Haematological and biochemical indices of broiler chicken fed graded levels of boiled African yam beans *(Sphenostylis stenocarpa)*

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Abstract

This study was carried out to investigate the haematological and biochemical indices of broiler chicken fed graded levels of boiled African yam beans. The birds, 120 in number were allotted into four treatment groups having three replicate per treatment and 10 birds per replicate in a completely randomized design were used. Diet 1 was the control and corn-soy bean-based while diets 2, 3, and 4 had boiled African am beans at 10, 15 and 20% respectively. Blood samples were collected from eight weeks old broiler chicken into two sets of labeled sterile bottles and used for the analysis. The values observed for white blood cells (2.43, 2.71, 2.72. 2.76), packed cell volume (31.00, 31.04, 28.00, 27.00) and mean corpuscular haemoglobin (32.83, 32.70, 29.60, 33.93%) for diets 1, 2, 3 and 4 respectively fell within the normal range reported for healthy broiler chicken while the red blood cells for diets 1, 2, and 3 are comparable. Blood of birds in Diets 2, 3 and 4 had similar values of alkaline phosphatase which were higher than those of diet 1. Those in diets3 and 4 had highest values of urea (30.00mg/dl), creatinine (0.413mg/dl) and lowest values of albumen (1.500d/L). Feeding boiled African yam bean above 10% level of inclusion resulted in increase in alkaline phosphatase, urea and creatinine. For optimal productivity 10% inclusion of boiled African yam beans is therefore recommended.

Keywords: African yam beans, broiler, dietary levels, boiled

Introduction

Soybean and groundnut, the conventional plant protein sources in poultry feeding, have become so costly and occasionally scarce. African yam bean (AYB) is a less exploited crop, cheap and available in lowland tropical conditions with climates ranging from savannah to rain forest (Rachie, 1972). Yield of AYB could be as high as 8.67tonnes per ha as compared with soya bean and groundnut. The crude protein content of AYB ranges from 21.1 and22.5 while the amino acid profile is similar to that of soybeans (Ene-obong, 1992). But the potential of AYB as plant protein source in livestock feeds is yet to be fully known and exploited in poultry nutrition. The effect of AYB on hematological and biochemical indices in broiler chicken is also not known.

A readily available and fast means of assessing clinical and nutritional health status of animal on feeding trial may be the use of blood analysis; the reason being that ingestion of dietary components has measurable effect on blood composition (Church *et al.,* 1984; Maxwell *et al.*1990) and may be considered as appropriate measure of long term nutritional status. Oke *et al.* (1996) also submitted that whatever affects the blood either drugs, pathogenic organs or nutrition will certainly affect the entire body adversely or moderately in terms of health growth, maintenance and reproduction.

According to Togun and Oseni (2005), haematological indices, red blood cells, white blood cells, packed cell volume and

haemoglobin have been found useful for disease prognosis and for therapeutic and feed stress monitoring. Abnormally high mean corpuscular haemoglobin, mean corpuscular volume and mean corpuscular haemoglobin concentration suggest poor quantity protein of the test diets (Awoniyi *et al.,* 2000). The use of biochemical indices as a pointer to conditions that may not be readily noticed by performance indices cannot be over emphasized. Plane of nutrition is known to affect these values (Agunbiade *et al.,* 2007). Urea is known to be a function of protein quality (Ranjan, 2001). He further explained that in a diet that is deficient in essential amino acid, the amino acid present will be de-aminated and hence result in an increase in the excretion of urea and molecular wastage (Eggum, 1990). High values of creatinine and urea suggests kidney disease and renal failure due to damage to the glomerulus and hence poor glomerular filtration and excretion. Aletor *et al*. (1998) reported low values of creatinine and urea implies better protein quality of test diets. The higher the values of albumin, the higher the clotting ability of the blood and hence prevention of haemorrhage (Roberts *et al*., 2003). Awojobi and Opiah (2000) observed that the higher the level of globulin, the greater the ability to fight infection, because globulin is known to fight infection (Aletor *et al*., 1998). He noted that low level of globulin could lead to high mortality. High values of serum total protein and alkaline phosphatase are indicators of poor quality protein of test stuff (Aletor *et al*., 1998**).** The objective of this study was to determine the suitability of boiled African yam beans as poultry feed resource and the optimal level of inclusion of boiled AYB through biological and haematological indices

Materials and methods

Period and location of experiment

The experiment was conducted at the Poultry Unit of the Research and Training Farm of the Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria. Umudike is located on latitude 5° 29Δand longitude 7° 32ΔEast in the rain forest of zone of Nigeria. The environmental temperature of the region is characterized by a daily range of 27 and 35°C throughout the year and an average rainfall of 250mm per annum. The experiment was conducted between August and November 2007.

