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Growth Performance, Haematological Parameters and Serum Biochemical Indices of Broiler Chickens Fed Baobab (*Adansonia digitata*) and Moringa (*Moringa oleifera*) Leaf Meals as Replacement for Synthetic Premix in a Semi-arid Environment

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Abstract The effects of Baobab (*Adansonia digitata*) and Moringa (*Moringa oleifera*) leaf meals dsignated as BOLM and MOLM respectively as replacement for synthetic premix on growth performance, haematological parameters and serum biochemical indices of broiler chickens were investigated using 180 two weeks old broiler chickens. The chickens were randomly allocated to six (6) treatments in a Randomized Complete Block Design (RCBD). The treatments were replicated three times with 10 chickens per replicate. The experimental diets were designated as T1 (0.30% synthetic premix), T2 (0.15% synthetic premix + 0.15% MOLM)), T3 (0.15% synthetic premix + 0.15% BOLM), T4 (0.15% MOLM and 0.15% BOLM), T5(0.30% MOLM) and T6(0.30% BOLM). The study lasted for 49 days, the study showed that significant ($P<0.05$) differences exist in final liveweight, total weight gain and total feed intake, but no significant ($P>0.05$) differences was observed in feed conversion ratio among the treatment groups. The haematological assay revealed that packed cell volume (PCV), haemoglobin (Hb) concentration, Red blood cells (RBC) count, white blood cells (WBC) count, mean corpuscular haemoglobin (MCH) and mean corpuscular volume (MCV) were significantly ($P<0.05$) different in all the treatments with the exception of mean corpuscular haemoglobin concentration (MCHC). For differential counts, neutrophils and lymphocytes showed significant ($P<0.05$) differences in the treatments. Eosinophils, monocytes and basophils showed no significant ($P>0.05$) differences. Serum biochemical indices revealed that total protein (TP), albumen, globulin, glucose, uric acid, conjugated bilirubin, creatinine, alanine aminotransferase (ALAT), Aspartate aminotransferase (ASAT) and alkaline phosphates were significantly ($P<0.05$) different among treatment groups but, cholesterol was not ($P>0.05$) different. From the results obtained, there were no definite indications of enhanced or depressive effects of Moringa or Baobab leaf meals fed to broiler chickens to replace synthetic premix on the growth performance, haematological parameters and serum biochemical indices. It can be concluded that Moringa and Baobab leaf meals can be used to replace synthetic premix in broiler chickens diets without adverse effects.

Keywords Baobab leaf meal, *Moringa oleifera* leaf meal, synthetic premix, performance, haematology, serum indices, broiler chickens

Introduction

The use of antibiotics as growth promoters in the poultry industry has been banned by the European Union in 2006 because of its harmful effects on human health. This is due to the development of microbial resistance to these products. Consequently, herbs, spices and various plant extracts considered to be natural products which consumers would accept have received increased attention as possible feed additive to replace antibiotic growth

promoters [1]. Several alternative growth promoters have been proposed such as organic acids and medicinal plants as natural feed additives and now they are being used in poultry diets to enhance performance and immune response of birds [2]. Two of such plants are Baobab (*Adansonia digitata*) and Moringa (*Moringa oleifera) which is* commonly known as "drum stick tree"[3] and [4] reported that *Moringa oleifera* leaves have antimicrobial effects and are good sources of fats, proteins and minerals. *Moringa oleifera* leaves are known to contain 23% crude protein, 2868MJ/kg metabolizable energy and posses 79.70% digestibility [5]. It also contains sufficient quantities of carotine, ascorbic acids, iron, methionine and cysteine[6]. *Moringa* also contain phenols, antinutritional factors such as tannins, saponins, phytates and oxalates[7]. Dietary supplementation of *Moringa oleifera* in broiler chicken diets was effective in enhancing the oxidative stability of chicken meat [8]. [9] reported that replacing antibiotic growth promoter with *Moringa* leaf powder at 0.1 or 0.05% levels have beneficial effects on growth performance and carcass yield of broiler chickens. [10] investigated the effects of inclusion of four levels (0, 1, 2 and 3%) of *Moringa oleifera* leaf meal (MOLM) on growth performance of broiler chickens and observed that MOLM significantly enhanced weight gain.

