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Full Length Research

Haematological and serum biochemical indices of finisher broilers fed *Spondias mombin* leaf meal

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ABSTRACT: An experiment was conducted to investigate the effect of *Spondias mombin* leaf meal on the blood indices of broiler finisher birds. *Spondias mombin* leaf meal was used to formulate four broiler finisher rations at 0.0, 5.0, 10.0 and 15.0% inclusion levels. Four groups of fifteen broiler chicks (28 days old) of Agrited breed were randomly assigned to four treatment diets in a completely randomized design and fed for 28 days. Each group was further subdivided into three replicates of five birds each. At the end of the feeding trial, blood was collected from three birds per treatment for haematological and biochemical analysis. Results showed that the haemoglobin (10.90 to 11.90 g/dl) and the red blood cells (32.6 to 36.33 $x10^{12}$/L) were significantly decreased ($P < 0.05$) at 10.0 and 15.0% dietary level compared to the control. The packed cell volume was significantly decreased ($P < 0.05$) at 15.0% dietary level compared to the control. The mean cell haemoglobin, mean cell volume, white blood cells and the eosinophils (%), did not show any treatment effect ($P > 0.05$). The biochemical indices showed that total serum protein, albumin, globulin, urea, creatinine and the enzyme-alkaline phosphatase were not affected by treatments ($P> 0.05$). Cholesterol was significantly decreased at 10.0 and 15.0% dietary levels. It was therefore concluded that, *Spondias mombin* leaf meal was not toxic to the blood of finisher broilers and therefore could be incorporated into broiler finisher ration up to 15.0% level without any deleterious effect.

Key words: Blood indices, finisher broilers, leaf meal, *Spondias mombin*.

INTRODUCTION

The need to increase the production of poultry and livestock products is becoming very urgent due to the low intake of proteins which is at 4.5 grams per caput per day as opposed to 34.4 grams per caput per day recommended by World health organization (WHO) (Anon, 1981). The major militating factor in production of poultry products is high cost of feed ingredients as reported by Okorie et al. (2016) that quality feeds are expensive because most of the constituent feed materials such as soya bean, maize, fish meal and groundnut cake are utilized not only by the animals but by humans and industries as well. This factor has resulted in high cost of production and consequently high cost of poultry products. This has also triggered research into the use of leaf meals as an alternate feed resource. It has been reported that leaves from *Alchornia cordifolia* (Udedibie and Opara, 1998) and *Azadirchta indica* (Esonu et al., 2005) could be of value in poultry diets. Plant leaves from which leaf meals are produced are relatively free and available with little cost on harvesting and processing. The feed value of any plant, if it is of good nutritional effect will drastically reduce the cost of poultry feed when incorporated and will thus make poultry protein available on the table of both the rich and the poor man. *Spondias mombin* is one of those leaf meals with a promising potential to serve as feed resource.

Spondias mombin (*Ijikara* in Ibo) is widely used in traditional medicine in Nigeria and Ibo land in particular. Every part of the plant is medicinally useful (Daniel, 1990). Offiah and Anyanwu (1989) reported that the aqueous extract of the leaf is abortifacient. Oladunmoye (2007) reported that the methanolic extract of *spondias mombin* affected the haematological parameters of rats resulting from *in vivo* antimicrobial activity on some pathogens. It has been reported that the plant has wide range of

antibacterial, antiviral and antifungal properties (Corthout et al., 1992). Ayoka et al. (2008) reported that the fruit is used in making wine and jams. It has also a blood lipid lowering activity (Igwe et al., 2008). Obidinma (2009) stated that feed consumed by an animal could be used to determine its effects on the blood indices of the animal. This could also be used to interpret the health status of the animal and the quality of their blood profile. Haematology refers to the study of the cellular elements of the blood and the use of these results in the diagnosis and monitoring of disease (Merck, 2012). The effect of a particular feedstuff on the blood profile of an animal will determine whether such a feedstuff is healthy or unhealthy for an animal to consume (Okonkwo and Esiegwu, 2017). Blood indices reflect the extent to which an animal is exposed to toxicant feedstuffs and this invariably affects the overall performance of the animal (Okonkwo and Esiegwu, 2017).

This study therefore, was aimed at investigating the effects of *Spondias mombin* leaf meal on the blood indices of finisher broilers.