Procurement and processing of African Yam Beans

African yam bean was purchased from Umuosu market in Isiala Ngwa Local Government Area of Abia State of Nigeria. Raw AYB was poured into pot of boiling water and allowed to boil at 100°C for 30min, after which the water was drained off and the AYB was sun dried, ground to fine (100µ mesh screen) powder and stored in air tight containers in room temperature until required.

Experimental birds and management

A total of one hundred and twenty unsexed broilers of the Anak strain were purchased from Zion Farms Nigeria Limited, Owerri, Imo State, Nigeria. Average initial weights of the chicks were taken. Thirty, 14 day old chicks were randomly allotted to each of the 4 dietary treatments. Each treatment was replicated 3 times with 10 birds per replicate in deep litter pens of fresh wood shavings. Each diet was offered to birds from 14 – 56 days (i.e. 6 weeks) *ad-libitum* throughout the duration of the study.

Experimental diets

Experimental diets of birds fed graded levels of boiled AYB are shown in Table 1. Maize was the major source of energy while

soybean meal and AYB meal were the major sources of protein. The diets were fortified with synthetic amino acids such as lysine and methionine. The feed was presented in mash form. Diet 1was soybean based (control) while the boiled AYB meal was added to diets 2, 3 and, 4 at 10, 15 and 20% respectively.

Table 1: Composition of experimental diets containing graded dietary levels of boiled African Yam Beans fed to broilers from 2-8 weeks

Ingredient	Level of inclusion 0%(D1)	Boiled AYB 10%(D2)	15%(D3)	20%(D4)
Maize	51.3	45.30	42.00	38.80
Soybean	28.00	24.00	22.30	20.50
AYB	-	10.00	15.00	20.00
Blood meal	2.00	2.00	2.00	2.00
Oyster shell	2.00	2.00	2.00	2.00
Vit. Premix*	0.25	0.25	0.25	0.25
Table salt (NaCl)	0.25	0.25	0.25	0.25
DL Methionine	0.01	0.01	0.01	0.01
Lysine	0.01	0.01	0.01	0.01
PKC	10.00	10.00	10.00	10.00
Fish meal	3.00	3.00	3.00	3.00
Bone meal	3.00	3.00	3.00	3.00
Total	100.00	100.00	100.00	100.00
Calculated composition				
Crude protein(%)	22.21	22,03	22.03	22.00
Metabolisable energy(KJg-1)	12.04	12.01	11.98	11.96

*AYB-African Yam Bean, PKC - Palm kernel cake. Each 2.5kg of premix contains vitamin A (8,500,000.00iu), Vitamin D_3 (1,500,000.00iu) Vitamin E (10,000.00mg), Vitamin K_3 (1,500.00mg), Vitamin B_1 (1,600.00mg), Vit. B_2 (4,000.00mg), Niacin (20,000.00mg), pantothenic acid (5,000mg), Vit. B_6 (1,500.00mg), Vit. B12 (10.00mg), Folic acid (500.00mg), Biotin (750.00mg), Zinc (30,000.00mg), Selenium (200.00mg), Manganese (40,000.00), Iron (20,000.00mg), Iodin e (1000.00mg), Copper (3,000.00mg), Cobalt (200.00mg), Chlorine Chloride (175,000.00mg). AYB =A frican yam beans; PKC = Palm kernel cake; CP = crude protein; ME =Metabolisable Energy

Blood collection and analysis

Blood samples were collected from two birds per replicate The samples were collected through the wing veins. The samples were collected into two sets of labeled sterile bottles. One set contained anti-coagulant (Ethylene-diaminetetra acetic acid) while the other set did not. The set of bottles containing anti-coagulant were used to determine the haematological indices:red blood cells (RBC), white blood cells (WBC), haemoglobin (Hb) and packed cell volume (PCV). The blood was analyzed according to the procedure of Dacie and Lewis (1991). The set of bottles without anti-coagulant were used to determine the biochemical indices such as urea, total protein, albumin, serum alkaline phosphatase and serum creatinine.

Statistical analysis

The experimental design used was completely randomized design.

Data collected were subjected to Analysis of Variance (ANOVA) described by Steel and Torrie (1980), and mean separation was carried out using Duncan's Multiple Range Test (Duncan, 1955).

