crude Fibre	7.85	5.10
Ether Extract	3.50	6.00
Ash	4.12	5.65
Nitrogen free extract	48.63	30.92
Metabolizable Energy(Kcal/kg)	1960	2600

Statistical Analysis

Data obtained were analysed, and Analysis of variance (ANOVA) was done using Statistical Analysis Software, SAS [10].Means with significant differences among the treatments were separated using the Duncan's option of the same software.

RESULTS AND DISCUSSION

Table 2 shows the gross composition of the experimental diets. The diets were isocaloric and isonitrogenous as suggested by Olomu [11].

Table 3 shows the serum electrolytes of cockerel starters fed with graded levels of CTM. The dietary treatments had no significant ($p > 0.05$) effect on the serum electrolytes investigated thereby implying that the osmoregulatory activities at cellular level was not negatively affected by the treatments. The values were within the range of the normal values for healthy male chicken as earlier reported by Mistruka and Rawnsley [12]. Table 4 shows the serum metabolites of the cockerel starters fed with graded levels of CTM. The result showed

no significant ($p > 0.05$) difference in the TP and AST of the birds compared with those in the control group.

Table 2: This table shows the gross composition of the experimental diets

Ingredients	Treatments				
	T1	T2	T3	T4	T5
Maize	40.00	41.50	43.00	44.50	45.70
Fish meal 72%	3.00	3.00	3.00	3.00	3.10
Blood meal	2.00	2.00	2.00	2.00	2.00
Groundnut cake (GNC)	15.00	11.25	7.50	3.75	-
Cowpea testa meal (CTM)	3.75	7.50	11.25	15.00	
Wheat offal	21.00	17.00	13.00	9.00	7.20
Palm kernel cake (PKC)	14.50	17.00	19.50	21.00	22.50
Bone meal	2.50	2.50	2.50	2.50	2.50
Oyster shell	1.50	1.50	1.50	1.50	1.50
Salt	0.25	0.25	0.25	0.25	0.25
*Premix	0.25	0.25	0.25	0.25	0.25
Total	100.0	100.0	100.0	100.0	100.0
Additives:					
Lysine	0.01	0.01	0.01	0.01	0.01
Methionine	0.01	0.01	0.01	0.01	0.01
Calculated Values:					
Crude Protein (%)	21.51	21.48	21.45	21.42	21.50
Metabolizable Energy (Kcal kg-1)	2818.60	2808.50	2866.20	2805.01	2815.65

Premix to provide the following per kg of feed; Vit A – 500 iu, Vit D3 – 1250mg,; Vit E – 11mg; Vit K – 2mg; Riboflavin- 25mg; Nicotinic acid – 15mg; Panthothenic acid – 7mg; Cobalamin – 0.08mg; choline chloride – 900mg; folic acid – 1.5mg; Biotin – 1.5mg; Iron – 25mg; Manganese – 80mg; Copper – 2mg; Zinc – 50mg; Cobalt – 1.25mg and Selenium – 0.1 mg.

Table 3: This table shows the serum electrolytes of cockerel starters fed graded levels of CTM

Parameters (mmol/l)	Treatments					
	T1	T2	T3	T4	T5	SEM
Na^+	135.45	137.65	140.05	139.25	141.15	6.00
K^+	5.25	5.15	5.18	5.20	5.30	0.20
Cl^-	110.55	109.45	107.65	112.55	115.35	8.00
HCO_3^-	14.55	15.05	15.15	15.35	15.55	1.50

SEM: Standard Error of Means; CTM: Cowpea Testa Meal

Table 4: This table shows the serum metabolites of cockerel starters fed with graded levels of CTM

Parameters	Treatments					
	T1	T2	T3	T4	T5	SEM
Total Protein (TP)(g/dl)	3.62	3.55	3.50	3.48	3.52	0.20
Albumin (g/dl)	1.96^a	1.75^{ab}	1.69^{ab}	1.40^b	1.39^b	0.10
Globulin (g/dl)	1.66^c	1.89^b	1.90^b	2.18^a	2.13^a	0.20
Alb/Glb ratio	1.28	0.97	0.94	0.71	0.65	
Blood Urea Nitrogen (BUN; mg/dl)	24.30^a	20.15^b	20.20^b	18.42^c	18.38^c	0.80
Creatinine (mg/dl)	1.42^c	1.45^c	1.71^b	1.99^a	2.15^a	0.10
Bilirubin (mg/dl)	0.35^b	0.38^b	0.57^a	0.60^a	0.61^a	0.05
AST (iu/l)	8.50	8.65	8.60	8.62	0.20	8.65
ALT (iu/l)	4.26^c	4.30^b	4.32^b	5.21^a	5.23^a	0.03
ALP (iu/l)	31.48^c	36.82^b	47.45^a	49.50^a	50.05^a	1.50

T1-T5: Treatments 1 to 5; SEM: Standard Error of Means; abc: Means with different superscript are significantly different ($p<0.05$)

However, serum Albumin, Blood Urine Nitrogen (BUN), creatinine, bilirubin, ALT and ALP were significantly($p < 0.05$) affected by the dietary treatments compared with those in the control group. Their values were increasing significantly with increase in the level of CTM inclusion. These parameters are indication of the kidney(renal) status in the body's physiology in excretion [13] and it can be deduced that as the CTM level is increasing in the diets, the nitrogen in the urea was not effectively excreted as a result of renal malfunction which may be linked to the anti-nutritional factors present in the CTM.

Moreover, the value of the ALT, ALP, creatinine and bilirubin are being used clinically to detect liver injury and the degree of hepatic cells degradation as reported by Duncan *et al* [13]. Progressive increase in the values of these parameters in the results of this experiment showed that the birds with higher level of CTM inclusion suffered hepatic trauma subclinically.

CONCLUSION

The results of this experiment suggest that CTM can be used to replace GNC in the diets of cockerel starters without detrimental effect on their health. However, higher inclusion level must be avoided to protect the birds against kidney and liver damage. Meanwhile, processing methods to reduce the levels of or to completely remove tannins and trypsin-inhibitors from CTM should be designed

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CONFLICT OF INTEREST

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