EFFECTS OF FEEDING PROCESSED BAOBAB (*Adansonia digitata*) SEED ON THE HEAMATOLOGY AND SERUM BIOCHEMISTRY OF BROILER CHICKS

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ABSTRACT

This study was conducted to determine the effects of feeding graded levels of processed baobab seed meal (Decorticated Un-defatted Roasted Baobab Seed meal, DURBSM) on one hundred and seventy six (176) Arbor Acre broiler chicks. They were fed at 0.0, 2.5, 5.0 and 7.5% inclusion level for 30 days. The data obtained were analyzed using one way Analysis of Variance in a Completely Randomized Design. Results showed significant differences (P<0.05) in haematology and serum biochemistry values of blood samples across the dietary treatments. Significant (P<0.05) variation existed in PCV (25.50-37.25), WBC (7.33 - 9.13), Hb (7.83– 9.60), Monocyte (0-1.75) and MCHC (25.98 - 31.00) values across the dietary treatments. RBC, Neutrophils, Lymphocytes, Eosinophils, Basophils, MCV and MCH were not significantly different (P>0.05). The biochemical indices showed significant differences (P<0.05) in all parameters measured except in Albumin-globulin ratio and Triglycerides where similar results were obtained. In this study, a normal range of values for all haematology and serum biochemical indices of the broiler chicks fed DURBSM was obtained at 2.5% and this is an indication that broiler chicks can tolerate 2.5% DURBSM without any negative effect on their health.

Key words: Baobab seed, Broiler chicks, Haematology, Serum Biochemistry

INTRODUCTION

Malnutrition has been known to be prevalent in the under-developed countries. Majority of malnourished people live in Asia and Africa and this is having a negative impact on their physical and health condition. The problem of malnourishment can be solved through adequate animal protein intake because it is a protein source that is well tolerated and assimilated. Ali-Balogun *et al*. (2003) stated that poor animal protein intake by man has been associated with dwindling livestock productivity. It is interesting to note that poultry production was identified as major means of solving problems that arise from malnutrition through provision of animal protein that are beneficial to humans within a short period (Nworgu, 2004). However, appropriate feeding presents a great challenge to poultry farmers in Nigeria and other tropical countries because of the high cost of feed ingredients that normally arise from competition between man and animal for conventional feed ingredients.

Poultry farmers in Nigeria are used to utilization of conventional feed ingredients in producing their feeds. Unfortunately, these feed ingredients have become scarce, oftentimes unavailable and very expensive. Apart from the major conventional plant protein sources (Soybean meal and groundnut cake), others like pigeon pea seed meal, cottonseed meal, cashew nut meal, sunflower seed meal and lima bean meal are not usually available and not within the reach of farmer (Mba *et al*., 1974; Odunsi *et al.,* 2002; Amaefule and Obioha, 2003). As part of research effort to search for alternative feed ingredients, Baobab and its products have been investigated (Shukla *et al.,* 2001; Sola-Ojo *et al.,* 2011; Oladunjoye *et al*., 2014b; Adamu *et al.,* 2015). Baobab seed contains 37.63% crude protein, 22.50% ether extract, 3.50% calcium, 46.11% magnesium and 45.38% potassium. Despite its high protein content, the presence of some anti-nutrition agents has limited its use in poultry especially when fed unprocessed as reported for layers chickens. Meanwhile, the author recommended that Baobab seed should be subjected to various forms of processing that can eliminate or reduce the anti-nutritional factors before feeding it to poultry. Even when baobab seed is processed, its effects on performance and state of health of animals must be duly investigated before recommending it to farmers. The effect of such diet will reflect in their body system and can be scientifically investigated by studying the physiological and pathological state of the animal through observation of blood and its components. Thus, the need to know the implication of feeding processed Baobab seed (Decorticated Undefatted Roasted Baobab Seed Meal, DURBSM) on blood parameters (haematology and serology indices) of young broiler is necessary. This study was therefore designed to investigate the effects of feeding processed Baobab seed meal on the haematology and serum biochemistry of broiler chicks.

