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Effect of Raw *Leucaena leucocephala* Seeds Meal in the Diet of Broiler Chickens

Matthew Mahakwe Ebogu Iwuchukwu, Adegbenro Henry Akinmutimi, and Nnamdi Mbanefo Anigbogu

Department of Animal Nutrition and Forage Science, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria.
Corresponding Author E-mail: matthewiwuchukwu53@gmail.com

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ABSTRACT: One hundred and twenty Marshall Breed broiler chickens were used to investigate the effect of raw *Leucaena leucocephala* seeds meal in the diet of broiler chickens. The birds were randomly assigned to the four treatments /diets in a Completely Randomized Design (CRD), each treatment made up of three replicates each with 10 birds per replicate. With the exception of treatment one (T_1) which is the control, the other treatments T_2, T_3 and T_4 contained incorporated milled raw *Leucaena leucocephala* seeds meal at 2.50%, 5.00% and 7.50% respectively. The result showed a significant difference ($P<0.05$) in the growth performance, cut-parts (expressed as % dressed weight) and in organ weights (expressed as % dressed weight). For haematological indices, the values were significantly different ($P<0.05$) for the parameters measured with the exception of hemoglobin (Hb). The values for the RBC, PCV, WBC and MCV, fell within the normal range of haematological indices for broiler chickens. For blood chemistry there were significant differences ($P<0.05$) for all the parameters measured. Values for total protein, albumin and urea for T_2 (2.5%) inclusion fell within the normal range for broiler production. From the economics of diet, in view of the cost/kgweight gain, weight gain, revenue and gross margin, birds on T_2 (2.5%) inclusion of raw *Leucaena leucocephala* seeds mealbased diets were most productive. In all, birds on 2.5% inclusion of raw *Leucaena leucocephala* seeds meal performed maximally or best than the rest. Hence soybean meal can be safely and most productively be replaced with 2.5% inclusion of raw *Leucaena leucocephala* seeds meal in the diet of broiler birds.

Keywords: *Leucaena leucocephala* seeds meal, broiler chickens, processing and diets

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INTRODUCTION

The conventional plant protein sources such as soybean and groundnut for poultry production are highly competed for by humans and other industrial users. This has led to high cost of feed accounting for 70 to 80% cost of poultry production (Obioha, 1992, Ogungowara, 1984). It has therefore become imperative, and pertinent to search for other alternative sources of protein that are less competitive, more available, less expensive and equally been able to meet the nutrient requirement of the animals. One of the alternative protein sources that come to mind is *Leucaena leucocephala* seeds meal. It is a non-conventional legume, known as the "miracle tree" because of its worldwide success as a long-lived and highly nutritious forage tree and its great variety of other uses. It is estimated to cover 2.5 million hectares worldwide (Brewbakar and Soresson, 1990). The crude protein content of mature *Leucaena leucocephala* seeds ranges from 26-28% of dry matter. Yield of 2tonnes/hectare has been reported by Brewbakar and Soresson (1990). The high cost of protein source has also resulted in protein intake in Nigeria been on the decline. The level of consumption of animal protein in Nigeria is estimated at

about 8g, per head, per day; about 27 grams below the nutrient requirement recommended by the National Research Council (NRC, 1994) of the United States of America (Obohia, 1992). Broiler production has a significant potential in developing countries like Nigeria, for the supply of the much-needed animal protein, required, to meet the increasing demand of the teeming population (Alikwe and Tuagha, 2013, Abdullali *et al.*, 2014); Ogunbode *et al.*,2014). This is possible due to a short generation interval and fast growth rate of boiler birds (Akinmutimi and Iboro, 2012). Like other legumes, *Leucaena leucocephala* seeds contain anti-nutritional factors such as mimosine, Trypsin inhibitors, tannins; hydrogen cyanides and pytates. The need therefore to detoxify the seeds before usuage through various proceeding methods. Processing calls for additional time, cost and energy. The objective of this study is to determine the effect of raw *Leucaena leucocephala* seeds meal in the diet of broiler chickens.

