Nutritional Evaluation of Phytogenic Feed Additives on Hematology and Serum Biochemical Parameters of Broiler Chickens

[1]Maidala, A. and [2]Abdullahi, I. B.
[1]Vocational and Technology Education,
Abubakar Tafawa Balewa University, P.M.B. 248, Bauchi,
Bauchi State
[2]College of Education kangere, Bauchi State.
Nigeria
Corresponding author: aminumaidala@yahoo.com

Abstract
An experiment was designed to evaluate the effect of some herbal plant extracts additives as alternatives growth promoters on hematology and serum biochemical parameters of broiler chickens.Three different phytogenic plants were collected i.e. Azandiracta indica, Gueiria senegalensis and Commiphora kerstingii were sundried and grounded into powder form and their extracts were fed to broilers with synthetic antibiotics fed as control diet. One hundred day old broiler chicks were randomly allotted to four treatments which constitute Azandiracta indica, Guerra senegalensis and Commiphora kerstingii with control diet without phytogenic plant. Each of the treatment was replicated five times (five birds per replicate) in a completely randomized design (CRD). At the end of eight weeks experiment hematological and serum biochemical evaluation were carried out. Results showed that there were significant differences in PCV(30.21-32.90%), creatine (5.00-9.00mg/dl), glucose (11.71-15.50mg/dl), ALAT (14.05-41.03), ASAT (21.40-27.52), ALP (26.74-61.34) and total protein (21.24-35,00g/dl). It was concluded that phytogenic leaf extracts can be fed to broilers without deleterious effects on hematology and serum biochemical parameters. However commiphora kerstingii leave extracts was more effective.

Keywords: *Broiler chickens, Phytogenic plants, Azandiracta indica, Guerra senegalensis, Commiphora kerstingii*

Introduction

Animal nutritionists in Nigeria have generally agreed that poultry production is the fastest means of bridging the protein deficiency gap prevailing in the country (Maidala and Istifanus, 2012). Poultry meat is an important source of nutrients as it contains all the essential amino acid, fatty acids, vitamins, minerals especially selenium, iodine, phosphorus, potassium, iron and zinc. The vitamins and minerals present in poultry meat help to boost the immune system, digestion and metabolism, strengthen bones and skin, build, maintain and repair body tissues (Atteh, 2002). Antibiotics were routinely used in broiler diets at low than therapeutic doses as to improve bird's performance (Kim *et al*., 2008). This practice derives from observations made since 1946, that incorporation of antimicrobial growth promoters improved feed efficiency in intensive poultry production (Peterolli *et al*., 2012). The use of antibiotics in poultry feed as growth promoter and for health maintenance can cause drug resistance bacteria and antibiotic residue effects (Wray