MATERIALS AND METHODS

This experiment was carried out at the Poultry Unit of Teaching and Research Farm, Imo State University Owerri, which is located within the South-Eastern agro-ecological zone of Nigeria. Owerri lies between latitude $5^0$29'North and longitude $7^0$20'East. It is about 91 m above sea level with annual rainfall, temperature and humidity ranging from 1,500 to 2,200mm, 20.0 to 27.5^{0}C and 75 to 90%, respectively (Accuweather, 2015).

Procuring and processing of the experimental material

The leaves of *Spondias mombin* were harvested from the bushes in Ohaji/Egbema where it is prevalent. The leaves were air-dried under room temperature for seven (7) days and milled in a hammer mill. The sample of the leaf meal was subjected to proximate analysis according to (AOAC, 2010). The proximate composition analysis result is shown in Table 1.

Experimental diets

The *Spondias mombin* leaf meal was used to formulate four broiler finisher rations designated as T1, T2, T3 and T4 containing 0, 5, 10 and 15% *Spondias mombin* leaf meal, respectively, to replace maize in the diet. The diets were isonitrogenous and isocaloric which contained 16% CP (crude protein) and 2800 kcal/kg ME. The ingredient composition and calculated nutrient composition of the experimental diets are presented in Table 2.

Experimental birds and design

Sixty (60) 4-weeks (28) days) old finisher broilers (Agrited) were randomly divided into four groups of fifteen birds and each group randomly assigned to one of the four treatments diets in a completely randomized design (CRD). Each group was further replicated three times with five (5) birds per replicate and placed in a deep litter compartment measuring 1.5 m by 1.5 m. Water was provided *ad libitum.* The trial lasted for four weeks (28 days).

Table 1. Proximate composition of*Spondias mombin* leaf meal.

Components	Amount (% DM)
Moisture	10.71
Crude protein	26.20
Ether extracts	8.97
Crude fibre	17.98
Ash	7.89
Nitrogen free extract	28.25
Metabolizable energy (Kcal/kg)	2706.02

Haematology and blood biochemistry

On the last day of the feeding trial, three broilers per treatment were randomly selected to determine the haematological and serum biochemical indices of the broilers. Blood samples (5 mls of blood) were collected from the wing vein of the birds using syringe and needle and placed in the specimen bottles with EDTA (Ethylene Diamine Tetra Acetate) for haematological studies. Blood was analysed within three hours of collection for haemoglobin (HB), packed cell volume (PCV), red blood cell (RBC), mean cell volume (MCV), mean cell haemoglobin (MCH), and white blood cell (WBC) as outlined by Ochei and Kolhatkar (2000). Blood samples placed in the specimen bottles without EDTA were used to analyse the serum biochemical parameters such as urea, total protein, creatinine, cholesterol and alkaline phosphatase as outlined by Ochie and Kolhatkar (2000).

Statistical Analysis

Data collected were subjected to analysis of variance using the SPSS software (2012). Significant means were separated with the use of Duncan's Multiple Range Test Procedure of the same statistical package.

RESULTS AND DISCUSSION

The results of the haematological and serum biochemical indices of finisher broilers fed *Spondias mombin* leaf meal are shown in Tables 3 and 4.

The haemoglobin, packed cell volume, red blood cell and heterophils showed significant differences ($P < 0.05$)

Table 2. Ingredients and calculated nutrient composition of the experimental diets.

Ingredients	T1 (0%)	T2 (5%)	T3 (10%)	T4 (15%)
Maize	56.00	51.00	46.00	41.00
Spondias mombin leaf meal	0	5	10	15
Fish meal	2.00	2.00	2.00	2.00
Soyabean meal	13.00	13.00	13.00	13.00
Groundnut cake	8.00	8.00	8.00	8.00
Palm kernel cake	10.00	10.00	10.00	10.00
Wheat offal	6.00	6.00	6.00	6.00
Bone meal	4.00	4.00	4.00	4.00
Salt	0.25	0.25	0.25	0.25
Trace-mineral/vitamin premix*	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
L-lysine	0.25	0.25	0.25	0.25
Calculated nutrient composition (% DM)				
Crude protein (Cp)	19.56	20.43	20.88	21.14
Metabolizable energy (Kcal/kg)	2844.82	2808.52	2772.22	2735.92
Crude fibre (Cf)	4.20	4.97	5.73	6.5
Calcium (Ca)	1.60	1.60	1.60	1.6
Phosphorous (P)	1.14	1.13	1.11	1.1
Lysine	1.19	1.18	1.17	1.16
Methionine	0.6	0.59	0.58	0.58