Baobab (*Adansonia digitata*) leaf meal (BOLM) is also an alternative protein source of plant origin. [11] reported that BOLM contains 10.6% protein. [12] reported that BOLM is rich in vitamin C, potassium, calcium and sugar. Similarly, [13] showed that the crude protein content of BOLM was 5 to 17%, fibre, 10 to 19% and calcium, 1 to 4%. [14] reported that BOLM is suitable to substitute soyabean meal in broiler chickens diets and gives adequate haematolocrite and immune response status, and thus recommended up to 75% of soyabean meal to be replaced by baobab leaf meal in the diets of broiler finisher chickens. The objective of this study therefore, was to evaluate the effects of replacing synthetic premix with *Moringa* and Baobab leaf meals in broiler chicken diets on growth performance, haematologcial parameters and serum biochemical indices.

Materials and Methods

Study Area

The study was carried out at the Poultry Unit of the Livestock Teaching and Research Farm, Department of Animal Science, University of Maiduguri, Borno State, Nigeria. Maiduguri is located between latitude 11^{o}05' and 12^{o} North and longitude 13^{o}05' and 14^{o} East and at an altitude of 354M above sea level [15]. Maiduguri falls within the Sahelian region which is noted for its great and harsh climate and seasonal rainfall variation. The ambient temperatures could be as low as 20^{o}C during the dry cold season (October to January) and as high as 44^{o}C during the dry hot season (February to May) and the relative humidity is about 5% in April and May and the day length varies from 11 to 12 hours [16].

Experimental Stock and Management

One hundred and eighty (180) two weeks old broiler chickens were used for the study. The chickens were weighed individually and allotted to six (6) experimental diets. The chickens were assigned to the six dietary treatments in groups of 30 birds per treatment and replicated thrice with 10 chickens per replicate in a Randomized Complete Block Design (RCBD). Six experimental diets were formulated and designated as treatments 1, 2, 3, 4, 5 and 6. T1 contained (0.30% synthetic premix), T2 (0.15% synthetic + 0.15% MOLM), T3 (0.15% synthetic premix + 0.15% BOLM), T4 (0.15% MOLM and 0.15% BOLM), T5 (0.30% MOLM) and T6 (0.30% BOLM). The chickens were provided with the experimental diets and drinking water *ad libitum*. Other management practices such as vaccination against Gumboro and New Castle diseases were carried out. The study lasted for 49 days. The ingredients composition and calculated analysis of the experimental finisher diets is presented in Table 1.

Table 1: Ingredients Composition and Calculated Analysis of the Experimental Broiler Finisher Diets

Ingredient	T1	T2	T3	T4	T5	T6
Maize	54.00	54.00	54.00	54.00	54.00	54.00
Soyabean	28.00	28.00	28.00	28.00	28.00	28.00
Wheat offal	10.00	10.00	10.00	10.00	10.00	10.00
Fish meal	4.00	4.00	4.00	4.00	4.00	4.00
Bone meal	3.00	3.00	3.00	3.00	3.00	3.00

Premix	0.30	0.15	0.15	0.00	0.00	0.00
Moringa leaf meal	0.00	0.15	0.15	0.00	0.00	0.00
Baobab leaf meal	0.00	0.00	0.15	0.15	0.00	0.30
Methionine	0.20	0.20	0.20	0.20	0.20	0.20
Lysine	0.20	0.20	0.20	0.20	0.20	0.20
Salt	0.30	0.30	0.30	0.30	0.30	0.30
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated Analysis						
Crude protein (%)	20.29	20.39	20.31	20.35	20.38	20.32
Crude fibre (%)	4.48	4.50	4.50	4.53	4.54	4.52
Ether extract (%)	8.27	8.28	8.28	4.28	4.28	4.29
Ash	2.91	2.92	2.92	2.93	2.94	2.93
Nitrogen free extract	52.62	52.67	52.72	52.77	52.73	52.65
Calcium (Ca)	0.16	0.16	0.16	0.16	0.16	0.16
Phosphorus (PH)	0.44	0.46	0.46	0.47	0.47	0.47
ME (kcal/kg)	3179.50	3179.50	3179.50	3179.50	3179.50	3179.50

ME = Metabolizable Energy (Kcal/kg)

