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Effect of Graded Levels of Dietary Editan (Lasianthera africana) Leaf Meal on Productivity of Broiler Chickens

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Abstract
An experiment was conducted to determine the dietary effect of Editan (*Lasianthera africana*) leaf meal (ELM) on the growth performance and carcass characteristics of broiler chickens. One hundred and five (105) day-old unsexed Ross 308 broiler chicks were used in a 56-day feeding trial. There were five dietary treatments (T1, T2, T3, T4, T5) replicated three (3) times and each had seven (7) birds per replicate with a total of 21 birds per treatment in a completely randomized designed (CRD).T1 was the control diet which had no Editan leaf meal (0% ELM), T2 contained 1% Editan leaf meal, T3 contained 2% Editan leaf meal, T4 contained 3% Editan leaf meal and T5 contained 4% Editan leaf meal respectively. The Editan leaf meal was incorporated into starter and finisher diets. Feed and water were given *ad libitum*. Results showed that at the starter phase diets had no significant (P>0.05) effect on all the parameters measured for growth performance. During the finisher phase, inclusion of Editan leaf meal up to 4% improved the final weight gain, total weight gain, daily weight gain, feed intake and feed gain ratio. Editan leaf meal up to 4% did not also show any negative effect on the breast, thigh wing, and drumstick and on the internal organs: gizzard, pancreas, heart, bile duct and large intestine. In conclusion, inclusion Editan N (*Lasianthera Africana) leaf* meal up to 4%at both the starter and finisher phases showed positive influence on productivity of broilers and recommended.
Keywords: Editan Leaf Meal; Growth performance; Internal Organs; Broiler Chickens
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1. Introduction

Poultry production in Nigeria, depending on the system adapted varies from subsistence to commercial use and has not kept pace with the rapid increase in domestic consumption. Nigeria has the second largest poultry population in Africa after South Africa (Sahel, 2015) producing 650,000 tonnes of egg and 300,000 tonnes of poultry meat in 2013 (FAOSTAT, 2017). Broilers in Nigeria are the most abundant livestock species which is reported to account for more than 60% of the total poultry population in the country (Biswas *et al*., 2011). In intensive poultry enterprise, feed is the major component cost and the ultimate challenge is to reduce cost of input to a minimum without compromising the quality of the products (Ziggers, 2011). Thus, adequate knowledge of poultry nutrition and of course micro-nutrients (vitamins and minerals) in alternative feed ingredients like leaves is imperative for good ration formulation (Adegbenro *et al.*, 2012). Vegetable-based feeds are a rich source of essential plant amino acids, vitamins and minerals. It has been established that green vegetable leaves are the cheapest and most abundant source of proteins because of their ability to synthesize amino acids from a wide range of available primary materials such as water, carbon dioxide and atmospheric nitrogen (Fasuyi, 2006).

Lasianthera africana has been reported to be fungicidal, bacteriostatic (Itah, 1996 and 1997), antidiabetic ((Ekanem, 2006) and antiplasmodial (Okokon *et al*., 2007). The leaf contains alkaloids, terpenes, saponins, tannins, flavonoids, anthraquinones and cardiac glycosides (10). The leaves of *Lasianthera africana* has been used as herbs in several generations to quench bacterial skin infections, gonorrhea and abdominal disturbance. The presence of anti-nutritional factors such as tannin, saponins,, cyanide, oxalate, phytate, etc. has been a great concern when incorporating leaf meals into broiler diets as they may negatively affect the nutrient digestibility and utilization of broiler chicks (Kagya-Agyemang *et al*., 2007; Buragohain, 2018). Some methods may be conducted to reduce the anti-nutritional factors in leaf meal. Among the methods, sun-drying has been reported to reduce the anti-nutritional factors content in leaf meal (Fasuyi *et al*., 2008). Other methods such as cooking, autoclaving, dehulling, soaking, toasting and using the anti-nutritional binding agents may also be carried out to reduce the contents of anti-nutritional factors in leaf meals (Medugu *et al*., 2012).