MATERIALS AND METHODS

One hundred and seventy six (176) day old Arbor Acre broiler chicks were obtained from Yammfy Farm Ilemona, Kwara State. The chicks were weighed and randomly allotted to four treatment groups in a metabolic battery cage. Each group was replicated four times with eleven chicks per replicate. The treatments consisted of four graded levels of DURBSM (0.0, 2.5, 5.0 and 7.5%) incorporated into a basal diet formulated to meet the nutrient requirement of broiler chicks (NRC, 1994) as shown in Table 1.0 and the nutrient in the diet was analyzed using the procedure of AOAC (1990). Routine management and vaccination programme necessary for broiler were duly followed. Feed and water were given *ad libitum* for the 30-day feeding trial. At the end of the feeding trials, sixteen chicks were selected randomly (four chicks per treatment) and blood samples were collected from each through the ventral part wing using a 5 ml syringe. 3 ml and 2 ml of the collected blood was poured into a sterile bottle containing Ethylene Diethyl Tetra Acetic acid EDTA bottle for determination of haematological parameter and a sterile plain bottle for serological indices respectively. The haematological indices were determined with the use of Wintrobes hematocrit, improved Neubauer haemocytometer as described by Dacie and Lewis (1991), MCV, MCH and MCHC were determined according to the method of Jain (1986), blood glucose was determined using Hexokinase method, total protein and albumin were determined by Biuret and Bromocresol Green method, respectively (Kohn and Allen, 1995; Peter *et al.* 1982). The creatinine and other liver enzymes were determined using the standard enzymatic method described by Bush (1991), serum cholesterol was determined by Burccad reactions. Blood parameters data determined were subjected to the analysis of variance using the Completely Randomized Design (CRD) according to Steel and Torrie (1980). Differences between treatment means were separated using Duncan's Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Haematological Indices of Broiler Chicks Fed Processed Baobab Seed.

The haematological indices of the broiler chicks fed graded levels of DURBSM are presented in Table 2.0. There was a significant ($P<0.05$) difference in Packed Cell Volume (PCV) among the dietary treatments with broiler chicks fed 5% DURBSM having the highest value (37.25) and this cut across other haematological parameters investigated. The PCV values obtained were within the range of 25-45 reported by Mitruka and Rawnsley (1977) and 30-40 reported by MVM (1986) where it was stated to be the normal range for poultry birds and indicates good health status in the broiler chicks. The PCV were also within the range reported by Oladunjoye *et al.* (2014a) when broiler chickens were fed fermented *Jatropha curcas* L. meal but were lower than 55- 88 reported for rabbit fed raw baobab pulp and seed meal by Oladunjoye *et al.* (2014b).This might be due to the nature of baobab fed and physiological status of the animal.

White Blood Cells (WBC) value obtained at 5% dietary inclusion was also the highest (9.13x109/l) and agreed with 9.56 x/l reported by MVM (1986). Broiler chicks fed 0% and 2.5% inclusion level had relatively lower and non-significantly ($P>0.05$) different WBC, while those fed 7.5% had a value that was not significantly different from that of 5%. The Red Blood Cell (RBC) showed a non-significant difference (P>0.05) among treatments. Birds given 5 and 7.5% DURBSM have their values (1.8-2.4x 1012/l) within the range reported by Mitruka and Rawnsley (1977) for poultry birds, while those fed 0 and 2.5% inclusion level had their RBC numerically lower (1.60 -1.65). The results obtained for the Haemoglobin Concentration (Hb) showed significant differences (P<0.05) among the treatments, birds fed DURBSM at 5% dietary inclusion have the highest Hb value (9.60g/dl), the lowest value was recorded for broiler chicks fed 0% DURBSM (7.83g/dl). We observed all were within normal range of Hb for poultry birds in accordance with MVM (1986) where haemoglobin value of birds were said to range from 9 to13g/dl. It also conforms to that of Ikhimoye *et al.*, (2000) where it was reported that Hb for birds ranged from 6-13g/dl and 7.06-9.37g/dl respectively. This study showed that the blood of chicks fed graded levels of DURBSM had an appreciable oxygen-carrying capacity and it is an indication that nutrient transport was not impaired by feeding varying levels of DURBSM. Higher Hb (g/dl) recorded in birds fed DURBSM shows that DURBSM increases the oxygen carrying capacity of the blood from the lungs to the tissues indicating good health status for the chicks fed DURBSM.