** Premix suppling the following per kg of feed. Vit. A = 50,000,000IU, Vit D_2 = 1,600,000IU, Thiamin = 2000Mg, Riboflabin = 5,000mg, Panthotenic acid = 10,000, Vit. B6 = 3000mg, Vit. B_{12} = 20mg, Vit. K = 100mg, E = 20,000mg, Vit. C = 100,000mg, Nicotinic acid = 25,000mg, Folic acid = 600mg, biotin = 0.5mg, Manganese = 100,000mg, Iron = 80,000mg, Zinc = 49,000mg, Copper = 5,000mg, Iodine = 200mg, Cobalt = 250mg, Selenium = 125mg, Choline chloride 400,000mg, Zinc bacitracin = 15,000mg, Farmers UGF = 75,000mg*

Data Collection

Performance Data

During the study, the data collected: were final liveweight, total weight gain, total feed intake and Feed conversion ratio.

Chemical Analysis

All feed samples collected were analyzed using [17] methods.

Haematology and Serum Biochemical Indices

At the end of the experiment, blood samples were collected from three (3) chickens in each treatment for haematological and serum biochemical analyses. The haematological indices determined were packed cells volume (PCV), haemoglobin (Hb) concentration, red blood cells (RBC) count and white blood cells (WBC) count. The mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were calculated according to the formulae outlined by [18]Schalm *et al.* (1975). The serum biochemical indices determined were levels of glucose, protein, albumen, globulin, uric acid, creatinine and cholesterol using the method outlined by [19]Bush (1975).

Statistical Analysis

All data collected were subjected to analyses of variance using the software, [20] and where applicable, means were separated by Least Significant Difference (LSD).

Results and Discussion

The chemical composition of broiler finisher experimental diets is presented in Table 2. The crude protein (CP) values ranged from 20.31 to 20.39%. These values were within the recommended CP levels 19 to 21%) [21] for broiler finishers. The crude fibre levels 4.48 to 4.50% were also within the accepted range (3 to 7%) reported by [22] for finishing broiler chickens. The values for ether extract (4.29 to 8.28%), ash (2.91 to 2.94%), nitrogen free extract (NFE) (52.62 to 52.77%) and metabolizable energy (ME) 3179.50 (kcal/kg) were all within the recommended levels outlined by [21] for finishing broiler chickens.

Table 2: Chemical Composition of the Experimental Broiler Finisher Diets Fed to Broiler Chickens

Constituents (%)	Treatments /Diets					
	T1	T2	T3	T4	T5	T6
Dry matter	97.60	99.20	98.20	99.00	98.90	99.40
Crude protein (CP)	20.29	20.39	20.31	20.35	20.38	20.32
Crude fibre (CF)	4.48	4.50	4.50	4.53	4.53	4.52
Ether Extract (EE)	8.27	8.28	8.28	4.58	4.29	4.30
Ash	2.91	2.92	2.29	2.93	2.94	2.93
Nitrogen free extract (NFE)	52.62	52.67	52.72	52.77	52.73	52.65
ME (Kcal/kg)	3179.50	3179.50	3179.50	3179.50	3179.50	3179.50

Growth performance of broiler chickens fed MOLM and BOLM to replace synthetic premix is presented in Table 3. The final live weight, total weight gain and total feed intake were significantly (<0.05) different among treatment groups with the exception of feed conversion ratio. Highest final liveweight, total weight gain and total feed intake were obtained in T3 (0.15% synthetic premix + 0.15% BOLM) and lowest values of final weight gain and total weight were observed in T2 (0.15% synthetic premix). Lowest total feed intake was obtained in T4 (0.15% MOLM + 0.15% BOLM). The higher final live weight and total weight gain observed in T3 (0.15% synthetic premix + 0.15% BOLM) agreed with [23] who reported that birds on 50% baobab leaf meal had better performance. [24] reported that 20% inclusion level of MOLM enhanced final live weight, while chickens on 0% MOLM had the lowest final live weight. Chickens fed 15 to 20% MOLM inclusion level had the highest feed intake. Numerically, the poorer feed conversion ratio observed in T4 (0.15% MOLM + 0.15% BOLM) could probably be due to the tannin contents and other antinutritional factors in *Moringa* and baobab leaves as reported by[24], which can depress growth and feed utilization[25].