The plant also may have minerals such as Na, K, Ca, P, Mg, Fe and Zn, in addition to undesirable components such as Oxalates, phytate and hydrocyanic acid (HCN) (Okwu, 2001; Atangwho *et al*., 2009). The objective of this study was to determine the effect of graded levels of dietary editan leaf meal (*Lasianthera africana*) on performance and carcass characteristics of broiler chickens.

2. MATERIALS AND METHODS

2.1 Experimental Site

The experiment was carried out at the Poultry Unit of Teaching and Research Farm of the University of Uyo, Akwa Ibom State, Nigeria. Uyo is located between

latitude $4^{0}57'$ N and longitude $7^{0}53'$E with average annual rainfall of 2,190mm. The average relative humidity during the experimental period was 81%.

2.2 Editan Collection, Processing and Diet Preparation

Editan leaves were purchased from the market. The leaves were plucked and washed with clean water to remove dirt, after which it was sundried for three days (at moderate sunlight) to reduce the moisture content. The dried editan leaves were milled using a hammer mill and the ground Editan leaf was incorporated into the starter and finisher broiler diets as shown in Tables 1 & 2.

Table 1: Ingredient and nutrient composition of starter diets

Ingredients (%)	**T1 0%ELM**	**T2 1%ELM**	**T3 2%ELM**	**T4 3%ELM**	**T5 4%ELM**
Maize	51.0	51.0	51.0	51.0	51.0
SBM PKC ELM	30.0 10.20 —	30.0 9.20 1.0	30.0 8.20 2.0	30.0 7.20 3.0	30.0 6.20 4.0
Fish meal	4.0	4.0	4.0	4.0	4.0
Bone meal	4.0	4.0	4.0	4.0	4.0
Salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.20	0.20	0.20	0.20	0.20
Methionine	0.10	0.10	0.10	0.10	0.10
Premix	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00
Calculated Nutrient Content (%)					
Crude protein	22.84	22.86	22.87	22.89	22.91
Ether extract	3.57	3.52	3.47	3.41	3.36
Crude fibre Ash	4.58 3.63	4.56 3.66	4.53 3.69	4.51 3.73	4.49 3.76
Energy Kcal/ME/kg)	2836.00	2814.71	2860.10	2872.15	2884.20

**Premix supplied per Kg starter diet: vitamin A 15,000 IU., vitamin D3 13,000 IU., thiamine 2mg, riboflavin 6mg, pyridoxine 4mg, cobalamin 0.05mg, biotin 0.08mg, choline chloride 0.05g, manganese 0.096g, zinc,0.06g, iron 0.024g, copper 0.006g, iodine 0.014g, selenium 0.24mg, cobalt 0.024mg and antioxidant 0.125g. SBM = Soybean Meal, ELM = Editan Leaf Meal, PKC=Palm kernel cake*

Table 2: Ingredient and nutrient composition of finisher duets

Ingredients(%)	**T1 0%ELM**	**T2 1%ELM**	**T3 2%ELM**	**T4 3%ELM**	**T5 4%ELM**
Maize	53.0	53.0	53.0	53.0	53.0
SBM PKC ELM	27.0 14.15 —	27.0 13.15 1.0	27.0 12.15 2.0	27.0 11.15 3.0	27.0 10.15 4.0
Fish meal	2.0	2.0	2.0	2.0	2.0
Bone meal	3.0	3.0	3.0	3.0	3.0
Salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

Calculated Nutrient Content (%)

Energy kcal/ME/kg Crude protein	2873.25 21.20	2885.30 21.22	2897.35 21.23	2909.40 21.25	2921.45 21.27
Ether extract	3.81	3.76	3.74	3.65	3.60
Crude fibre Ash	5.13 3.35	5.11 3.36	5.08 3.39	5.06 3.42	5.04 3.45