Results and Discussion

Haematological indices of 8-week old broiler chicken fed graded levels of boiled AYB are presented in Table 2. There were

significant (P<0.05) differences in all the parameters except for the WBC, PCV and MCH. The values obtained for these parameters fell within the range established by Mitruka and Rawnsley (1977). The values of RBC obtained for birds fed diets 1, 2 and 3 were similar (P> 0.05) and significantly higher than that obtained for birds on diet 4 (P < 0.05). This showed that the birds fed diets 1, 2 and 3 may not be proned to anaemia. High concentration of RBC and haemoglobin (Hb) showed the absence of toxic factors such as haemoglutinin which has adverse effect on blood formation (Akinmutimi, 2004). The values obtained for MCHC decreased as the values of boiled AYB increased in the diets. Only the MCHC of diet 1 fellwithin the normal range established for broiler chicken by Mitruka and Rawnsley (1977). This could be due to poor ratio of haemoglobin to packed cell volume since both haemoglobin and PCV fell within normal range (Ross *et al.,* 1978). The values obtained across treatments for MCV fell within the normal range reported by Mitruka and Rawnsley, (1977).

Table 2 : Haematological Indices of 8 - week old broiler chicken fed graded levels of boiled African Yam Beans

	Level of inclusion of boiled AYB%				
Parameters	0%	10%	15%	20%	SEM
WBC x ($10^6cm^{-3)}$)	2.43	2.71	2.72	2.76	0.23
RBC x ($10^6/cm^3$)	3.10^a	2.63^{ab}	2.50^{ab}	2.02^b	0.202
PCV (%)	31.00	31.04	28.00	27.00	1.17
Hb (g/100ml)	12.00^a	8.63^b	7.40^{bc}	6.45^c	0.63
MCH (%)	32.83	32.70	29.60	33.93	1.93
MCHC (%)	38.54^a	27.71^b	26.45^{bc}	23.86^c	0.927
MCV (%)	100.32^c	117.82^b	112.80^b	133.66^a	3.79

Means within the same row with different superscripts (a - c) are significantly (P < 0.05) different. SEM – Standard Error of AYB - ……Mean. WBC - White Blood Cells; RBC – Red Blood Cell; PCV – Packed Cell Volume; Hb – Haemoglobin; MCH – Mean Corpuscular Haemoglobin; MCHC – Mean Corpuscular Haemoglobin Concentration; MCV – Mean Corpuscular Volume.

There were significant (P< 0.05) differences among the treatment means for all the parameters considered for biochemical indices as seen in Table 3. Birds fed diets 2, 3 and 4 had similar values of alkaline phosphatase (P<0.05). These values were significantly (P < 0.05) higher than that of D1. The albumin values decreased as the quantity of boiled AYB increased in the diets. The total protein for diet 1 (5.00g per l), 2 (4.35g per l) and 3 (4.20g per l) were similar (p > 0.05) and significantly higher than what was obtained for birds on diet 4. The blood of birds on diets 3 and 4 had the highest value for urea (30.00mg per dl each) followed by those on diet 2 (26.00mg per dl) and diet 1 (19.00mg per dl). The urea values were significantly different from each other (P<0.05). Birds on diets 3 and 4 also had the highest creatinine values (0.413mg per dl and 0.400mg per dl) respectively. The value of creatinine for diet 1 (0.300) and diet 2 (0.333) are statistically the same (p > 0.05). The high values of alkaline phosphatase, urea and creatinine observed for diets 3 and 4 was a reflection of the poor protein quality of the test diet (Aletor *et al.,* 1998). High urea values observed for diets 3 and 4 suggests poor metabolism of protein while high values of creatinine made the birds to be prone to muscular wastage (Eggum 1970; Aletor *et al*., 1998).

Table 3: Biochemical indices of 8 weeks old broiler chicken fed graded levels of boiled African Yam Beans

	Level of inclusion of boiled African yam beans (%)				
Parameter	0 (D1)	10 (D2)	15(D3)	20(D4)	SEM
Alkaline Phosphatase µ/l	110.00^{b}	142.00^{a}	144.00^{a}	147.00^{a}	3.240
Albumin (g/l)	2.12^{a}	1.80^{b}	1.700b^{c}	1.500^{c}	0.082
Total protein (g/l)	5.00^{a}	4.35^{ab}	4.2^{ab}	4.0^{b}	0.239
Urea (mg/dl)	19.00^{c}	26.00^{b}	30.00^{a}	30.00^{a}	0.707
Creatinine (mg/dl)	0.300^{b}	0.333^{b}	0.413^{a}	0.400^{a}	0.018

Means within the same row with different superscripts (a - c) are significantly ($P < 0.05$) different. SEM – Standard Error of Mean.

Conclusion

It could be concluded from the result that boiled African Yam Beans(AYB) is a potential feed resource and inclusion of boiled AYB UP TO 10% in the diet of broiler chicken has no debilitating effect on their biochemical and haematological indices.

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