Table 3: Growth Performance of Broiler Chickens Fed *Moringa oleifera* and Baobab lead Meals Replacing Synthetic Premix

Constituents (%)	Treatments /Diets						
	T1	T2	T3	T4	T5	T6	SEM
Initial liveweight (g)	576.25	552.00	560.65	555.00	570.80	555.80	9.20^{NS}
Final liveweight (g)	1628.80^{ab}	1456.40^{b}	1775.90^{a}	1511.20^{ab}	1635.10^{ab}	1681.20^{ab}	98.20^{*}
Total weight gain (g)	1052.50^{ab}	904.40^{b}	1215.50^{a}	956.20^{ab}	1064.30^{ab}	1125.40^{ab}	97.40^{*}
Total feed intake (g)	4393.40^{ab}	4598.80^{ab}	4882.90^{a}	4257.00^{b}	4572.80^{ab}	4773.40^{ab}	149.74^{*}
Feed Conversion Ratio	4.20	4.80	3.90	4.90	4.50	4.30	0.39^{NS}

a,b = Means bearing different superscripts within the same differ significantly (P<0.05), NS = Not significant (P>0.05), SEM = Standard Error of Means

The Haematological values of broiler chickens is presented in Table 4. The packed cells volume (PCV); 24.25 to 27.50%) were within the normal range 25 to 45% for chickens reported by Jain [26]. The haemoglobin (Hb) concentration values; 8.05 to 8.78 (g/dl), red blood cells count; 1.91 to 2.29 ($10^{6}mm^{3}$) and mean corpuscular haemoglobin concentration; 33.12 to 33.27 (g/dl) were within the values reported by [23] Jain. However, the values for white blood cells count; 12.40 to 17.30 ($10^{6}mm^{3}$) were higher than the values 3.00 to 10.00 ($10^{3}mm^{3}$) outlined by [26]. Similarly, the mean corpuscular volume; 11.09 to 14.41(fl) were lower than the values 90 to 140 (fl) reported by [23] for normal chickens. The differential counts; neutrophils, eosinophils, lymphocytes and monocytes were within the range outlined by [23]. The packed cell volume, haemoglobin concentration, red blood cells counts white blood cells count, mean corpuscular haemoglobin and mean corpuscular volume showed significant (P<0.05) differences in all the treatments except mean corpuscular haemoglobin concentration. The differential counts; neutrophils and lymphocytes were significantly (P<0.05) different, but monocytes and basophils did not (P>0.05) differ in all the treatments. The highest value of lymphocytes recorded in T6 (0.30% BOLM) indicates that the diet contained adequate nutrients that can support the immune system in the body. The higher level of the white blood cells indicated higher level of leucocytes which serve as defense mechanism against diseases. This signifies that *phagocytes* were at peak in the bird fed BOLM diets.

Table 4: Haematological Parameters of Broiler Chickens Fed *Moringa oleifera* and Baobab leaf Meals Replacing Synthetic Premix

Parameters	Treatments /Diets						
	T1	T2	T3	T4	T5	T6	SEM
PCV (%)	25.50^{ab}	24.25^{b}	26.50^{ab}	24.50^{b}	25.25^{ab}	27.50^{a}	0.92^{*}
Hb (g/dl)	8.48^{ab}	8.05^{b}	8.78^{ab}	8.13^{b}	8.42^{ab}	9.13^{a}	0.31^{*}
RBC (x 10^{6}/mm^{3})	1.98^{c}	2.19^{ab}	2.29^{a}	2.07^{b}	1.91^{c}	1.93^{c}	0.09^{*}
WBC (X 10^{3}/mm^{3})	14.90^{b}	14.73^{b}	12.40^{c}	17.30^{a}	14.83^{b}	15.51^{b}	0.56^{*}
MCH (Fl/cell)	4.28^{b}	3.68^{c}	3.85^{bc}	$3.94b^{c}$	4.41^{ab}	4.78^{a}	2.05^{*}
MCV (Fl/cell)	12.87^{ab}	11.09^{c}	11.63^{bc}	11.88^{bc}	13.29^{b}	14.41^{a}	6.64^{*}
MCHC (g/dl)	33.23	33.19	33.12	33.17	33.27	32.35	0.32^{NS}
Neutrophils (%)	25.25^{bc}	30.00^{ab}	25.50^{bc}	33.50^{a}	28.00^{b}	21.25^{c}	2.74^{*}
Eosinophils (%)	1.50	1.50	2.75	1.00	0.75	1.00	0.21^{NS}
Lymphocytes (%)	73.00^{ab}	68.25^{bc}	71.35^{ab}	63.75^{c}	70.00^{b}	77.75^{a}	2.84^{*}
Monocytes (%)	0.25	0.25	0.50	0.50	0.25	0.00	0.00^{NS}
Basophils (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00^{NS}

a,b,c = Means bearing different superscripts within the same differ significantly (P<0.05),
NS = Not significant (P>0.05)
SEM = Standard Error of Means