**Premix supplied per Kg finisher diet: vitamin A 10,000. IU., vitamin D3 12,000 I.U., vitamin E 20 I.U., vitamin K 2.5mg, thiamine 2.0mg, riboflavin 3.0 mg, pyridoxine 4.0mg, niacin 20mg, cobalamin 0.05mg, pantothenic acid 5.0mg, folic acid 0.5mg, biotin 0.08mg, choline chloride 0.2mg, manganese 0.006g, zinc 0.03g, copper 0.006g, iodine0.0014g, selenium 0.24g, cobalt 0.25g and antioxidant 0.125g. SBM - Soybean Meal, ELM-Editan Leaf Meal, PKC - Palm Kernel Cake*

2.3 Experimental Treatment and Design

One hundred and five (105) day- old unsexed broiler chicks of Ross 308 were used. There were five dietary treatments (T1, T2, T3, T4 and T5) each having 21 birds and each treatment was replicated three times with 7 birds per replicated on a completely randomized design (CRD).The birds on arrival to the farm were weighed using a sensitive weighing balance to obtain the initial weight. The birds were managed in deep litter pens during the brooding and the rearing phases. Glucose and multivitamins solution were given to the birds to reduce stress and thereafter, they were allotted to the various treatment groups. T1 was the control diet without editan leaf meal, T2 contained 1% editan leaf meal, T3 contained 2% editan leaf meal, T4 contained 3% editan leaf meal and T5 contained 4% editan leaf meal. Starter feed was given from 1-4weeks and finisher from5-8weeks. The experiment lasted for 56 days. Feed and water were given *ad libitum*

2.4 Data collection and statistical analysis

The daily feed intake was recorded at the end of the week and average daily feed intake was recorded. Weekly live body weight was measured and average daily live weight calculated. These values were used to obtain the feed intake per bird per day, total weight gain, weight gain per bird per day and feed to gain ratio.

At the end of the experiment, three birds with average mean weight from each of the treatment were slaughtered, immersed in hot water (60^{o}C) for 30 seconds their feathers were plucked and their abdomen were opened and their internal organs removed and thereafter were cut into different cut parts. Each internal organ and the cut parts were weighed and the cuts parts weight expressed as percentage of their dressed weight while internal organs were expressed as percentage of live body weight.

Data collected from the growth performance of broiler chickens fed dietary levels of editan leaf meal were subjected to analysis of variance (ANOVA) in a Completely Randomized Design according to Steel and Torrie (1980) using SPSS software 20.0 where significant effects were separated using the Duncan Multiple Range Test (Duncan, 1955).

3 RESULTS

The effect of graded levels of dietary Editan Leaf Meal (ELM) on growth performance of starter broiler chicks is shown in Table 3. Diets had no Significant effect (P>0.05) on all the parameters measured for growth performance at this phase of production. Inclusion of ELM up to 4% in the diet did not have negative effect on the growth indices.

Table 3: Effect of graded levels of dietary Editan (*Lasianthera africana)* leaf meal on growth performance of starter broiler chicks.

PARAMETERS	T1 (0% ELM)	T2 (1% ELM)	T3 (2% ELM)	T4 (3% ELM)	T5 (4% ELM)	SEM
Initial weight(g)	32.00	34.00	34.00	32.00	32.00	4.18
Final live weight(g)	697.35	701.35	665.82	625.10	689.25	36.68
Daily gain(g)	28.41	28.65	27.05	25.02	28.16	1.63
Total feed intake (g)	1592.36	1615.88	1547.84	1486.80	1528.80	45.67
Daily feed intake(g)	56.87	57.71	55.28	53.10	54.60	2.46
Feed gain ratio	2.01	2.02	2.04	2.12	1.94	0.06
Daily protein intake(g)	12.98	13.19	12.64	12.15	12.51	0.56
Protein efficiency ratio	2.18	2.16	2.14	2.05	2.26	0.22

abc. Means along the same row with different superscripts are significantly (P<0.05) different SEM = Standard Error of Mean, ELM =Editan Leaf Meal