and Davies, 2000). There was a ban on the use of all antibiotics and chemotherapeutic drugs as growth promoters in the European Union on Jan 1st 2006, this ban has caused increase in the search for alternative growth promoters. Plant active principles are chemical compounds present in the entire plant or in specific part of the plant that confers them therapeutic activity or beneficial effects (Martins *et al*., 2000). Heamatological parameters both in human and animal sciences are important indices in physiological state of individuals (Khan and Zapper, 2005: Maidala et *al*., 2014). Blood in animal's body serves as a medium of transporting nutrients absorbed from the digestive system or released from storage in adipose tissues or in liver. The blood picture changes with advancement of animal with age and with certain conditions such as nutrition. The heamatological parameters which are of significant diagnostic values include the packed cell volume (PCV), hemoglobin (Hb), total protein (TP) and Serum globulin (SG) are known to affect health, production and adaptability to environmental conditions in livestock (Medugu *et al.*, 2010: Adenkola *et al.*, 2009: Adenkola *et al*., 2011).Therefore, researches have been directed towards natural antimicrobial products as indispensable resources (Ferrini, 2008). Phytogenic feed additives are the plant derived products used to improve performance of livestock and poultry (Windisch *et al*., 2008 and Jacela *et al*., 2010). They comprise of a wide variety of herbs, spices and products derived thereof and are mainly essential oils. This class of feed additives is at present used to a great extent as alternatives to the antibiotic growth promoters in poultry and swine nutrition. Natural products of plant origin like spices, herbs and many plant extract can be considered as alternative to antibiotics as growth promoters in improving broiler performance (Hernandez *et al*., 2004). Spices and herbs of various plants extract have appetizing and digestion stimulating property and antimicrobial effects. Abdulmanan (2012) concluded that herbs are valuable substitutes for health and nutrition in poultry industry. They can stimulate feed intake, the endogenous secretion, or may have antibacterial or anticoccidial activities. A wide range of plant metabolites that belong to class isoprene derivatives, flavonoids and a large number of these compounds may act as antibiotics and antioxidants (Shin, 1995). As an alternative of antibiotic medicinal plants like garlic, ginger, neem, *Guerra senegalensis* and *Commiphora kerstingii* etc are the most popular option for growth promoters ((Elangovan *et al*., 2000: Esonu *et al*. (2006) Hanus *et al*., 2005: Goji *et al*., 2009: Somboro *et al*, 2011). Different parts of plants, their extracts viz. oil, leaves, bark, seed, roots and other vegetative parts etc. have been experimentally used in poultry as a growth Promoters. Certain herbal formulations have showed encouraging results reported significant improvement with respect to weight gain, feed efficiency, lowered mortality and increased livability in poultry birds. Nigeria is blessed with vast resources of herbal plant that can be used as growth promotants, plants like neem (*Azandiracta indica*), *Guerra senegalensis* and *Commiphora kerstingii* are throughout the savanna regions of Nigeria. This study was undertaken to compare the efficacy of commercial herbal growth promoter with phytogenic plants on the hematology and serum biochemical parameters of broiler chickens.

Materials and Methods

The experiment was conducted at Poultry Research Center of School of Undergraduate Studies, College of education, Azare, Bauchi state. Katagum local government is situated in the northern part of Bauchi state, Nigeria. It is located between latitudes 11^0 42' and 11^0 40' and longitude 10^0 31' and 10^0 11' east (Anon, 2009). It shares common boundary with Itas/Gadau local government in north west, Jama'are to the west, Dambam to the east, Misau to the south west, Giade to the south and Shira to the southwest (Azare, 2013). It has a landmass of 1,120 square

kilometers (NPC, 2009). The climate of the study area is controlled by the inter tropical convergent zone (ITCZ) which is marked by the rainy and dry season. The major climate elements that influence the climate of the study area and affecting the farming system are temperature and precipitation (rainfall), the annual temperature ranged between 22-33^0 C from April to May (Bashir *et al*.,2001). The mean annual rainfall ranged between 615.6-985mm with peak between July- Augusts. The study area is in the Sudan savanna, the vegetation is greatly determined by the nature of the soil. The soil in the study area is aerosol with sandy and loamy sand texture and a high percolation rate. One hundred (100) Anak 2000 day old chicks (DOC) were used for this research work. Before the arrival of the chicks, the pens were cleaned, washed and disinfected with antiseptic liquid (Dettol). Three days to the arrival of the chicks to the pens after brooding fresh dry saw dust was spread on the floor to serve as litter material. Two days before the arrival of the day old chicks, the brooding pen was arranged. Heat and light sources were provided using 200 watts electric bulb but in case of electric failure, a rechargeable lantern and a kerosene stove were used to supply light and heat for the chicks. The birds were vaccinated with Gumboro and Lasorta vaccine at the required age of vaccination.

Phytogenic plants leaves i.e. *Azandiracta indica*, *Guerra senegalensis* and *Commiphora kerstingii* were harvested fresh and subjected to manual extraction. Exposure to sunlight was avoided to prevent the loss of active components. The leaf extract was obtained by cutting one kilogram of fresh leaves each of the phytogenic plants, the leaves were separated from the stalk, washed, drained, chopped and pound in a mortar. After which, it was further squeezed with hand to get the deep green extract which was filtered with filter paper to obtain a homogenous extract. The different phytogenic plants leaf extracts were add to the drinking water of the birds at 5% per liter each of water respectively as their level of inclusion (0ml liter of water) served as the control. The experimental diets include; treatment 1 control (0% medicinal plant, keprocyl is given in drinking water), treatment 2 (neem leaves extract), treatment 3 (*Guerra senegalensis* leaves *extract*) and treatment 4 (*Commiphora kerstingii* leaves extract). Formulated broiler starter and finisher were given to the birds at the starter and finisher respectively. The diets were isocaloric and isonitrogenous .The percentage composition of the experimental diets is shown in Table 1 and 2 for broiler starter and finisher respectively. After the brooding period for one week (7 days) the chicks were weight and assigned to 4 experimental treatments. Each of the treatment was replicated five times in a completely randomized design (CRD).