The non significant (P>0.05) difference observed for eosinophils is indicative of detoxification property in the BOLM diets. No significant (P<0.05) differences were observed among all the treatment groups for for basophils. These cells contain the anticoagulant *Heparin* which are released in areas of inflammation to prevent clotting of blood and lymph[27] (Frandson, 1986).

Results of serum biochemical indices is presented in Table 5. The values of total protein (TP) obtained in this study were 46.50 to 59.75 (g/L). These values were higher than the value 24.00 (g/L) reported by[26] Uchegbu *et al* (2010) for broiler chickens. [28] Bush (1991) reported that an increase in TP may be due to dehydration and increase in globulin level, while decrease in TP is always due to low level of albumen. Higher TP was observed in T2 (0.15% synthetic premix + 0.15% MOLM). Total proteins were significantly (P<0.05) different in all the treatment groups. Higher total proteins obtained in this study indicated adequate protein in the treatment diets. Albumen levels were 31.00 to 38.75 (g/L) and were within the normal range 20 to 35 (g/L) for chickens reported by [29]. Higher level of albumen was obtained in T2. Cholesterol values showed no significant (P>0.05) differences among all the treatment groups. Cholesterol values obtained in this study were 144.50 to 157.25 (mmol/L) and were within the normal range 129.00 to 297.00 (mmol/L) reported by [30]. Higher values than normal will create liver dysfunction, hypothyroidism and diabetes while decreases level may indicate debility and malfunction of fat [29](Bush, 1991).

Alkaline phosphates obtained in this study were 42.50 to 47.75 (IU/L) and were within the normal range 10 to 106 (IU/L) reported by [29] Clinical Diagnostic Division (1990). This implies that, liver, pancrease and bones are in good condition provided. Similarly, the aspartate amino transferase and alanine amino transferase were significantly (P<0.05) different among treatment groups. Aspartate amino transferase obtained in this study were 40.50 to 103.00 (IU/L) and were within the reference values 70 to 220 (IU/L) reported by [31].

Table 5: Serum Biochemical Indices of the Broiler Chickens

Parameters	Treatments /Diets						
	T1	T2	T3	T4	T5	T6	SEM
Total protein (g/L)	46.50^{bc}	59.75^{a}	54.50^{c}	50.00^{ab}	51.05^{ab}	56.75^{b}	3.13^{*}
Albumen (g/L)	31.75^{b}	38.75^{a}	31.75^{b}	31.00^{c}	31.73^{b}	32.00^{b}	1.38^{*}
Globulin (g/L)	14.75^{bc}	21.00^{ab}	23.00^{b}	10.00^{c}	19.75^{ab}	24.75^{a}	2.40^{*}
Glucose (mmol/L)	5.08^{a}	4.38^{b}	47.73^{ab}	5.05^{a}	4.23^{b}	4.83^{ab}	0.20^{*}
Cholesterol (mmol/L)	150.75	154.00	144.50	157.25	153.00	146.50	4.85^{NS}
Uric Acid (mmol/L)	4.50^{ab}	3.78^{b}	4.38^{b}	3.63^{b}	5.05^{a}	3.73^{b}	0.39
Conjugated bilirubin (mmol/L)	3.48^{a}	3.30^{a}	1.85^{b}	3.73^{a}	2.98^{ab}	3.40^{ab}	0.39^{*}