MATERIALS AND METHODS

Study location

The experiment was carried out at a private poultry farm at Uyo Local Government Area of Akwa Ibom State Nigeria. Uyo Local Government Area has a total land mass of about 150.49 square kilometers and is located within the fresh water swamp forest zone. The area is characterized by low level land and shallow depression (Udofia, 2007).

Preparation of raw *Leucaena leucocephala* seeds meal

Leucaena leucocephala matured dry seeds were sourced from the fallow lands of Uyo Local Government Area of Akwa Ibom State. Some of the *Leucaena leucocephala* seeds were left unprocessed (raw). 3kg of the raw was sun dried, milled and sieved with 1.5mesh sieve.

Experimental Birds and their management.

One hundred and twenty (120) Marshal breed broiler chickens were purchased from a poultry farm in Uyo, Akwalbom State and used for the study Prior to the commencement of the experiment, the birds were brooded for two weeks and were fed commercial broiler-starter and water *ad-libitum* for the two weeks. Afterwards the birds were weighed and assigned to the four dietary treatments designated T_1, T_2, T_3 , T_4 , made up of three replicates each with ten birds per replicate after balancing for weight. T_1 is the control that contained no *Leucaena leucocephala* seeds meal while treatments T_2, T_3 and T_4 contained 2.5%, 5.0% and 7.5% inclusions of raw *Leucaena leucocephala* seeds meal respectively. Experimental diets and water were administered *ad-libitium* for experimental period that lasted for 42 days. The birds were managed in deep litter pens. Wood shaving served as the litter material. Routine vaccination was strictly adhered to.

Data collection

Weight gain was taken weekly while feed intake was taken daily. Data on growth performance was carried out according to Scott *et al.* (1969).

Data on hematological indices

Data on haematological analysis was carried out according to the method described by Schalm *et al.* (1975). Carcass quality and organ weight were carried out by Scott *et al.* (1969) as reported by Ubak (2012). Haemoglobin concentration (Hb) was estimated using the Cyanmethaemoglobin method Cannan, 1958). Packed Cell Volume (PCV), Mean Corpuscular Volume (MCV), Red Blood Cell (RBC) and White Blood Cell (WBC) were determined according to the method of Schalm *et al.* (1975).

Blood chemistry

Total serum protein and albumin were determined using bromocresol purple method (Varley *et al.*,1980).
Blood Globulin was determined by Berg (1917). Serum creatinine level was determined using the method described by Tietz (1986). Alkaline phosphatase values were determined by chromogenic substrate method of Badson (1965). Data on economics of the experimental diets were computed as described by Shonaiya *et al.* (1986) and reported by Ekwu (2008).

Analytical procedure

Samples of feed were analyzed for proximate composition using the methods of AOAC (1995). The energy of the feed was determined using the bomb-calorimeter (AOAC, 1995).

Experimental design and statistical model

The design was Completely Randomized Design (CRD). The Statistical Model for this design for the experiment was:

$Yij = \mu + T_1 + eij$

Where

Yij = Single Observation
μ = Overall Mean
Ti = Effects of Treatment
eij = Error term, which is independently identically normally described with a zero mean and constant variance.

Table 1: Composition of experimental diets containing raw leucaena leucocephala seeds meal-based diets.

Ingredients Treatments	T_1 0%	T_2 2.5%	T_3 5%	T_4 7.5%
Maize	52.00	52.00	52.00	52.00
Soybean meal	29.00	26.50	24.00	21.50
Raw Leucaena Leucocephala seeds meal	0.00	2.50	5.00	7.50
Wheat offals	5.00	5.00	5.00	5.00
Palm Kernel Cake	6.00	6.00	6.00	6.00
Fish Meal (65%CP)	4.50	4.50	4.50	4.50
Bone Meal	3.00	3.00	3.00	3.00
Salt	0.25	0.25	0.25	0.25
Vitamin Premix	0.25	0.25	0.25	0.25
Total	100	100	100	100
Calculated Composition				
Crude Protein (%)	22.01	21.53	21.05	20.57
Metabolicable Energy (Kcal/Kg)	2909.70	2904.45	2899.20	2893.95
Ether Extract (%)	3.88	3.94	4.01	4.10
Crude Fibre (%)	4.12	4.10	4.07	4.04
Calcium (%)	1.20	1.22	1.25	1.27
Phosphorous (%)	0.83	0.84	0.83	0.84
Lysine (%)	1.23	1.44	1.64	1.85
Methionine (%)	0.37	0.41	0.53	0.49

Vitamin A, D_3, E, K, B_1, B_2, B_6, B_{12}, Niacin Pantothenic Acid, Folic acid, Biotin Chlorine Chloride, Manganese, Zinc, Iron, Copper, Iodine, Selenium, Cobalt and Antioxidants.