The dietary effects of graded levels of Editan Leaf Meal on finisher broilers is presented in Table 4. Diets did not significantly (P>0.05) influenced the total feed intake, daily feed intake, feed gain ratio, daily protein intake and protein efficiency ratio but final live weight and daily weight gain were significantly (p<0.05) affected by diets. Inclusion 0f editan leaf meal up to 4% in the finisher broiler diet significantly (P<0,05) influenced the final live weight and daily weight gain. Also higher values were recorded for total feed intake, daily feed intake, daily protein intake and protein efficiency ratio for birds fed 4% editan leaf meal.

Table 4: Effect of graded levels of dietary Editan (*Lasianthera africana)* leaf meal on growth performance of finisher

PARAMETER	T1 (0% ELM)	T2 (1% ELM)	T3 (2% ELM)	T4 (3% ELM)	T5 (4% ELM)	SEM
Initial weight(g)	697.35	701.35	665.82	625.10	689.25	36.68Ns
Final live weight(g)	2466.67^{b}	2583.33^{ab}	2436.67^{b}	2303.33^{b}	2886.00^{a}	120.14
Daily weight gain(g)	63.19^{b}	67.21^{ab}	63.24^{b}	59.94^{b}	78.24^{a}	4.13
Total feed intake	3942.68	3935.68	3973.76	3731.00	4155.48	78.34
Daily feed intake(g)	140.81	140.56	141.92	133.25	148.41	5.76
FCR(g)	2.24	2.09	2.25	2.23	1.92	0.13
Daily protein intake(g)	29.85	29.83	30.13	28.32	31.57	1.22
PER(g)	2.13	2.26	2.09	2.12	2.47	0.14

broilers.

abc. Means along the same row with different superscripts are significantly (p<0.05) different SEM = Standard Error of Mean, ELM = Editan Leaf Meal

Table 5 shows the effect of graded levels of dietary Editan leaf meal on cut parts of finisher broiler chickens. Diets significantly (P<0.05) influenced all the parameters except the dressing percentage, wing, breast and back cut which were not significantly (P>0.05) affected by the diet. Inclusion of editan leaf meal up to 4% resulted to a higher live weight, dressed weight and drumstick weight than the control group.

Table 5: Effect of graded levels of dietary Editan (*Lasianthera africana)* leaf meal on cut parts of finisher broiler chickens.

PARAMETERS	T1 (0%ELM)	T2 (1%ELM)	T3 (2%ELM)	T4 (3%ELM)	T5 (4%ELM)	SEM
Live weight (g)	2566.67^{ab}	2433.33^{b}	2600.00^{ab}	2600.00^{ab}	2800.00^{a}	98.88
Slaughter weight (g)	2433.33^{ab}	2300.00^{b}	2466.67^{ab}	2466.67^{ab}	2666.67^{a}	90.67
Dressed weight (g)	1957.37^{ab}	1867.37^{b}	$20f11.50^{ab}$	1926.00^{ab}	2138.50^{a}	66.14
Dressing percentage (%)	76.00	76.00	77.00	74.00	77.00	0.04
Wing (%)	10.32	10.34	10.13	9.71	10.10	0.26
Breast(%)	32.18	30.27	35.79	33.25	31.98	1.66
Back cut (%)	20.69	19.49	19.86	21.62	18.38	1.16
Drumstick (%)	11.78^{c}	13.59^{b}	13.09^{bc}	13.05^{bc}	16.50^{a}	0.51
Thigh (%)	14.79^{b}	14.13^{b}	13.61^{b}	16.11^{a}	12.11^{c}	0.36

abc. Means along the same row with different superscripts are significantly (p<0.05) different. SEM = Standard Error of Mean. ELM = Editan Leaf Meal

