

HAEMATOLOGY AND SERUM BIOCHEMISTRY OF BROILER CHICKENS FED SOAKED *Balanites aegyptiaca* FRUIT MEAL BASED DIETS WITH ACIDIFIER SUPPLEMENTATION

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ABSTRACT

An experiment was conducted to determine the haematology and serum biochemistry of broiler chickens fed soaked *Balanites aegyptiaca* fruit meal (BAFM) based diets supplemented with acidifier (Fysal®). A total of one hundred and eight (108) day old Cobb-500 chicks were allocated to four isocaloric and isonitrogenous dietary treatments, each having three replicates of nine chickens. Raw BAFM was processed by soaking in water for 24 hours with 8 hourly change of the water. It was dried and ground before incorporation in the diets. The diets contained 0.0, 2.5, 5.0 and 7.5 % levels of BAFM while 0.1% organic acids was supplemented in the diets for treatments 2 to 4. Haematology and serum biochemistry were determined at the end of the finisher phase. Haematology and serum biochemistry of chickens in all treatment groups were within the normal range for healthy chickens. Hence, the study concluded that BAFM is healthy for broiler chickens as it did not show negative effects on the blood parameters.

Keywords: *Balanites aegyptiaca*, Acidifier, Broiler, Supplementation, Feed

Introduction

One of the primary limitations to large scale commercial poultry production around the world is the cost of feeding, accounting for over 60% of the entire production process (Sogbesan *et al.*, 2005). Consequently, this has necessitated the need to look for alternative protein sources for poultry nutrition in order to reduce cost of production (Ugwumba and Ugwumba, 2003). Blood plays a vital role in determining the physiological, nutritional and pathological status of farm animals (Muhammad *et al.*, 2000). The use of blood examination as a way to assess the health status of animals could provide information on the nutritional value of diets consumed. Thus, haematological and biochemical indices are index and reflection of the effects of dietary treatment on animals as reported by Muhammad *et al.* (2000). Since haematology and serum biochemistry play significant roles in determining health status of an animal on a given diet, it is imperative to also evaluate both parameters in this study.

Experimental Site

The experiment was carried out at the Teaching and Research farm, in the Poultry Unit, of the Department of Animal Technology, Federal College of Forestry, Jos-Plateau State. The farm is located on latitude 9° 56'49.0" N and longitude 8° 53'34.1" E, at an altitude of 1250m above sea level. The temperature of the area ranges between 21-25°C depending on the season. The wet period in Jos is between April and November with annual rainfall between 1200 – 1500mm (FCF, 2019).

Source of *Balanites aegyptiaca* Fruits and Organic Acid (FYSAL®)

Raw *Balanites aegyptiaca* fruits were bought from Yandoya market in Jos metropolis, Plateau State. The organic acid was sourced from commercial feed milling outlets in Zaria, Kaduna state. FYSAL® contains a blend of acidifiers viz; sorbic, lactic, propionic, ascorbic and citric acids.

Source of Broiler Chicks

One hundred and eight (108) day old broiler chicks of Cobb-500 strain were sourced from Zartech hatchery located in Ibadan, Oyo State, Southwestern Nigeria.

Processing of *Balanites aegyptiaca* Fruits

Raw *Balanites aegyptiaca* fruits were processed by soaking for a duration of 24 hours within which the water was drained and refilled 8 hourly.

Experimental Design and Management of Chickens

One hundred and eight (108) day old broiler chicks of Cobb-500 strain were used for the experiment. The chicks were weighed to obtain their initial weights and randomly allotted to four dietary treatments each replicated thrice with nine (9) chickens per replicate in a completely randomized design (CRD). The chickens were raised on deep litter with feed and water provided *ad libitum*.

Parameters measured were: initial weight, final weight, weight gain and feed intake. Feed conversion ratio, and feed cost per kilogram gain were calculated and mortality was recorded as it occurred.

Experimental Diets

Four finisher diets were formulated to contain 0.0, 2.5, 5.0 and 7.5% inclusion levels of soaked *Balanites aegyptiaca* fruit meal (BAFM) in (T₁), T₂, T₃ and T₄ respectively. Organic acid (FYSAL[®]) was supplemented at 1g/ton in diets for treatments two to four (T₂, T₃, T₄). The compositions of the experimental diets are presented in Table 1.