The data collected for the design was subjected to analysis of variance (ANOVA) according to Steel and Torrie (1980). The means were separated using the Duncan's Multiple Range Test as described by Duncan (1955).

RESULTS AND DISCUSSION

Table 1 shows the progressive replacement of soybean meal with raw *Leucaena leucocephala* seeds meal at 2.5%, 5% and 7.5% for T_2 T_3 and T_4 respectively. The inclusion in the diets of wheat offal, fish meal, palm kernel cake, bone meal, salt and vitamin premix were uniformly the same weights for all the treatments. This gives uniform weight of 100kg for all four treatments. This ensures that any variation in growth performance will not be as a result of differences in weight. Both the calculated protein, metabolizable energy and iron and amino acids used in the diet formulation are as required for broiler production.

Table 2 shows that the crude protein content ranges from 21.42 - 22.25% and the crude fibre ranges from 4.30-5.90%. The crude protein and crude fibre values fell within the requirement of broiler chickens placed on straight diets (Okah and Udoh, 2014; Ewa, 2015; Udosen *et al*. 2018). The gross energy content of the diet ranging from 3.85-4.30 Kcal/g provided the needed energy required for broiler birds placed on straight diet.

Table 3 shows the growth performance of broiler birds fed raw *Leucaena leucocephala* seeds meal- based diets. In the growth performance, apart from the initial weight/ bird/gm and percentage mortality, all the other parameters were significantly different($P<0.05$) from each other. In the final weight , weight gain/bird/g, and daily weight gain/bird/g, the birds on T_2 (2.5%) inclusion of raw *Leucaena leucocephala* seeds meal performed best than the other treatments, next was T_1 (control From T_3 (5%) to T_4 (7.5%) inclusions of raw *Leucaena leucocephala* seeds meal, there was a general decrease of the parameters considered probably because of the inhibitory effects of the ant-nutritional factors such as mimosine, tannins and trypsin inhibitors in *Leucaena leucocephala* seeds at those levels of inclusion. The highest final weight gain and daily weight gain of birds of T_2 (2.5%) inclusion of *Leucaena leucocephala* seeds meal could be due to the high protein content of *Leucaena seeds* and the non-depressive effect of the anti-nutritional, factors for birds on T_2. T_3 (5%) and T_4 (7.5%) had low palatability arising from the astringent property of tannin resulting in its ability to bind with the protein of saliva and mucosa membranes (Melansho *et al*.,1987*;* D'mello and Devandra, 1995). The Feed Conversion Ratio (FCR) i.e. (2.37) of birds on T_2 boiled sample was superior to others since the lower the value of FCR the more the superiority.

Table 4 shows the cut-parts of broiler chickens fed raw *Leucaena leucocephala* seeds meal-based diets. There were significant differences ($P<0.05$) in the parameters considered. Like in the growth performance, the live weight /bird/gram, the dressed weight/bird/gram, the thigh/bird/gram. the drumstick as well as the breast cut/ of the birds that were fed on T_2 (2.5%) inclusion of raw *Leucaena leucocephala* had highest performance than the other treatments, followed by birds on T_1 (Control %). This could be attributed to a more efficient utilization of nutrients in terms of digestion, absorption and assimilation (Olajide, 2012; Diarra *et al, 2015*). This result also indicated best muscle build up in the T_2 (2.5%) inclusion with non-deleterious anti-nutritional factors as compared to T_3 (5%) and T_4 (7.5%) inclusions. (Akinmutimi *et al.* (2009). On the whole the treatment (T_2) containing 2.5% inclusion of raw *Leucaena leucocephala* seeds meal gave the best performance particularly when absolute values of thigh, drumstick, breast cut and back-cut are considered. This implies that the diet (T_2) (2.5%) inclusion is more

Table 2: Proximate composition and gross energy of experimental diets using the raw *leucaena leucocephala* seeds meal.