At the end of the experiment 2ml of blood was collected through the wing veins using disposables syringes and needles. It was done in the morning to avoid excessive bleeding. The blood samples were collected into sample bottles one with out and one with dipotassium salt of ethylene diamine tetra acetic acid which served as anticoagulants. Hematological indices were estimated using standard procedures (Jain, 1986) for its hemoglobin, red blood cells (RBC), packed cell volume (PCV) and white blood cells (WBC) contents as described by Makinde *et al*. (1991), Mafuvadze and Erlwanger (2007) and Tripathi *et al*. (2008). Others such as mean corpuscular haemoglobin (MCH), mean corpuscular volume (MCV) and mean corpuscular haemoglobin concentration (MCHC) were obtained by calculation according to standard formulae (Schalm *et al*., 1975 and Jain, 1986) as shown below:

$$MCV = \frac{PCV \times 10}{\text{RBC count (m 106/mm3)}}$$

$$MCH = \frac{Hb\ (g/dl) \times 10}{}$$

RBC (m106/mm3)

$$MCHC = \frac{Hb\ (g/dl) \times 10}{PCV}$$

All the data obtained were subjected to analysis of variance for completely randomized design (Steel and Torrie, 1980) using Mini tab analysis software. Where statistical significance was observed, the means were compared using the Duncan's New Multiple Range Test (Duncan's 1955).

Results and discussion

Table 1 and 2 showed the percentage composition of the experimental diets for broiler starter and finisher respectively and the crude protein and Metabolizable energy were adequate for broiler chickens in the tropics (Aduku, 2004). The hematological and serum biochemical parameters were presented in Table 3, results showed that pack cell volume was affected by the different phytogenic plants ($P<0.05$) with commiphora leaves having higher values and the values slightly increases in diets containing phytogenic plants were fed confirming with the earlier reports of Ewuola *et al*., 2014 who reported an increase in packed cell volume of rabbits fed growth promotants. The hemoglobin was not affected by the different medicinal plants ($P<0.05$) and this concords with reports of Onu *et al*., 2015 on broilers fed natural feed additives. The hemoglobin values were slightly higher than those reported by Obiokanu *et al*., 2011 (8.40-9.17) who fed aqueous neem leaf extract to broilers. Urea was not detected in the diets except in commiphora leaves accompanied by high level of creatine ($P<0.05$), this suggest that proteins were adequate for the diets. The different phytogenic plants decreases slightly the serum glucose level ($P<0.05$), this is at variance with the findings of Liukkonen-Anttila, 2001 who reported an increase in blood glucose level on broilers fed leaf meals. The decrease in Aspartate aminotransferase (ASAT) in the control diet ($P<0.05$) to the phytogenic plants showed that the phytogenic plants leaf extract can be fed at 5% to broilers without a deleterious effects, higher level of ASAT indicates presence of toxin or poisons in the heart and liver. ASAT is found in appreciable quantities and forms in the heart and liver. It is the serum enzyme that shows the functioning of the heart and liver, when hepatic cell are damaged. ALAT (Alanine transaminase and ALP (aspartate transaminase) were depressed in the different medicinal plants indications that the liver and heart are working normally without toxicity (Allelo and Mays, 1998: Stewart, 1990). Higher values indicated toxicities (Iyayi, 2001). ALAT is found principally in the liver with only small amounts being present in other organs. When there is liver cell damage, the serum or plasma level of both ASAT and ALAT raised tremendously. Albumins and cholesterol were lower values indicating effective utilization of different meals and this concurred with the results of Osho *et al*. (2016) in broiler chickens. The cholesterol is lowest on plants fed commiphora leaves and values were lowered compared to earlier reports of Uzochukwu *et al*., 2015. From the result of this experiment, it can be concluded that phytogenic leaf extracts can be fed to broilers without deleterious effects in hematology and serum biochemical parameters. *Commiphora kerstingii* leave extracts was more effective.