**Provided the following per kg of feed; vitamin A, 1000iu; vitamin D3, 1500iu; vitamin E, 51mg; vitamin K, 2mg; Riboflavin, 3mg; Pantothenic acid, 10mg; Nicotinic acid, 25mg; Choline, 350mg; Folic acid, 1mg; Mg, 56mg; Iodine, 1mg; Fe, 20mg; Zn, 50mg; Co, 1.25mg.

Table 3. Haematological indices of finisher broilers fed *Spondias mombin* leaf meal.

Parameters	T1 (0%)	T2 (5.0%)	T3 (10.0%)	T4 15.0%	SEM
Haemoglobin (g/dl)	11.90^{a}	11.60^{ab}	11.30^{bc}	10.90^{c}	0.13
Packed cell volume (%)	36.33^{a}	36.00^{a}	34.33^{ab}	32.66^{b}	0.56
Red blood cell ($x10^{12}$/L)	12.00^{a}	11.60^{ab}	11.26^{b}	10.83^{c}	0.14
Mean cell volume (fl)	130.30	131.03	130.30	132.10	0.37
Mean cell haemoglobin (Pg)	19.80	20.00	20.06	20.13	0.07
White blood cell ($x10^{9}$/L)	11.23	11.16	10.93	10.70	0.09
Heterophils (%)	53.33^{ab}	50.66^{b}	53.00^{ab}	54.33^{a}	0.53
Eosinophils (%)	1.33	1.66	2.00	1.33	1.48

^{abc}Means within the same row with different superscripts are significantly different ($P < 0.05$).

Table 4. Serum biochemical indices of finisher broilers fed *Spondias mombim* leaf meal.

Parameters	T1 (0%)	T2 (5.0%)	T3 (10.0%)	T4 (15.0%)	SEM
Serum protein (g/dl)	5.77	5.60	5.67	5.67	0.60
Albumin (g/dl)	2.33	2.20	2.13	2.07	0.62
Globulin (g/dl)	3.43	3.40	3.53	3.60	0.83
Urea (Mmol/l)	8.33	8.20	8.36	8.16	0.04
Creatinine (Mmol/l)	21.33	22.66	21.33	20.33	0.39
Cholesterol (Mmol/l)	9.26^{a}	9.23^{a}	8.73^{b}	8.60^{b}	0.09
Alkaline phosphatase (µ/l)	1.36	1.23	1.16	1.23	0.04

^{ab}Means within the same row with different superscripts are significantly different ($P < 0.05$).

among treatments. The haemoglobin count ranged from 10.90 to 11.90 g/dl and at 10% and 15% dietary levels of *Spondias mombin* leaf meal were significantly decreased ($P < 0.05$) compared to the control. The values of the haemoglobin were within the normal reference ranges (7.0 to 13.0 g/dl) (Banerjee, 2013). This suggests that there was adequate proteins and iron for haemoglobin synthesis and subsequent oxygen transport to the tissues. Iron is a very important component of haemoglobin. Adequacy of iron will produce a normal concentration of serum haemoglobin. The values obtained were higher than 7.40 to 8.27 g/dl reported by Onimisi et al. (2016) for broiler chickens tested on four commercial sources of synthetic lysine but similar to 9.65 to 11.65 g/dl reported by Emenalom et al. (2009) for finisher broilers fed *Mucuna pruriens* leaf meal. The packed cell volumes were 36.33, 36.00, 34.33 and 32.66% for 0.0, 5.0, 10.0 and 15.0% dietary levels respectively. At 15.0% dietary level, the packed cell volume was significantly decreased ($P < 0.05$) compared to the control. The values obtained from this study were higher than the value 14.0 to 19.0% reported by Ukpabi et al. (2015) when raw *Adenanthera pavonina* seed meal was fed to finisher broilers and within the normal range (35.9 to 41.0%) (Merck, 2012; Wikivet, 2013). Esonu et al. (2001) reported that reduction in the concentration of packed cell volume in the blood usually suggests the presence of a toxic factor with adverse effect on blood formation. The value for the packed cell volume observed in this work indicated absence of toxicity and a healthy state of the animal and good blood formation. Red blood cell count ranged from 10.83 to 12.00 x 10^{12}/L decreasing significantly ($P < 0.05$) as the inclusion level of *Spondias mombin* leaf meal increased. The values were higher than the values (2.41 to 3.14 x10^{12}/L) reported by Ashom et al. (2016) for finisher broiler chickens fed diets containing unprocessed and variously processed Roselle seeds and within the normal range (7 to 112 µm) reported by Banerjee (2013) indicating that the birds were not anaemic. There was no significant treatment effect ($P > 0.05$) on the mean cell volume and mean cell haemoglobin which was an indication of a physiological normalcy of cells of the red blood cell. Mean cell volume fall within the normal reference range (90 to 140 Pg) (Banerjee, 2013). The white blood cells and the eosinophils showed no treatment effect ($P > 0.05$). The primary function of eosinophil is detoxification of foreign proteins or toxins produced by bacteria and parasites (Banerjee, 2013). This may suggest that there was no toxicity of the blood arising from the feed. The mean cell volume was within the normal range (Banerjee, 2013). The heterophil was not statistically increased compared to the control.