Neutrophils and Lymphocytes values showed no significant difference (P>0.05) in the treatment groups from this experiment and were within the normal range of 20-40% and 30-70% as reported by Okoro *et al.* (2011). The authors were of the opinion that normal Neutrophils is an indication that birds did not suffer any infection because usually Neutrophils travel in the blood to infected sites where they engulf germs or foreign bodies through phagocytosis. The differential leucocytes counts (monocyte, eosinophil and basophil) of the birds fed DURBSM at 2.5%, 5% and 7.5% inclusion levels were higher than those fed the Control. Monocyte cells are helpful in fighting severe infections and are considered as the body's second line of defense against infection, and it ranges from 0-9%. Monocyte values in this experiment were within the normal range recorded for poultry birds (MVM, 1986). It indicates good health status and shows that DURBSM inclusion did not affect the differential blood count of broilers chicks in this experiment and therefore no case of infectious disease. Eosinophils and Basophils results obtained in this study are within the range reported by Okoro *et al.* (2011) and it was reported that such diet did not affect the differential blood count of birds. Mean Corpuscular Heamoglobin (MCH) and Mean Corpuscular Volume (MCV) values were not significantly (P>0.05) different among the dietary treatments, while significant (P<0.05) differences existed among the Mean Corpuscular Haemoglobin Concentration (MCHC) values. MCH values ranged from 41.90 at 5% inclusion level to 50.00 at 0% inclusion level, while MCHC values ranged from 25.98 at 5% to 31.00 at 0% and were above the normal ranges of 25-27% and 21-23% for MCH and MCHC as reported by Ali-Balogun *et al.* (2003) when sheep were fed with cassava foliage as a protein supplement. Mean Corpuscular Volume (MCV) values were within the normal range of 84.27-163.56fl except at 2.5% inclusion level when MCV value was 177.10fl but was not significantly (P>0.05) different from others. Normal level of MCV is an indication that DURBSM did not cause any deviation away from the normal red blood cell and haemoglobin indices.

Serum Biochemical Indices of Broiler chicks fed graded level of Processed Baobab Seed

The serum biochemical indices of the broiler chicks fed graded levels of Baobab seed meal are presented in Table 3.0. There were significant (P<0.05) differences in all serum biochemical indices tested for except for Albumin-Globulin ratio and Triglycerides that showed no significant (P>0.05) differences. The serum glucose values showed significant difference (P<0.05) in the treatments and the values were within the normal range as in the control. The serum glucose reduced at 0% and 5.0% dietary inclusion of DURBSM and attained its highest level of 6.15Mmol/l at 7.5% inclusion; while chicks fed 2.5% dietary inclusion level had the lowest value of 3.00Mmol/l. The total serum protein, albumin and creatinine were significantly (P<0.05) better in chicks fed DURBSM supplemented diet compared to the control, and this is an indication that the additional protein from DURBSM did contribute positively to chicks development. Iyayi and Tewe (1998) earlier reported that quantity and quality of protein affects the total serum urea and total protein in the blood. Changes in the nutritional status of an animal are easily detected in the albumin because they are about two-thirds of total protein (Mitruka and Rawnsey, 1977). Broiler chicks fed DURBSM in this study did not have a reduced serum albumin which is usually said to be as a result of protein malnutrition owing to decreased synthesis, thus, they were not affected by any chronic diseases during the course of the experiment. The birds fed DURBSM at 5% inclusion level had the highest albumin value than all other inclusion levels. The values of total serum protein obtained increased proportionally from 24.38g/l at 0% to 33.80g/l at 5% inclusion, and reduced to 27.75g/l at 7.5%. The serum protein values obtained in this study were lower than 38.67-45.00g/l reported by Adamu *et al.* (2015) when broiler chicks were fed Baobab leaf meal and it is an indication that the normal protein metabolism in DURBSM-fed broiler chicks were not altered.

Globulin is an 'antibody' protein that is important in fighting diseases and in this study, there were significant (P<0.05) differences in the serum globulin values at all inclusion levels. This implies significant possibilities in the degree of disease resistance of the birds at all inclusion levels. In this study, the serum albumin-globulin ratios obtained (0.84 to 1.12) did not differ significantly (P>0.05) across the dietary treatments but fell below the reference range (1.4-4.9) reported by Coles (2005) and could be associated with poor antibody production as stated by Okoro *et al.* (2011). It also may be due to decrease in the production of albumin by liver thus reflecting malhepatic function (Champe, 2008; Chimvuramahwe *et al.*, 2011). There was a significant difference (P<0.05) in the creatinine level between the control and 5% inclusion level; with birds fed at 5% having the highest value while the control had the lowest value among the treatments. Serum creatinine is a measure of muscle mass, it gives the extent of depletion of tissue creatinine phosphate and is a measure of amino acid economy in vivo (Balogun and Otchere, 1995). High level of creatinine is a sign of depressed kidney and kidney function (i.e. high work rate of the liver) which could be as a result of disease or infection. 5% DURBSM inclusion recorded the highest level of both Alanine transaminase (ALT) and Aspartate transaminase (AST). ALT, AST and Alkaline phosphatase (ALP) were depressed as the level of dietary Baobab seed meal increased, indicating no toxic effect within the liver parenchyma of the birds.