Laboratory Analyses

Serum biochemistry was determined according to procedures described by Bahman *et al.* (2011). Similarly, haematological parameters were determined according to procedures by Ritchie *et al.* (1994) at the Biochemistry Laboratory, National Veterinary Research Institute, Vom, Plateau State. Proximate composition and anti-nutritional factors in the test ingredient were determined in our previous study.

Data Analyses

Data obtained from the experiment was subjected to analysis of variance using the general linear model procedure of SAS (2001). Significant differences among treatment means was also separated using Duncan's Multiple Range Test, Duncan (1955).

Results and Discussion

Haematological Parameters of Broiler Chickens Fed Soaked *Balanites aegyptiaca* Fruit Meal Based Diets with Supplementation of Acidifier (Fysal[®])

The haematological parameters of broiler chickens fed diets containing differently processed *Balanites aegyptiaca* fruit meal is presented in Table 2. No significant ($P>0.05$) difference was observed in all haematological parameters except monocytes. Red blood cell, packed cell volume and haemoglobin concentration were not significantly ($P>0.05$) different among treatment groups but were within the range for clinically healthy chickens as reported by Abeke (2008). This is an indication that the diets support erythropoiesis and the chickens were not anaemic. This also suggests that the processing method used was adequate for detoxification of *Balanites aegyptiaca* fruit. White blood cell count values were within the normal range of $9.3 - 31.0 (\times 10^{12/L})$ for chickens. Normal value of white blood cell count shows increase leucopoiesis which supports defence mechanism. White blood cell count below the normal range is an indication of allergic conditions, anaphylactic shock and certain parasitism, while elevated values indicate the existence of recent infection, usually with bacteria (Muhammad, *et al.*, 2000). The leucocyte differential count namely neutrophils, lymphocytes, basophils and eosinophils also did not vary significantly among treatment means. Leucocyte differential counts are used as indicators of stress response, parasitic infection, allergic infection and sensitive biomarkers crucial to immune function (Abeke, 2008).

Serum Biochemistry of Broiler Chickens Fed Soaked *Balanites aegyptiaca* Fruit Meal Based Diets with Supplementation of Acidifier (Fysal[®])

Table 3 shows the serum biochemistry of broiler chickens fed diets containing varied levels of soaked *Balanites aegyptiaca* fruit meal based diets supplemented with acidifier. There were no significant ($P>0.05$) differences in total protein, albumin, cholesterol and high density lipoprotein across all treatments. The results showed non-significant ($P>0.05$) reduction in cholesterol level up to 5.0% BAFM diet. However, total protein, albumin and cholesterol levels were within the range for healthy chickens as reported by Eggum (1989). The normal ranges observed in cholesterol and total protein across the treatment groups implied adequate protein and energy metabolism. Triglycerides and low density lipoprotein, "bad cholesterol", were lower among chickens fed BAFM based diets with acidifier supplementation. This may be significant on consumers' view point as high triglycerides and low density lipoprotein levels could increase the risk of developing atherosclerotic plaques around the soft organs in the body.

Conclusion:

The study showed that processed (soaking for 24 hours) BAFM could be utilized in broiler diet up to 7.5 % without showing negative effects on blood indices. All blood parameters investigated in this study were within the normal range for healthy chickens. Thus, *Balanites aegyptiaca* can be included in the diet for broiler chickens up to 7.5% dietary level without any deleterious effect on blood parameters.

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Table 1: Composition of Broiler Finisher Diets Containing Graded Levels of Soaked *Balanites aegyptiaca* Fruit Meal Supplemented with Organic Acid (FYSAL®)