Creatinine (mmol/L)	51.75^{c}	85.25^{a}	64.00^{b}	36.50^{d}	62.75^{b}	65.00^{b}	2.76*
Alkaline phosphate (IU/L)	42.50^{b}	45.72^{ab}	47.25^{a}	44.25^{ab}	44.75^{ab}	47.75^{a}	1.49*
Aspartate amino Transferase (IU/L)	77.00^{b}	45.75^{c}	40.50^{c}	93.00^{ab}	103.00^{a}	54.75^{c}	6.37*
Alanine amino transferase (IU/L)	69.75^{a}	49.75^{c}	58.75^{ab}	65.75^{b}	58.50^{ab}	63.25^{b}	6.27*

a,b,c,d = Means bearing different superscripts within the same differ significantly (P<0.05), NS = Not significant (P>0.05), SEM = Standard Error of Means

Conclusion

From the results obtained in this study, it can be concluded that (Moringa) *Moringa oleifera* and baobab (*Adansonia digitata*) leaf meals can be used to replace synthetic premix in broiler chicken diets without deleterious effects on growth performance, haematological parameters and serum biochemical indices. However, there are no definite indications of enhanced or depressive effects of *Moringa* and baobab leaf meals on performance, haematology and serum biochemical indices. Further research work will be needed to ascertain the potentials of these leaf meals to replace synthetic premix in different classes of poultry.

References

[1]. Catala-Gregori, P., Mallet, S., Travel, A., & Lessire, M. (2008). Efficiency of a prebiotic and a plant extract on broiler chicken performance and intestinal physiology. *Proceedings of 16th European Symposium on Poultry Nutrition. In: World's Poultry Science Association*. Stransburg France. Pp. 118 – 121.

[2]. Saki, A.A., Hircine, R.N., Rahmatnejad, E., & Salary, J. (2012). Herbal additives and organic acids as antibiotic alternatives in broiler chicken diets for organic production. *African Journal of Biotechnology*, 11:2139 – 2145.

[3]. Makkar, H.P.S., & Becker, K. (1997). Nutrient and anti-quality factors in different morphological parts of the *Moringa oleifera* tree. *Journal of Agricultural Science*, 128: 311 – 322.

[4]. Olugbemi, T.S., Mutayoba, S.K,. & Lekule, F.P. (2010). Effect of *Moringa oleifera* inclusion in cassava diets fed to broiler chickens. *International Journal of Poultry Science*, 9(4): 363 – 367.

[5]. Becker, B. (1983). The contribution of wild plants to human nutrition in the ferlo (Northern Senegal). *Agroforestry systems*, 1:257 – 267.

[6]. Makkar, H.P.S., & Becker, K. (1996). Nutritional value and anti-nutritional components of whole and ethanol extracted *Moringa oleifera* leaves. *Animal Feed Science and Technology*, 63:211 – 228.

[7]. Gupta, K., Barat, G.K., Wagle, D.S., & Chawla, H.K.L. (1989). Nutrient contents and anti-nutritional factors in conventional and non-conversional leafy vegetables. *Food Chemistry*, 31:105 – 116.

[8]. Qwele, K., Muchenje, V., Oyedemi, S.O., Mayo, B., & Masika, P.J. (2013). Effect of dietary mixtures of *Moringa oleifera* leaves, broiler finisher and crushed maize on anti-oxidative potential and physicochemical characteristics of breast meat from broiler chickens. *African Journal of Biotechnology*, 12(3): 290 – 298.

[9]. David, L.S., Vidanarachi, J.K., Samarasinghe, K., Cyril, H.W., & Dematawewa, C.M.B. (2012). Effects of *Moringa* based feed additives on the growth performance and carcass quality of broiler chickens. *Tropical Agricultural Research*, 24(1):12–20.

[10]. Banjo, S. (2012). Growth and performance as affected by inclusion of *Moringa oleifera* leaf meal (MOLM) in broiler chick diet. *Journal of Biological Agricultural Health Care*, 2(9):35 – 38.

[11]. Claire, S. (2008). The tree of life (and its super fruits). The independent, July, 17th 2008. *http://www.independent.co.uk/new/word/africa/the* tree-of-life-and its supper fruit 869737.html.

[12]. Hankey, A. (2004). *Adansonia digitata al. http://www.books.nap.edu/open book.php.record id=//879. pp 44-45.*

[13]. Feedipedia (2013). Composition and nutritive value of pulp and seeds in the fruit of the baobab. *African Agricultural Journal*, 9(3): 144 - 145.