The serum cholesterol values obtained in this study ranged from 2.73-4.60 and did not agree with Aderemi (2004) which suggested its values to be between 5.1-5.8 Mmol/l. The values of the serum cholesterol decreases with increase in inclusion level of DURBSM and may be as a result of feeding the birds with processed baobab seed meal and the decrease in serum cholesterol indicates an impaired lipid metabolism and transportation (Champe, 2008). The decline in the cholesterol level with increase dietary treatments in this study is in agreement with Ogbuewu *et al.* (2008). Adamu *et al.* (2015) also reported a decline in the blood cholesterol level of broiler fed graded levels of Baobab leaf meal as a replacement for Soybean meal. The results suggested that increase DURBSM caused a reduction in the triglyceride biosynthesis and favour the re-distribution of cholesterol among the lipoprotein molecules.

Therefore, it can be said that baobab seed meal supplemented in the diets of broiler exhibited anti-lipogenic and anti-cholesterogenic effects on the chicks. Uric acid had its highest value at 7.5% inclusion level of DURBSM and the blood uric level of chicks in this experiment increases with increasing levels of DURBSM which indicates a higher utilization of protein according to Cetin (2002), because uric acid is reported to be a product of protein, non-protein nitrogen and purines and high levels of uric acid can result in kidney disease (Champe, 2008), broiler chicks at 0%, 2.5% and 5.0% dietary inclusion of DURBSM conformed to the normal range of 0.35-0.75Mmol/l of uric acid as reported by MVM (1986) while broiler chicks at 7.5% inclusion level did not conform to the normal range and this shows that birds at 7.5% inclusion level are prone to disintegration of liver cells from higher concentration of DURBSM in the diet or higher work rate of the liver.

CONCLUSION

This investigation indicates that DURBSM can be incorporated into the diet of broiler chicks. However, the best level obtained in this study is 2.5% where all the haematology and serum biochemistry examined fell within the normal range of values for poultry birds, with none higher than the normal range as obtained in creatinine and uric acid level which were higher at 5 and 7.5% respectively. Better differential Leucocytes counts (monocytes and eosinophil) were also recorded at 2.5% inclusions level, indicating better immune response of the bird. Feeding broiler chicks with 2.5% DURBSM at starter phase (0-4weeks) is therefore recommended because it will have no detrimental effect on their health as reflected in the haematology and serum biochemical indices studied.

Table 1: Composition of the Experimental Broiler Starter Diet

Feed Ingredients	0% DURBSM	2.5% DURBSM	5% DURBSM	7.5% DURBSM
Maize (kg)	50.00	50.00	50.00	50.00
Maize bran (kg)	7.00	7.00	7.00	7.00
Soybean Meal(kg)	23.00	20.50	18.00	15.50
DURBSM (%)	0.00	2.50	5.00	7.50
Groundnut Cake (kg)	6.00	6.00	6.00	6.00
Fish Meal (kg)	10.00	10.00	10.00	10.00
Bone Meal (kg)	2.00	2.00	2.00	2.00
Oyster Shell (kg)	1.00	1.00	1.00	1.00
Methionine (kg)	0.25	0.25	0.25	0.25
Lysine (kg)	0.25	0.25	0.25	0.25
Vit-Min Premix (kg)	0.25	0.25	0.25	0.25
Common salt (kg)	0.25	0.25	0.25	0.25
Total	100	100	100	100
Analyzed Nutrient Content	0%	2.5%	5.0%	7.5%
Parameters				
Moisture Content	10.88	10.95	10.64	10.45
Crude Protein	22.69	23.72	23.78	23.78
Crude Fibre	8.24	7.05	7.48	7.98
Ether Extract	3.70	4.02	5.21	5.40

*DURBSM: Decorticated Undefatted Roasted Baobab Seed Meal

Composition of the vitamin-mineral premix per 1kg vitamin A= 12500IU, vitamin D3= 2500IU, vitamin E= 50.00mg, vitamin K= 32.50MG, vitamin B1= 3.00MG, vitamin B2= 6.00mg, vitamin B12= 0.25mg, Pantothenic acid= 5mg, nicotinic acid= 20mg, folic acid= 1.00mg, choline chloride= 300mg, manganese= 100mg, iron=50mg, zinc= 45mg, copper= 2.00mg, iodine= 1,55mg, cobalt= 0.25mg, selenium= 10mg.