Determined composition	T_1 0%	T_2 2.5%	T_3 5%	T_4 7.5%	SEM
Crude Protein (%)	22.25[a]	21.70[b]	21.52[c]	21.42[d]	0.040
Ether Extract (%)	3.70[a]	3.65[b]	3.53[d]	3.56[c]	0.003
Crude Fat (%)	5.90[a]	4.87[c]	5.84[b]	4.02[d]	0.013
Crude Fibre(%)	5.90[a]	5.84[b]	4.35[c]	4.30[d]	0.017
Ash (%)	6.81[a]	6.64[b]	5.77[d]	5.90[c]	0.014
Dry Matter (%)	90.64[c]	90.50[b]	91.15[a]	91.07[b]	0.016
Gross Energy (Kcal/g)	4.30	4.20	4.11	3.85	0.001

a-d means treatments in a raw with different superscripts are significantly different (P<0.05). SEM= Standard Error of Mean

Table 3: Growth performance of broiler birds fed raw *leucaena leucocephala* seeds meal-based diets.

Parameters	T_1 (0%)	T_2 (2.5%)	T_3 (5%)	T_4 (7.5%)	SEM
Initial weight (g/ bird)	350	350	350	350	0.00
Final Weight (g/bird)	2010.00[b]	2030.00[a]	1766.67[c]	1750.00[d]	31.14
Weight gain (g/bird)	1660.00[b]	1680.00[a]	1416.67[c]	1400.00[d]	31.4
Daily weight gain (g/bird)	39.52[b]	39.99[a]	33.73[c]	33.33[d]	0.74
Feed intake (g/bird)	4100.00[a]	3978.33[b]	3708.67[c]	3636.17[d]	34.04
Daily feed intake (g/bird)	97.62[a]	94.72[b]	88.31[c]	86.81[d]	0.88
FCR	2.47[c]	2.37[d]	2.61[b]	2.62[a]	0.20
Mortality	0.00	0.00	0.00	0.00	0.00

a-d means treatment in a row with different subscripts are significantly different (P<0.05). SEM = Standard Error of Mean; FCR = Feed Conversion Ratio

Table 4: Cup-parts of broiler chickens fed raw *leucaena leucocephala* seeds meal-based diet**.**

Parameters	T_1 (0%)	T_2 (2.5%)	T_3 (5%)	T_4 (7.5%)	SEM
Live weight (g/ bird)	1993.33[b]	2006.67[a]	1761.67[c]	1728.33[d]	8.33
Dressed Weight (g/bird)	1783.33[b]	1816.67[a]	1583.33[c]	1540.00[d]	23.63
Dressed (%)	89.44[b]	90.52[a]	89.40[c]	88.53[d]	0.66
Thigh (g)	12.14[d]	14.78[a]	14.58[b]	14.39[c]	0.99
Drumstick (%)	13.07[b]	14.43[a]	10.54[d]	12.39[c]	0.96
Breateut (%)	25.36[b]	29.45[a]	23.77[c]	23.16[d]	1.49
Backcut (%)	15.88[b]	20.27[a]	14.74[c]	13.91[d]	0.51
Wingcut (%)	10.41[b]	11.11[a]	8.42[d]	9.07[c]	0.92

productive and more economical considering the above parameters especially when prime parts (drumstick, thigh and breast-cut) are considered.

Table 5 shows organ yields of broiler chickens fed raw *Leucaena leucocephala* seeds meal. There were significant differences (P<0.05) for the values obtained. The values for the liver and gizzard for T_3 (5%) and T_4 (7.5%) inclusions of raw *Leucaena leucocephala* seeds meal were higher than those of T_1 (0%) and T_2 (2.5%). This suggests that there was no toxicity problem with diets T_1 and T_2 (Diarra *et al*., 2015). The higher values observed in T_3 and T_4 for liver and gizzard could be due to the increased activity of the organs especially liver to detoxify toxins thereby leading to increase in their weights (Adetola *et al*., 2012); Hanif *et al*., 2008; Ologhobo *et al*.,1993).