Table 1: Percentage composition of experimental diets fed to broiler starter age 1-5 weeks of age

Parameters	**Control 1**	**Neem leaves 2**	**Guairá leaves 3**	**Commiphora leaves 4**
Maize	42.35	42.29	42.29	42.29
soyabean	41.75	40.31	40.31	40.31
Medicinal plant	00.00	1.50	1.50	1.50
Wheat offal	10.00	10.00	10.00	10.00
Fishmeal	2.00	2.00	2.00	2.00
Bone meal	3.00	3.00	3.00	3.00
Sodium chloride	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
Vitamin mineral premix*	0.25	0.25	0.25	0.25
Total	**100.00**	**100.00**	**100.00**	**100.00**
Calculated analysis (%)				
Crude protein	23.00	23.00	23.00	23.00
Metabolizable energy	2809	2807	2808	2800
Crude fibre	6.25	6.45	6.32	6.45

* Each kilogram contains; vit. A, 10,000,000 IU, vit. D3 2,000,000 IU, Vit. E 23,000mg, Vit. K3 2.000mg, Vit, B1 1,800mg, Panthothenic Acid 7,500mg, Vit. B6 3,000mg, Vit. B12 15mg, Folic acid 750mg, Biotin 11260mg, Choline Chloride 300,000mg, Cobalt 200mg, Copper 3,000mg, Iodine 1,000mg, iron 20,000mg, Manganese 40,000mg, Selenium 200mg, Zinc 30,000mg, Antioxidant 1,250mg

Table 2: Percentage composition of experimental diets fed to broiler finisher age 5-8 weeks of age

Parameters	**Control 1**	**Neem leaves 2**	**Guerra leaves 3**	**Commiphora leaves 4**
Maize	58.71	58.71	58.71	58.71
soyabean	22.29	22.29	22.29	22.29
Medicinal plant	00.00	1.50	1.50	1.50
Wheat offal	15.00	15.00	15.00	15.00
Fishmeal	5.00	5.00	5.00	5.00
Bone meal	3.00	3.00	3.00	3.00
Sodium chloride	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
Vitamin mineral premix*	0.25	0.25	0.25	0.25
Total	**100.00**	**100.00**	**100.00**	**100.00**
Calculated analysis (%)				
Crude protein	**20.00**	**20.00**	**20.00**	**20.00**
Metabolizable energy	**2860**	**2865**	**2862**	**2840**
Crude fibre				

*Each kilogram contains Vit A 3600, 000 IU. Vit. D3 600.000 IU. Vit E 4.000.000mg. Vit B1-

B6 640, 1600, 600, 4.00mg. Panthothenic acid 2000mg, Biotin 300mg. Manganese 16000mg. Manganese 16000mg. Selenium 80mg. Vit. K3 600mg. Cobalt 80mg. Copper 1200mg. Zinc 12,000mg. Folic acid 200mg. Choline chloride 700000mg. Antioxidant 500mg.

Table 10: Blood parameters of broilers fed different phytogenic feed additives (1-8 weeks of age)