Table 2: Hematological parameters of broiler chicks fed graded levels of Processed Baobab seed.

Parameters	0% DURBSM	2.5% DURBSM	5% DURBSM	7.5% DURBSM	±SEM
PCV (%)	25.50^{a}	28.00^{a}	37.25^{b}	30.25^{ab}	1.07*
WBC($x10^{9}$/l)	7.33^{a}	7.55^{a}	9.13^{b}	8.30^{ab}	0.20*
RBC(x 10^{12}/l)	1.65	1.60	2.35	2.03	0.11^{NS}
Hb (g/dl)	7.83^{a}	7.88^{a}	9.60^{b}	8.78^{ab}	0.20^{*}
Neutrophil (%)	31.00	29.50	29.75	36.25	0.99^{NS}
Lymphocyte(%)	68.75	66.00	68.25	62.00	1.03^{NS}
Monocyte (%)	0.00^{a}	1.75^{b}	0.75^{ab}	0.50^{ab}	0.15*
Eosinophil (%)	0.25	2.75	1.25	1.25	0.36^{NS}
Basophil (%)	0.00	0.00	0.00	0.25	0.06^{NS}
MCV (fl)	160.60	177.10	161.00	150.48	5.31^{NS}
MCH (pg)	50.00	49.88	41.90	43.98	2.04^{NS}
MCHC (%)	31.00	28.13	25.98	29.10	0.59^{*}

[a,b,c]means within the row bearing different superscripts differ significantly (p<0.05). SEM = Standard Error of the Mean, NS = Not significant (p>0.05) *= Significant (p<0.05).

Table 3: Serum Biochemical Indices of broiler chicks fed graded levels of Processed Baobab seed.

Parameters	0% DURBSM	2.5% DURBSM	5% DURBSM	7.5% DURBSM	±SEM
Glucose (Mmol/l)	5.83^{b}	3.00^{a}	3.23^{a}	6.15^{b}	0.14*
Albumin (g/l)	12.35^{a}	14.30^{b}	16.05^{c}	14.25^{b}	0.14*
Globulin (Mmol/l)	12.03^{a}	17.25^{bc}	17.75^{c}	13.50^{ab}	0.64*
Albumin Globulin ratio	1.12	0.84	0.93	1.06	0.06^{NS}
Protein (Mmol/l)	24.38^{a}	31.55^{bc}	33.80^{c}	27.75^{ab}	0.12
Creatinine (Mmol/l)	45.00^{a}	64.75^{b}	83.25^{c}	72.52^{b}	1.16*
ALT (iµ/l)	27.25^{b}	19.25^{a}	33.25^{c}	16.25^{a}	0.56*
AST (iµ/l)	26.10^{ab}	21.00^{a}	42.43^{c}	37.83^{bc}	1.80*
ALP (iµ/l)	168.25^{b}	165.75^{a}	167.00^{ab}	165.25^{a}	0.23*
Cholesterol (Mmol/l)	4.60^{b}	3.35^{a}	2.80^{a}	2.73^{a}	0.12*
Triglyceride (Mmol/l)	3.65	3.95	3.21	3.13	0.17^{NS}
HDL (Mmol/l) 2.55	2.55^{b}	2.55^{b}	1.92^{ab}	1.54^{a}	0.09*
LDL (Mmol/l)	1.33^{b}	1.15^{b}	0.53^{a}	0.66^{a}	0.05*
Uricacid (Mmol/l)	0.57^{a}	0.63^{a}	0.70^{ab}	0.82^{b}	0.02*

[a,b,c]means within the row bearing different superscripts differ significantly ($p<0.05$). SEM = Standard Error of the Mean, NS = Not significant ($p>0.05$) *= Significant ($p<0.05$).

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