The effect of graded levels of dietary Editan Leaf Meal (*Lasianthera africana)* on the internal organs of broiler chickens is shown in Table 6. Significant differences (P<0,05) were recorded in the percentage weight of lung, proventriculus, liver, kidney, pancreas, bile ducts, gizzard, small intestine and the large intestine. No significant (P>0.05) differences were recorded in the percentage weight of spleen and heart. Dietary inclusion of editan leaf meal up to 4% resulted to higher secretion of bile and higher weights of the heart, gizzard and the large intestine indicating that editan leaf meal is safe and was not detrimental to the internal organs.

Table 6: Effect of graded levels of dietary Editan leafmeal(*Lasianthera Africana)* internal organs of broiler chickens.

PARAMETER	T1 (0% ELM)	T2 (1% ELM)	T3 (2% ELM)	T4 (3% ELM)	T5 (4% ELM)	SEM
Lung	0.55^{ab}	0.65^{a}	0.41^{b}	0.46^{b}	0.49^{ab}	0.05
Proventriculus	0.56^{ab}	0.51^{ab}	0.46^{ab}	0.57^{a}	0.42^{b}	0.04
Spleen	0.33	0.11	0.09	0.20	0.10	0.11Ns
Heart	0.39	0.49	0.48	0.47	0.50	0.03Ns
Liver	1.78^{a}	1.60^{ab}	1.39^{c}	1.66^{ab}	1.45^{bc}	0.07
Kidney	0.20^{ab}	0.26^{a}	1.77^{ab}	0.09^{b}	0.12^{b}	0,03
Pancreas	0.16^{b}	0.18^{a}	0.19^{b}	0.29^{a}	0.19^{b}	0.01
Bileduct	0.06^{b}	0.16^{a}	0.18^{a}	0.15^{a}	0.16^{a}	0.02
Gizzard	3.07^{abj}	2.48^{b}	2.45^{b}	3.29^{a}	3.24^{a}	0.21
Small intestine	1.39^{b}	1.02^{c}	1.29^{bc}	1.93^{a}	1.31^{bc}	0.10
Large intestine	1.86^{bc}	2.30^{a}	1.68^{c}	1.88^{bc}	2.03^{b}	0.08

abc. Means along the same row with different superscripts are significantly (p,0.05) different. SEM = Standard Error of Mean. ELM= Editan leaf meal.

4 DISCUSSION

Generally, the primary benefit of forage consumption is that plant matter is typically high in both vitamins and minerals. Besides the vitamins and minerals, forages also contain components such as fiber, protein, energy (calories) and other compounds like carotenoids and omega-3 fatty acids that are important for metabolic functions in poultry (Esonu *et al*., 2003). Editan (*Lasianthera africana*) serves as excellent forage in poultry diet. The non-significant effect of diets on growth performance of starter broilers when *editan leaf meal* was added up to 4% could probably be due to the presence of bioactive components in leaf meal which improve growth performance of broiler chicks. The result was in line with findings of (Mariana *et al*., 2018; Mustafa, 2019) who reported that leaf meals increased the production and activities of digestive enzymes as well as improved the intestinal morphology (villi development) of broilers resulting in improved nutrient digestibility and utilization. The inclusion of Editan leaf meal at the different graded levels enhanced the growth performance of the birds as recorded in the final weight gain, total weight gains and daily weight gain. The above findings agreed with previous reports that the improvement of intestinal microbial ecosystem, immune responses and physiological conditions of chicks may also be attributed to the increased growth rate in broilers fed with leaf meals (Rahman and Yang 2018; Mustafa, 2019). Editan leaf meal is therefore safe for inclusion in broiler starter diet.