Parameters	**Control 1**	**Neem leaves 2**	**Guerra leaves 3**	**Commiphora leaves 4**	**SEM**
Packed cell volume (%)	30.21	31.41	31.06	32.90	*2.32
Haemoglobin (g/dl)	10.56	10.98	11.21	13.16	NS
Red blood cell (10^6/mm/^{3})	2.92	2.83	2.56	2.98	NS
Mean corpuscular volume (fl)	103.46	110.99	122.77	110.40	NS
Mean corpuscular haemoglobin (pg)	36.16	38.80	43.79	44.16	NS
Mean corpuscular haemoglobin concentration (%)	3.50	3.50	3.61	4.00	NS
Urea (mg/dl)	0.00	0.00	0.00	1.00	* 1.00
Creatine (g/dl)	5.00	6.00	5.00	9.00	*4.21
Glucose (mg/dl)	12.50	12.41	15.50	11.71	*2.61
ALAT	41.03	18.05	20.05	14.05	*25.78
ASAT	27.52	21.40	21.82	23.50	* 3.56
ALP	29.70 [c]	26.74 [d]	40.26 [b]	61.34 [a]	* 14.60
Protein (g/dl)	35.00 [a]	28.05 [a]	21.24 [b]	22.11 [b]	*10.56
Albumin	15.05	14.02	12.07	12.00	*3.27
Total cholesterol (mg/dl)	2.51	2.61	2.61	2.03	NS

*= (P<0.05), SEM=Standard error of means, NS= Not significant

References

Abdulmanan, C., N., Khan S, Qureshi, M. S., Altaf-Ur-Rehman & Jan, B. (2012). Effect of Periodic supplementation of herbal infusion on the liver function and lipid profile of broiler chicken. *Sarhad Journal of Agriculture*, **28**(1):75-82

Adenkola, A.Y. and Ayo, J.O. (2009). Effect of ascorbic acid on rectal temperature fluctuations In indigenous turkeys during hot dry season. *International Journal of Poultry Science* **8** (5):457-461

Adenkola, A.Y., Idoga, E.S. and Tughgba, T. (2011).Comparative assessment of erythrocyte Osmotic fragility and heamatological parameters of broiler and local chicken during the Hot –dry season in Makurdi, Nigeria. Proceedings of 36th Annual Conference of Nigerian Society of Animal production. University of Abuja, Nigeria. Pp 117-119

Aduku, A.O. (2004). Animal Nutrition in the Tropics. Feeds and feeding, Pasture management, Mon gastric and ruminant Nutrition. Typeset by Davcon computers and business bureau. 11 Baptist church road Samaru, Zaria, Nigeria.

Allelo, S.E. and Mays A. (1998). The Merck's Veterinary Manual. 8th edition. Merck and Co. Inc; Whitehouse station. N.J. Amaefule, K.U. and Obioha F.C. (2001). Performance and nutrient utilization of broiler starter diets containing raw, boiled or dehulled pigeon seeds

(Cajanus Cajan). *Nigerian Journal of Animal Production* **28**(1): 31-39.

Atteh, J. O. (2002). Principles and Practice of Livestock Feed Manufacturing. Adlek printers, Ilorin p.137.

Anonymous (2009). Mapsofworld. Com. Available at http://www.mapsofworld.com /Nigeria/cities/azare/html mapXL inc. 10s third street Suite 310 San Jose.

Azare, I.M. (2013).Evaluation of farmer's response strategies to climate change in Katagum Local government area of Bauchi state. *Journal of Environment Technology and Sustainable Agriculture* **2** (10):26-33

Bashir, M.M., Bala, A., Mohammed, I.T., Isa, H.J., Adamu, M.B., Hamisu, M.S., and Abdullahi, A. (2001).Request for the creation of Katagum state out of the present Bauchi state of Nigeria. A memorandum submitted to the speakers, House of Representatives, national assembly, Abuja, Nigeria pp 1-28.

Duncan, D.B. (1955), "New Multiple Range Test". Biometry, 11: 1 – 48.

Elangovan, A.V., Verma, S.V.S., Sastry, V.R.B. and Singh, S. (2000). Effect of feeding neem (Azadirachta indica) kernel meal on growth, nutrient utilization and physiology of Japanese quails (Coturnix coturnix japonica). *Asian-Australia Journal of Animal Science*, **13**: 125-128.

Ewuola, E.O,Omoniyi, B.A. and Omotoso, J.O. (2014).Growth indices, haematological and serum biochemical response of weaned rabbits fed growth promotants. *Nigerian Journal of Animal Production.* **41**:60-70

Esonu, B.O., Opara, M.N., Okoli, I.C., Obikaonu, H.O., Udedibie, C and Iheshiulor, O.M (2006).
Physiological response of laying birds to neem leaf meal based diets; body weight organ characteristics and hematology. *Outline Journal of Health and Allied Science* **5**: 26-30.