Biochemical indices showed no treatment effect for total serum protein, albumin, globulin, urea, creatinine and alkaline phosphatase. Cholesterol significantly decreased ($P < 0.05$) at 10 and 15% dietary levels. This implies that the leaf meal may have a hypocholesteroaemic effect on the blood of the broilers at these levels of inclusion, that is, a cholesterol lowering effect on the blood. Serum protein has been reported as a pointer to strong amino acid metabolism (Shukla and Pachaurri, 1995). Decreased serum protein concentration is an indication of alteration of normal metabolism due to interference of protein utilization (Bolu and Balogun, 2009). The study therefore, suggests an effective protein metabolism and utilization. It also implies that the dietary proteins were of good quality (Shalm et al, 1975). The non-significant effect ($P > 0.05$) of the serum albumin is a pointer to good health and normal serum protein availability. Serum albumin is a strong predictor of health, and a low albumin concentration is a sign of poor health (Kostow, 2009). Serum albumin will increase when protein intake exceeds the amount required for growing and maintenance compared to the control (Ogunbode et al., 2016). The non-significant treatment effect ($P > 0.05$) on the serum globulin was a sign of good health, intact immune state and normal physiological functioning of the internal organs. Sanchez-Monge et al. (2004) reported increased globulins to be implicated in liver damage, chronic infections and kidney dysfunction whereas Akinmutimi (2004) reported that low levels of globulin affect the animal's ability to fight disease. Urea is a good indicator of protein quality. The non-treatment effect ($P > 0.05$) of the urea compared to the control was a sign of good protein quality. Nworgu et al. (2007) reported that an increase in the urea quantity was an indication of a reduction in the protein quality of the blood. The higher the urea quantity, the lower the protein quality (Esiegwu, 2017). The non-significant difference of the creatinine across treatments was an indication of no muscle wastage. High blood creatinine implies muscle wastage which means that the animal was surviving at the expense of body reserves which also result in weight loss (Ross et al., 1978). The values obtained from this study were higher than 0.40 to 0.50 mg/dl reported by Ukpabi et al. (2015) for finisher broilers fed different levels of raw *Adenanthera pavonina* seed meal. Similarly, Ogunbode et al. (2016) reported that increase in blood creatinine could also be as a result of excess breakdown of blood proteins. Cholesterol was decreased significantly ($P < 0.05$) at 10 and 15% dietary levels. The low serum cholesterol observed suggests that *Spondias mombin* has anti-cholesterol action. Bush (1991) reported that low levels of cholesterol was an indication of fat malabsorption in the body and in the blood. Serum enzyme activities are used for checking toxicity as well as monitoring protein quality (Ukpabi et al., 2015). Alkaline phosphatase was statistically similar in all the treatments. The study suggests that there was no toxicity of any of the organs arising from the use of the *Spondias mombin* leaf meal at the various levels applied.

Conclusion and recommendation

The result of the trial showed that *Spondias mombin* leaf meal had no deleterious effect on the haematological and

serum biochemical indices of finisher broilers up to 15% dietary level. It was therefore, concluded that 15% dietary level of inclusion is safe for finisher broilers.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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