During the finisher phase, the feed intake of birds fed editan leaf meal were not affected by the up to 4% inclusion level and this may be due to the particular variety (afia variety) which was used in the study. The feed gain ratio for 4% ELM inclusion recorded the least feed gain ratio and was the best which indicated that birds adequately utilized the feed and this could be due to the bioactive compounds of editan leaf meal like flavonoids and alkaloids. Phytochemical screening of *Lasianthera africana* revealed the presence of alkaloids, terpenes, flavonoid and anthraquinones (Okokon *et al.,*2007).The higher values recorded for total feed intake, daily feed intake, daily protein intake and protein efficiency ratio for birds fed 4% editan leaf meal could be attributed to the fact that green vegetable leaves are the cheapest and most abundant source of proteins because of their ability to synthesize amino acids from a wide range of available primary materials such as water, carbon dioxide and atmospheric nitrogen as reported by (Fasuyi, 2006).Although, (Tewe, 1991) reported that high fibre content and presence of anti-nutritional factors are major factors limiting the utilization of leaf meals generally in poultry. This result shows that the use of *Lasianthera africana* (editan leaf meal) up to 4% did not pose any effect on growth performance of finisher broilers. This result is also in line with (Agbede and Aletor, 2003) who stated that Leaf meals from tropical legumes, browse plants and shrubs is among the possible feed ingredient that can be included in formulation of ration for poultry.

On the cut parts, the result in Table 5 affirms that Editan leaf meal inclusion up to 4% did have any adverse effects on the carcass quality which in turn will ensure sustainable meat production.

The weights of the gizzard of other editan leaf meal inclusion levels were the same as control. This suggests that inclusion of editan leaf meal in the diet did not impair the breaking of feed in the gizzard for proper

digestion. The control group recorded the highest liver weight than the groups that consumed editan leaf meal. This shows that their liver was not enlarge due to the consumption of editan leaf meal. The small intestine was larger in 3% editan leaf meal and the smallest was recorded for birds in 1% editan leaf meal. Meanwhile, the large intestine was larger in 1% and 4%, but smaller in 2% and control. The above results are in accordance with Atteh, (2004), who stated that the weight of organs in broilers reflects the anatomical response of birds to the type of diet consumed.

5. CONCLUSION

Feeding of 4% editan leaf meal (*Lasianthera africana)* did not adversely affect the growth performance of broiler chickens. Furthermore, the cut parts and the internal organs of the birds were not also affected negatively by the inclusion of editan leaf meal up to 4% level in the diet. It is imperative to know that editan leaf meal *Lasianthera africana) is* rich in some nutrients and can take advantage of these nutrients by including it in starter and finisher broiler diets up to 4% whenever palm kernel cake is very expensive. It is therefore recommended and could be an ideal practice for optimum broiler performance.

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REFERENCES

Adegbenro, M., Ayeni, A. O., Olowoyeye, J.O., Onibi, G.E. and Aletor, V.A. (2012). *Leaf composite mix as alternative premix to commercial premix in broiler finisher diets.* Pp. 1-4.

Agbede, J.O. and Aletor, V.A. (2003). Comparative evaluation of weaning foods from *Glyricidia* and *Leucaena* leaf protein concentrates and some commercial brands in Nigeria. *Journal of the Science of Food and Agriculture,* 84 (1): Pp. 21-30.

Atangwho, I. J., Ebong, P. E., Eyong, E. U., Williams, I. O., Eteng, M. U. and Egbung, G. E. (2009). Comparative chemical composition of leaves of some antidiabetic medicinal plants: *Lasianthera africana, Vernonia amydalina* and *Gongronema latifolium. Afr. J. of Biotech.,* 8 (18): Pp. 4685-4689.

Atteh, J.O. (2004). Theory and practice of poultry production. Adlek printers. Pp. 2-4; 112-117.

Biswas, A, Ahmed, M., Bharti.,V.K. and Singh, S.B. (2011). Effects of anti-oxidants on physico-chemical and haematological parameters in broiler chicken at high altitude. *AsianJournal of animal science*, 24: Pp. 246.