The lower performance of birds on T_3 (5%) and T_4 (7.5%) on all the parameters considered is not unconnected with the effects of anti-nutritional factors especially mimosine in the raw *Leucaena leucocephala* seeds meal leading to deleterious effects on the birds. The observation in this study shows that inclusion of raw *Leucaena leucocephala* seeds meal at 2.5% did not have any deleterious effect on the birds placed on it; but rather gave highest performance hence increase in their organ weights.

Table 6 shows haematological indices of broiler birds fed raw *Leucaena leucocephala* seeds meal. There were significant differences (P<0.05) for the parameters measured with the exception of hemoglobin (Hb). The values for the RBC, PCV, WBC, MCV, fell within the normal range of haematological indices for broiler chickens as reported by Mitruka and Rawnsley (1977), Ross *et al.* (1978); Howlett (2000) and Banerjee (2007). The low values of MCH and MCHC for treatments T_3 (5% and T_4 7.5%) inclusions, indicate the effect of the ant-nutritional factors. This also confirms the uneconomical and unprofitability of raw *Leucaena leucocephala* to quantitatively replace soybean meal above 2.5% dietary level of inclusion.

There were significant differences (p<0.05) for all the parameters measured. The values for creatinine, alkaline phosphatase and urea for T_3 and T_4 diets were higher (Table 7). These higher values suggest poor quality

Table 5: Organ yields of broiler chickens fed raw *leucaena leucocephala* seeds meal- based diet.

Parameters	T_1 (0%)	T_2 (2.5%)	T_3 (5%)	T_4 (7.5%)	SEM
Liver (%)	2.81^c	2.75^d	3.32^b	3.95^a	0.11
Gizzard (%)	1.81^c	1.75^d	2.32^b	2.95^a	0.10
Heart (%)	0.52^c	0.49^d	0.62^a	0.59^b	0.02
Spleen (%)	0.26^d	0.29^b	0.33^a	0.27^c	0.02
Kidney (%)	0.53^d	0.56^c	0.67^b	0.69^a	0.02
Proventriculus (%)	0.50^d	0.55^c	0.688^a	0.61^b	0.66
Intestine (%)	8.03^d	10.08^b	11.95^a	9.48^c	1.16

a-d means treatment in a row with different subscripts are significantly different (P<0.05). SEM = Standard Error of Mean

Table 6: Haematological indices of broiler birds fed raw *leucaena leucocephala* seeds meal- based diet.

Parameters	T_1 (0%)	T_2 (2.5%)	T_3 (5%)	T_4 (7.5%)	SEM
RBC (x 10^6 mm)	3.54^a	3.50^b	3.30^c	2.72^d	0.05
PCV (%)	38.56^c	38.55^a	37.82^b	31.84^d	0.39
Haemoglobin (g/dl)	10.90	10.55	9.34	9.32	0.16
WBe(x 10^6 mm)	25.40^c	26.35^b	23.65^d	27.45^a	0.0
Neutrophils (%)	40.00^a	29.50^d	39.50^b	38.50^c	0.75
Lymphocytes (%)	48.50^c	49.50^b	49.60^a	45.50^a	0.65
Monocytes (%)	4.80^a	4.33^a	4.80^a	4.33^c	0.39
Easinophilis (%)	2.50^b	3.00^c	2.50^d	2.77^a	0.19
Basophils (%)	1.50^b	1.00^c	0.80^d	2.00^a	0.51
MCV (μm^3)	101.02^d	121.21^c	137.43^b	148.03^a	0.41
MCH (pg)	30.15^a	29.50^b	27.32^c	23.82^d	0.25
MCHC (%)	34.40^b	35.30^a	32.80^c	25.82^d	1.20

SEM	Stand Error of Mean
RBC	Red Blood Cell
WBC	White Blood Cell
MCV	Mean Corpuscular Volume
WBC	White Blood Cell
MCV	Mean Corpuscular Haemoglobin
MCHC	Mean Corpuscular Haemoglobin Concentration

Table 7: Blood chemistry of birds fed raw *leucaena leucocephala* seeds meal-based diet..