Ferrini, G., Baucells, M. D.., Esteve- Garcia, E. & Barroeta, A. C. (2008). Dietary polyunsaturated fat reduces skin fat as well as abdominal fat in broiler chickens. *Poultry Science* **87**: (3) 528-535.

Goji, A.D.T., Dikko, A.A.U., Bakari, A.G., Mohammed, A. and Tanko, Y. (2009). Evaluation of the Effect of Aqueous-ethanolic Stem Bark Extract of Commiphora Africana on Blood Glucose Levels of Alloxan Induced Diabetic Wistar Rats. *Asian Journal of Medical Sciences* **1** (2): 18-21.

Hanus, L.O., Rezanka, T., Dembitsky, V.M. and Moussaieff, A. (2005). Myrrh— Commiphora, chemistry. *Biomedical Paper* **149**: 3–28.

Hernandez, F., Madrid, J., Gargia, V., Orengo J., & Megias, M.D. (2004). Influence of two plant extracts on broiler performance, digestibility and digestive organ size. Poult. Sci., 83: 169-174.

Iyayi, E.A. (2001). Cassava leaves as supplement for feeding weaner swine. *Tropical Animal Production Investigation* **4**: 141-150.

Jacela, J.Y., Frobose, H.L., DeRouchey, J.M., Tokach, M.D., Dritz, S., Good, R.D.(2010). Amino acid digestibility and energy concentration of high-protein corn dried distillers grains and high-protein sorghum dried distillers grains with solubles for swine. J Anim Sci 2010;**88**:3617–23

Jain, N.C.(1986) Veterinary Hematology. 4th edition. Baillere, Tindall 1986; 297.

khan, T.A. and Zafar, F. (2005). Heamatological study in response to varying doses of estrogen in broiler chicken. *International Journal of Poultry Production* **4**(10):748-751

Kim, S. W. , Fan, M. Z. & Applegate, T. J. (2008). Nonruminant nutrition symposium on natural phytobiotics for health of young animals and poultry : mechanism and application. *Journal of Animal Science*, **86**:138-139.

Liukkonen-Anttila J (2001). Nutritional and genetic adaptation of gallitorns birds: Implications for hand rearing and resticking. Acanic Dissertation, Faculty of Science, University of Oulu, Oulu Yilopisto, Finland. Retrieved September 17, 2007 from http://herkulesoulu.fi/isbn951425990index.html

Mafuvadze, B. and Erlwanger, K.H. (2007). The effect of EDTA, heparin and storage on the erythrocyte osmotic fragility, plasma osmolality and haematocrit of adult ostriches (Struthio camelus). *Veterinarski Arhiv*. **77**(5), 427-434

Maidala, A. and Istifanus, J.A. (2012). The role of micro livestock in alleviating protein deficiency and poverty reduction in Nigeria. Proceedings of 2nd National conference of school of vocational and technical education, College of Education Azare. Bauchi state (Eds) Dantata, I.J., Maidala, A. and Garba, A.R.

Maidala, A., Doma, U.D. and Egbo, L.M.(2014). Heamatological and serum biochemical indices of broiler chickens fed differently processed African locust bean seeds (*Parkia biglobosa*). Nig. Soc. for Anim. Prod. 16 - 19 March, 2014. Babcock Univ. Ilishan-Remo, Ogun State, Nigeria.

Martins E.R, Castro D.M, Castellani DC, Dias J.E (2000). Plant as medicinal. Viçosa, MG: UFV 20

Makinde, M.O., Otesile, E.B. and Fagbemi, B.O. (1991). Studies on the relation between energy levels and the severity of Trypanosoma brucei infection: The effect of diet and infection on blood plasma volumes and erythrocytes osmotic fragility on growing pigs. Bulletin of Animal Health and Production in Africa 31, 161- 166.

Medugu, C.I., Kwari, I.D., Igwebuike, J., Nkama,, I., Mohammed, I.D. and Hamaker, B. (2010).Carcass and blood components of broiler chickens fed sorghum or millet as replacement for maize. *Agriculture and Biology Journal of north America.*1(3):326-329

National Population Commission (2006).National Population Commission Bulletin.