[14]. Adamu, S.B., Mohammed G., Inuwa, L., Ugwumadu, C.R., Muhammad, A.I., & Muhamma, A.A. (2015). Studies on Haematology and serum biochemistry of broiler chickens finished on varying levels

of Baobab (*Adansonia digitata)* leaf meal as replacement for soyabean meal. *Research Journal of Agriculture*. *http://www.researchjournal.com/editor.php*.

[15]. Encarta (2007). *Microsoft Students Encarta Dictionary* Inc. USA. Retrieved March 25, 2015 from *http://commons.wikimedia.org/wiki/commons*. DVD.

[16]. Raji, A.O., Aliyu, J., Igwebuike, J.U., & Chiroma, S. (2009). Effect of storage methods and egg quality traits of laying hens in a hot dry climate. *ARPN Journal of Agriculture and Biological Science*, 4:1 – 7.

[17]. AOAC (2006). Association of official Analytical Chemists. *Official Methods of Analyses*, 18th edn. Horwitz, W. (ed) Arlington, V.A. USA. 1018pp.

[18]. Schalm, O.W., Jain, N.C., & Carol, E.J. (1975). *Veterinary Haematology.* 3rd edn. Published by Lea and Febiger, Philadelphia, USA pp. 129 – 250.

[19]. Bush, B.M. (1975). Haematological examination. William Heineman medical Books Ltd, London 447 Pp.

[20]. Statistix (2008). *Statistix for Windows Manual* Analytical software, 9.0 version.

[21]. Olomu, J.M. (2011). *Monogastric Animal Nutrition: Principles and Practice*. A Jachem publication, Benin City, Nigeria. 478pp.

[22]. Varastegani, M.E., & Dahlam, J. (2014). Influence of dietary fibre level on feed utilization and growth performance of poultry. *Journal of Animal Production Advances*, 4(6): 422 – 429.

[23]. Rafiu, T.A., Okunlola, D.O., Olasunkanmi, G.O., & Pelemo, T.T. (2017). Nutritional Evaluation of *Adansonia digitata* as a replacement for maize in the diet of broiler chickens. *Nigerian Journal of Animal Science*. 19(2): 39 – 46.

[24]. Ayo-Ajasa, O.Y., Omotayo, I.G., Abiona, J.A., Fafiolu, A.O., Egbeyale, L.T., Odeyemi, A.Y., & Abel, F.A.S. (2015). Growth performance characteristics of broiler chickens fed graded levels of *Moringa oleifera* leaf meal. *Proceedings of the 20th Annual Conference of Animal Science Association of Nigeria* (ASAN), 6 – 10th Sept., 2015. *International Conference Centre, University of Ibadan, Nigeria*. Pp. 607 – 610.

[25]. Douglas, J.H., Sullivan, T.W., Gonzalez, N.J., & Beck, M.M. (1993). Differential age response of turkey to protein and sorghum tannin levels. *Poultry Science*, 72:1944 –1951.

[26]. Jain, N.C. (1993). *Essentials of Veterinary Haematology*. Lea and Febeger, Ma Ivern, Pennsylvania, USA pp. 33 – 53.

[27]. Bush, B.M. (1991). *Interpretation of Laboratory Results for Small Animal Clinician* Blackwell Scientific publication, UK. Pp. 32 – 67.

[28]. Frandson, R.D. (1986). *Anatomy and Physiology of Farm Animals*. 4th edn. Lea and Fibeger publishers, 600 Washington Square, USA. Pp. 92 – 1330.

[29]. Uchegbu, M.C. Ezuma. C.C., Ogbuewu, I.P., & Opara, M.N. (2010). Physiological response of finisher broilers to yam peel meal: Haematological and Serum biochemistry. *Elec. Journal of Environment and Food Chemistry* 1:1657 – 1664.

[30]. Mitruka, B.M., & Rawsley, H.M. (1977). *Clinical, Biochemical and Haematological Reference values in Normal Experimental Animals*. Manson publishing company, New York, USA. pp. 21 – 24.

[31]. Clinical Diagnostic Division (1990). *Veterinary Reference guide*. Rochester, New York, Resourcekodak.*com/ support/pdf/en. Accessed on 15/08/2017.*

[32]. Melluzzi, A., Primiceri, G., Giodani, R.A., & Fabris, G. (1992). Determination of blood constituents reference value in broiler chickens. *Poultry Science*, 71:337–345.