Parameters	T_1 (0%)	T_2 (2.5%)	T_3 (5%)	T_4 (7.5%)	SEM
Total protein (g/dl)	3.36^b	3.15^c	3.45^a	3.14^d	0.23
Albumin (g/dl)	2.01^d	2.10^a	2.03^b	2.02^c	0.31
Globulin (g/dl)	1.35^b	1.05^d	1.42^a	1.12^c	0.25
Creatinine (mg/dl)	1.66^d	1.67^c	1.75^b	1.8^a	0.35
Alkaline					
Phosphatase (g/dl)	65.05^d	65.23^c	67.53^b	68.53^a	0.87
Urea(mg/dl)	10.37^d	10.43^c	12.72^b	13.45^a	0.52

a-d treatment means in a row with different subscripts are significantly different (P<0.05). SEM = Standard Error of Mean

protein of those diets due to the greater presence of deleterious anti-nutritional factors (Eggum 1990 Ologhobo *et al*. (1993). Values for total protein, albumin and urea for T_2 (2.5% inclusion fell within the normal range as reported by Mitrua and Rawnsley (1977)); Ross *et al.* (1978) Howwlett (2000), Thrall (2007) and Murray *et al.* (2006). This further points to the use of 2.5% inclusion of raw *Leucaena leucocephala* seeds meal as a preferable level of inclusion.

Table 8 shows the economics of production of broiler birds fed raw *Leucaena leucocephala* seeds meal-based diet. Cost of feed consumed decreased progressively from T_1 -T_4; T_4 being the least as dietary inclusion levels of raw *Leucaena leucocephala* seeds meal increased from 2.5 -7.5% respectively. The progressive decrease in price of feed consumed could be attributed to the low cost of the substituted feed ingredient *Leucaena leucocephala* seed meal which was ₦80/kg as compared to soybean meal whose cost was ₦154/kg. So, the higher the increase of *Leucaena leucocephala* seeds meal, the lower the cost of feed consumed. T_2 (2.5%) had the overall advantage of having the highest weight gain as compared to other birds on the other treatments. This is in agreement with the works of Olajide, (2012); Onu *et al*. (2011).

Correspondingly, the revenue and the gross margin or the profitability/ bird on 2.5% were highest. From the economic perspective, considering the cost/kg weight gain, weight gain, revenue and gross margin, birds on T_2

Table 8: Economics of production of chickens fed raw *leucena leucocephala* seeds meal-based diets.

Parameters	T_1 (0%)	T_2 (2.5%)	T_3 (5%)	T_4 (7.5%)	SEM
Cost/kg feed/bird(₦)	155.04	153.05	151.05	149.06	0.00
Cost of feed consumed/bird (₦)	635.67[a]	608.89[b]	552.42[c]	551.85[d]	5.62
Cost/kg weight gain/bird (₦)	382.94[c]	362.59[d]	390.25[b]	394.82[a]	9.08
Cost of production/bird (₦)	635.66[a]	609.09[b]	551.33[c]	550.33[d]	5.55
Revenues/bird (₦)	1660.00[b]	1680.00[a]	1406.16[c]	1381.33[d]	24.94
Gross margin/bird (₦)	1031.04[b]	1071.11[a]	900.83[c]	832.01[d]	25.09

a-d means treatment in the same raw, not followed by the same letter are significantly different (P<0.05) from one another.

(2.5%) inclusion of raw *Leucaena leucocephala* seeds meal based diets proved to be most superior (best) among the birds than the other treatments, thereby making T_2 (2.5%) the most preferred diet and economically superior diet among others.

Conclusion

The investigation on the effect of raw *Leucaena Leucocephala* in the diet of broiler chicken has been found to be safe, most productive and most profitable at 2.5% inclusion; not at 5% and 7.5% inclusion and hence 2.5% inclusion of raw *Leucaena leucocephala* is recommended in the diet of broiler chickens.

REFERENCES

Abdullali, A. U, Suleiman, S and Garba S. (2014). Carcass characteristics and organ weight of finisher broiler chickens fed soaked Bamkera groundnut (Vigia subleromeum) seed meal as a source of protein. roc. of 39th Conf. Nig. Proc. for Anim Prod. 16-19 March, 2014. Babecock Univ-Ilosha-Remo, Ogun State, Nigeria.