Buragohain, R. (2018). Growth performance, nutrient utilization, and feed efficiency in broilers fed *Tithonia diversifolia* leaf meal as substitute of conventional feed ingredients. *Mizoram.Veterinary World*, 9: Pp. 444-449.

Duncan, D. B. (1955). Duncan's Multiple Range Test. Biometrics 11: Pp. 1- 42.

Ekanem, A. (2006). Antidiabetic activity of ethanolic leaf extract and fractions of *Lasianthera africana* on alloxan diabetic rats

Esonu, B.O., Iheukwumere, T.C., Iwuji, F.C., Akanu, N. and Nwugo, O.H. (2003). Evaluation of *Microdesmis puberula* leaf meal as feed ingredientin broiler starter diets. *Nig. J. Anim. Prod.*, 30: Pp. 3-8.

FAOSTAT. Food and Agricultural Organization of the United Nations. (2017). http://www.fao.org/statistics/en/

Fasuyi, A.O. (2006). Nutritional potentials of some tropical vegetable leaf meals: chemical characterization and functional properties. *African journal of Biotechnology*, 5 (1): Pp. 049-053.

Itah, A. Y. (1996). Screening of plants part for fungicidal properties. *Trans Nig Soc Bio Conserv,* 4 (**1**): Pp. 26-40.

Itah, A. Y. (1997). Bactericidal and Bacteriostatic effect of edible leafy vegetable extract on growth of canned food borne bacteria. *Trans Nig Soc Bio Conserv*, 6: Pp. 103-111.

Kagya-Agyemang, J. K., Takyi-Boampong, G., Adjei, M. and Karikari-Bonsu, F. R. (2007). A note on the effect of *Gliricidia sepium* leaf meal on the growth performance and carcass characteristics of broiler chickens. *Journal of Animal and Feed Science*, 16: Pp. (104-108).

Mariana, R. A., Cecilia, J. P., Carlos, J. W., Jesús, R. G, Alejandro, Á. E. and David, S. C. (2018). Inclusion of the Moringa oleifera leaf on immunological constants in broiler chickens. *Abanico Veterinario,* 8: Pp. 68-74.

Medugu, C. I., Saleh, B., Igwebuike, J. U. and Ndirmbita, R. L. (2012). Strategies to improve the utilization of tannin-rich feed materials by poultry. *International Journal of Poultry Science*, 11: Pp. 417-423.

Mustafa, M. A. G.(2019). Effect of eucalyptus leaf and its supplementation with diet on broiler performance, microbial and physiological statues to alleviate cold stress. *Iraqi Journal of Agricultural Science*, 50:Pp. 953-963.

Okokon, J. E., Antia, B. S. and Essiet, G. A. (2007). Evaluation of invitro antiplasmodial activity of ethanolic leaf extract of *Lasianthera africana. Res. J. pharmacol.*, 1(2): Pp. 30 -33.

Okwu, D. E. (2001). Evaluation of the chemical composition of indigenous spices and flavoring agents. *Glob. J.*

Pure Appl. Sci., 7(**3**): Pp. 455– 459.

Rahman, M. M. and Yang, D. K.(2018). Effects of Ananas comosus leaf powder on broiler performance, haematology, biochemistry, and gut microbial population. *Revista Brasileira de Zootecnia*, 47.

Sahel. (2015). An assessment of the Nigerian poultry sector. http://sahelcp.com/wp-content/uploads/2016/12/SahelNewsletter-Volume11.pdf

Steel, R.G. and Torrie, H. (1980). Pricipal and Procedure of Statistics. A biometric approach (2nd Ed.) Mc Graw Hill Book Inc. New York.Pp.67-78.

Tewe, O.O. (1991). Detoxification of cassava products and effect of residual toxins on consuming animals. Pp. 16.

Ziggers, D. (2011). Optimising nutrient density in a volatile market. *All about feed*, 2 (3): Pp. 18-21.