Obikaonu, H.O., Okoli, I.C., Opara, M.N., Okoro, V.M.O., Ogbuewu, I.P, Etuk, E.B. and Udedibie, A.B.I. (2011). Haematological and serum biochemical indices of starter broilers fed neem (Azadirachta indica) leaf meal. Online Journal of Animal and Feed Research Volume 1, Issue 4: 150-154 (2011)

Ogbuewu, I.P., Okoli, I.C. and Iloeje, M.U. (2009). Effect of neem (Azadirachta indica) leaf meal on serum metabolite profiles of male rabbits. Revista UDO Agrícola 9(4), 986-991

Osho, I.B. Morakinyo, J.K. and Awoniyi, T. A.M. (2016). Effect of inclusion of two medicinal plant extract on commercial feed on broiler chicken performance. *Vom Journal of Veterinary Science* 11: 2016: 45 -57

Onu, P.N., Uguru, J.O., Onutu, S.E., Obianwuna, U.E. and Aniebu, A.O. (2015).Effect of allium cepa and allium sativum on th performance and heamatology indices of broiler starter. Proceedings of 20th bAnnual Conference of Animal Science Association of Nigeria. 6-10 Ibadan. Pp 436-440

Peterolli, T. G., Albino, L. F. T., Rostango, H .S. , Gomez, P. C. , Tavernari, F. de C. & Balbino, E. M. (2012). Herbal extracts in diets for broilers. Revista Brasileria de Zootechnica. **41**(7):1683-1690.

Schalm OW, Jain NC, Carrol E. 1975. Veterinary haematology 3 rd Edition Lea and Febiger, Philadelphia USA. p. 160 – 210.

Shin, L., Pelly, H. P. & Kripke, M. L. (1995). Use of Aloe vera yoghurt for acid production, ` viscosity, sensory properties and quality retention. J. Invest. Dermat. 102(2):197-204.

Somboro, A.A., Patel, K. Diallo, D., Sidibe, L., Chalchat, J.C., Figueredo, G., Ducki, S., Yves Troin, Y. and Pierre Chalard, P. (2011 Faculté des Sciences et Techniques, Université de Bamako, Bamako, Mali. (2011). An ethno botanical and Phytochemical study of the African medicinal plant Guiera senegalensis J. F. Gel *Journal of Medicinal Plants Research* **5**(9), pp. 1639-1651, 4 May, 2011

Steel, R. G.D. and Torrie, J.H. (1980). Principles and Procedures of Statistics, 2nd Edition published by McGraw Hill books Co. New York, USA.

Stewart, M. (1990).Animal physiology . first edition . pp 129. Tottenham court road London.

Toshi Wati, A , Tapan, K. Ghosh, A , Basharat Syed, B , Haldar, S. (2015). Comparative efficacy of a phytogenic feed additive and an antibiotic growth promoter on production performance, caecal microbial population and humoral immune response of broiler chickens inoculated with enteric pathogens. Animal Nutrition 1 (2015) 213–219

Tripathi MK, Mondal D, Karim SA. 2008. Growth, haematology, blood constituents and immunological status of lambs fed graded levels of animal feed grade damaged wheat as substitute of maize. Journal of Animal Physiology and Nutrition 92: 75–85. http://dx.doi.org/10.1111/j.1439-0396.2007.00712.x

Uzochukwu, I.E., Amaefule, B.C., Udeh, C.E.., Dim, C.E., Tarinipre, G. and Ezekwe, A.G. (2015). Effect of probiotics on the growth performance and serum lipid profile of finisher broilers. Proceedings of 20th bAnnual Conference of Animal Science Association of Nigeria. 6-10 Ibadan. Pp578-582

Windisch W, Schedle K, Plitzner C, Kroismayr A. Use of phytogenic products as feed additives for swine and poultry. J Anim Sci 2008;86(E. Suppl.):E 140–8.

Wray, C. and Davies, R.H. (2000). Competitive exclusion - An alternative to antibiotics. Vet. J., 59:107-108.