Adetola, O.O; Sajo, A.P, Ogunwole, O.A and Omojola A.B(2012). Growth, Careass characteristics and organ weight of broiler chickens fed toasted Sesame seed (Sesomum indicam) Linn based diets. Proceeding of 17th Animal Science Association of Nigeria 9-13 Abuja.

Akinmutim, A.H; Onyekwodiri, EO; Ibe, S.N and Onwudike O.C. (2009). Response of broiler birds fed diets containing raw Sword bean meal in place of Soybean meal (Starter phase). Agricultural Journal 4(1):1-9.

Akinmutimi, A.H, and Iboro, U.A (2012). Performance of weaner pigs fed graded levels of Yam and Sweet potato peel meal in place of maize based diet. Proceedings of 17th Animal Science Association of Nigeria 9-13, Abuja.

Alikwe, P.C. N., Tuagha, B. (2013). Performance of Broiler Chicks fed varying replacement levels of Alchornea cordifolia leaf meal for Soy bean. Proceedings 38th Conference, Nigerian Society of Animal Production 17th -20thMarch, Rivers State University of Science and Technology, PortHarcourt Pp. 255-257.

AOAC (1995). Official methods of Analysis 16th edu. Association of official Analytical Chemists Washington D.C.

Badson, L.A. (1965). Clinical Chemistry, 11-78.

Banerjee, G.C. (2007). A textbook of Animal Husbandry. 8th edition of Oxford and IBH Publishing Co. Pvt. Ltd. 113-134 Shahpurjat Nwe Delhi-710049.

Brewbakar, J.I. and Sorensson C.T (1990). Taxonomic classification of legume Trees In: Janick and Simon, J.E. (2nd ed.) Advances in New Crops Timber Press Portland Pp. 200-230.

Cannan, R.K. (1958). Book of Clinical Practical Chemistry. Vol. 1 Fifth Ed. Publishers and Distributors, New Delhi India Pp. 479-480.

Diarra, S.S.; Sandakabatu, D.; Perera, D.; Tabuaciri, P. and Mohammed, U. (2015). Growth performance and carcass yield of broiler chickens fed commercial finisher and Cassava copra meal leased diets. *Journal of Applied Animal Research, 43:3, 352-356.*

D'Mello, J.P.F. and Devandra, G. (1995). *Tropical Legumes in Animal Nutrition.* United Kingdom Pp.96-133.

Duncan, B. (1955). Multiple range and multiple f-test biometrics, 11:1-41. Reddy, N.R Mic. Press New York, Pp143-153.

Eggum, B.O (1990) Blood urea measurement as a technique for measuring protein quality British Journal of Nutrition. 24: 985-988.

Ekwu, U (2008). The effects of forage to concentrate rations on the performance of weaner rabbits. A project report (B. Agric) Michael Okpara University of Agriculture, Umudike, Abia State. Nigeria.

Ewa, E. (2015). Chemical and nutritional evaluation of Velvet bean (Mucuna sloane i) as protein source for broiler chickens Ph.D Thesis. Micheal Okpara University of Agriculture, Umudike, Abia State, Nigeria.

Hanif, N. O; Mohammed, G, Siddique, M. Khamum, A; Ahmed, T; Gadahai, J. A. and Karkab, G. (2008). Clinico-pathomorphological serum biochemical and histopathological studies in broilers fed Ochratoxin A and a toxin deactivate (Mycofix plus) British Poultry Science Vol. 49 No. Pp. 632 -642.

Howlett, J.C. (2000). Clinical and diagnostic procedures. In. Jamour J.H. (ed) Avian Medicine London, Harcourt Publishers Ltd Pp.28-50.

Melansho, H. Barler, L. G. and Carlson, D.M. (1987). Dietary tannins and salinary proline rich proteins: Interactions and induction and defence mechanisms. *Annual Review of Nutrition 7:423-440.*

Mitruka, B. M. and Rawnsley, H.M. (1977). *Clinical Biochemical and Haematological Reference Value in Normal Experimental Animal.* Mason Publishing Company. New York Pp.35-50.