Ingredients	Control	Inclusion Levels of BAFM (%)		
		2.5	5.0	7.5
Maize	68.70	67.00	64.70	61.35
Soya cake	17.50	17.50	17.50	17.50
GNC	5.30	4.20	3.80	1.00
Blood meal	3.50	3.60	3.40	4.40
Bone meal	2.90	2.95	2.95	2.95
Limestone	1.10	1.10	1.10	1.10
BAFM	0.00	2.50	5.00	7.50
Salt	0.30	0.30	0.30	0.30
*Vitamin Premix	0.25	0.25	0.25	0.25
Lysine	0.20	0.20	0.20	0.20
Methionine	0.20	0.20	0.20	0.20
Maize offal	0.05	0.20	0.60	3.25
**FYSAL®	0.00	0.10	0.10	0.10
Total	100.00	100	100	100
Calculated analysis				
ME (Kcal/Kg)	3015.00	3018.00	3016.00	3012.00
Crude Protein (%)	19.25	19.21	19.21	19.25
Ether Extract (%)	4.10	4.19	4.30	4.31
Crude Fibre (%)	3.29	3.35	3.46	3.65
Calcium (%)	1.21	1.22	1.22	1.22
Available Phosphorus (%)	0.50	0.50	0.50	0.50
Lysine (%)	1.18	1.17	1.14	1.17
Methionine (%)	0.77	0.76	0.74	0.73
Feed cost/kg diet (₦/kg)	112.43	111.61	110.99	108.86

*Biomix chick premix provide per kg of diet vit A, 10,000 I.U; vit D, 2000 I. U; vit E; 23mg; vit K, 2mg; calcium pantothenate, 7.5mg; B12, 0.015mg; folic acid, 0.75mg, choline chloride, 300mg; vit B1, 1.8mg; vit B2, 5mg; vit B6, 3mg; manganese, 40mg; iron, 20mg; zinc, 53.34mg; copper, 3mg; iodine, 1mg; cobalt, 0.2mg; selenium, 0.2mg; zinc, 30mg. ** FYSAL® contains a blend of acidifiers viz; sorbic, lactic, propionic, ascorbic and citric acids; it is supplemented at 0.1%. BAFM= *Balanites aegyptiaca* fruit meal.

Table 2: Haematological Parameters of Broiler Chickens Fed Soaked *Balanites aegyptiaca* Fruit Meal Based Diets with Supplementation of Acidifier (Fysal®)

Parameters	Levels of BAFM (%)				Normal range	SEM
	Control	2.5	5.0	7.5		
Red blood cell ($\times 10^{12}/L$)	5.10	5.47	5.30	5.23	2.5-5.5	0.30
Packed cell volume (%)	30.67	31.33	29.00	32.00	22.0-35	1.93
Haemoglobin (g/dl)	10.17	10.43	9.50	10.63	7-13	0.69
White blood cell ($\times 10^9/L$)	9.97	11.83	12.33	12.47	9-31	1.24
Heterophil (%)	15.00	15.67	16.67	14.67	20-30	1.29
Lymphocyte (%)	80.00	77.33	87.33	79.00	60-80	4.72
Monocytes (%)	2.33 ^c	2.33 ^c	3.67 ^a	2.67 ^b	1-3	0.01
Eosinophil (%)	2.00	1.67	2.33	2.33	1-3	0.50
Basophil (%)	0.00	0.00	0.00	0.00	0-2	0.00

a,b,c= Means with different superscript on the same row differ significantly ($P < 0.05$), SEM= Standard error of mean, BAFM=*Balanites aegyptiaca* fruit meal, /L= per litre, g/dl= gram per decilitre, %= Percent

Table 3: Serum Biochemistry of Broiler Chickens Fed Soaked *Balanites aegyptiaca* Fruit Meal Based Diets with Supplementation of Acidifier (Fysal®)

Parameters	Levels of BAFM (%)				Normal range	SEM
	Control	2.5	5.0	7.5		
Total protein (g/dl)	4.73 ^b	4.63 ^a	5.00 ^a	4.23 ^b	2.5-4.5	3.45
Albumin (mg/dl)	4.73	4.23	5.07	4.73	3-3.5	0.49
Cholesterol (mmol/l)	2.03	1.53	1.63	1.70	3-3.24	0.27
Triglycerides (mg/dl)	99.67 ^b	96.33 ^{ab}	89.33 ^a	91.33 ^a	60-80	3.05
LDL (mg/dl)	22.67 ^a	20.67 ^a	17.00 ^b	17.33 ^b	<50	1.22
HDL (mg/dl)	25.33	25.67	29.33	25.33	<40	4.80

a, b= Means with different superscript on the same row differ significantly ($P < 0.05$), g/dl= gram per decilitre, mg/dl= milligram per decilitre, mmol/l= millimole per litre, SEM= Standard error of mean, BAFM = *Balanites aegyptiaca* fruit meal, LDL=low density lipoprotein, HDL = high density lipoprotein.