Murray, R. K.; Bender, D. A.; Botham, K.M.; Kenelly, P.J.; Rodwell, V.W and Well, P.A. (2006). Harpers illustrated biochemistry. 28th edition. The McGraw Hill Companies. Inc. Pp. 100-150.

National Research Council (NRC) (1994). Nutrient Requirements of Poultry 9th Revised edition, National Academy Press Washington D.C. 19-26.

Obioha, F.C (1992). A guide to poultry Production in the tropics. Accna Publishers Nigeria Pp 18-35.

Ogunbode, A.A. Ogumbenro, S.D; Raji, M.O and Akinosum, A.A (2014). Proximate and photochemical composition of raw and roasted Pride of barbados seed. Proceedings of 39th conference of Nigerian Society of

Ogungowara, O. (1984). Structure, costs and rations of feed management. Training workshop Dept. of Agric Economics University of Ibadan Nigeria.

Okah, U. and Udoh, A. (2014). Performance and economic evaluation of single- and two-phase diets in broiler production. A research reports. Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria.

Olajide, R. (2012). Growth performance, carcass, haematology and serum metabolites of broilers as affected by contents of anti-nutritional factors in soaleed wild cocoyam (Colocasia esculental). Schott corn-based and diets. Asian Journal Animal Science 6(1): 23-32.

Ologhobo, A.D, Apata, A. Oyejide A and Akinpelu, R.O (1993). A comparison of protein fraction prepared from Lima beans (Phaseolus Cunatus/ in starter.) Animal Resources 4:13-30.

Onu, P.N; Madubuike, F.N; Onu, D.O and Ekenyem, B.V. (2011). Performance and Economic Analysis of broiler starter chicks fed enzyme supplemented sheep-manure based diets. ARPN Journal of

Agricultural and Biological Science, Vol.6:No.1.
Ross, DG. Christich; Holliey, W.A and Jones R.M (1978). Haematological and blood chemistry comparison values for chemical pathology in poultry veterinary Record 102:29-31.
Schalm, O.W; Jain N.C. and Qureshi, M.O. (1975). Textbook of veterinary Haematology. 2nd Edition. Lea and Febiger, Philadelphia Pp. 129-250.
Scott, M. l., Hili, N.F. Parson, E.A.Jr and Buchnes, J.A (1969). Studies on duck nutrition. Effect of dietary energy protein relationship upon growth, feed utilization and carcass composition in market dwelling. Poultry Science 38. 497-507.
Shonaiya, E.B; Williams, A.R. and Oni S.A. (1986). A biological and economic appraisal of broiler production up to 16 weeks. Journal of Animal Science Research 6(2) 112-123.
Steel, R.G.D., Torrie, H. (1980). Principles and Procedures of Statistics. A Bio metrical Approach 2nd Edn. McGraw Hill Book Co. Inc. New York (NY).
Ubak, E.E. (2012). Nutritional evaluation of raw Anthonotha macrophylla seeds meal as replacement for soybean meal in the diet of broiler chickens. Micheal Okpara University of Agriculture, Umudike, Abia State. M.Sc. Thesis Unpublished.
Udofia, S.I (2007). Status of home gardens in Akwa Ibom State. Unpublished. Ph.D Dissertation, Micheal Okpara University of Agriculture, Umudike, Abia State, Nigeria Pp.35-70.
Udosen, E. O., Ojewola, G.S. and Adedokun, O.O. (2018). Substitution value of Squilia meal for fishmeal in the diets of broiler production: Effects on growth performance, carcass and organ properties. *Nigerian Journal of Animal Production* 45(2):124-128.
Varley, H; Gowelock, A.H. and Bells, M. (1980) Determination of Serum Urea using the acetylmonoxide method. Practical Biochemistry. 5th edu. William Heinemann Medical Book, London.
Thrall, M. A. (2007). Haematogia ebioquimica clinica veterinaria. Philadelphia Lippinincolt, Williams and Wilkins, Saopaulo Roca. p .582
Tietz, N.W. (1986). Textbook of Clinical Chemistry Philadelphia, W.B. Saunders Co.