Growth Performance and Cost Benefit Analysis of Broiler Chickens Fed Phytogenic Feed Additives in a Semi-Arid Enviroment of Bauchi State, Nigeria

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Abstract
An experiment was designed to evaluate the effect of some herbal plant extracts additives as alternatives growth promoters for broiler chicks. 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 one week old unsex Armor broiler chicks were randomly allotted to the three dietary treatments with another treatment serving as control. Each of the treatment was replicated five times (five birds per replicate) in a completely randomized design (CRD). The birds were fed with experimental diets for eight weeks. Results showed that daily weight gain, feed conversion ratio, and mortality were affected by the different types of phytogenic plants (P<0.05) in starter phase, finisher phase and overall phase. Economics of production revealed a decrease in the cost of gains of broilers fed phytogenic plants, with least cost in Commiphora kerstingii leaves extract (₦223.88). The broiler chickens utilized all the medicinal plants like they utilize the commercial additive. It can be concluded that out of the three medicinal plants, Commiphora kerstingii gave the highest performance, it can be recommended as source feed additive for broiler production in the tropics; this will provide availability of the materials since they are sourced locally in the environment and reduce the cost of production in buying synthetic feed additives.

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). Growth promoters are chemical and biological substances which are added to poultry feed with the aim to improve the growth, improve the feed utilization, stimulation of the immune system and increased vitality, regulation of the intestinal micro-flora, reduced morbidity and mortality due to various diseases (Thomke and Elwinger, 1998) and in this way realize better production and financial results. Growth promoters are generally liver tonics which optimize hepatic functions of the birds (Mishra, 1991).

In Nigeria millions of naira is spent every year in the purchase of feed additives in the poultry industries. Therefore researches should be directed toward the use of natural phytogenic plants to reduce the cost of production in the poultry industries. Phytogenic feed additives are herbs, spices and products derived thereof and are mainly essential oils. 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 evaluate phytogenic feed additive extract on growth performance and economics of production of broilers 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, 2006). 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). The birds were weighed at the beginning and end of the experiment. Fresh, clean water and feed were supplied *adlibitum*. Data on daily feed consumption, daily weight gain, feed conversion ratio and economics of production based on the prevailing market conditions at the time of the experiment were recorded. 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 growth performance of broiler chickens fed phytogenic leaf extract as additives at the starter phase is shown in Table 3. Results showed daily

weight gain, feed conversion ratio and feed efficiency ratio were affected across the treatments (P<0.05). Birds on control diet performed better at the starter phase (P<0.05), this can be attributed to the inability of the broiler chicks to utilize the phytogenic leaf extract. The growth performance of broiler chickens fed phytogenic leaf extract as feed additives at the finisher phase is shown in Table 4. Results showed daily feed intake, daily weight gain, feed conversion ratio and mortality were affected across the treatments (P<0.05). The phytogenic feed additives improve performance and the livability of the experimental birds. Debnath *et al*., 2014 have reported that natural feed additives improve performance and reduce mortality of broiler chickens. The overall performance of broilers fed phytogenic leaf extract as feed additives is shown in Table 5. Results showed that daily feed intake, daily weight gain, feed conversion ratio and mortality were better (P<0.05) in birds fed phytogenic feed additives than those in control diet. These findings reaffirmed the previous reports of Jacela *et al*., 2010 and ToshiWati *et al*., 2015 that phytogenic feed additives improve performance of livestock and poultry. Highest feed intake was on broilers fed *commiphora kerstingii* (82.52g) (Table 5) similar increase in feed intake of broiler chicken supplemented with leaf extract of *Allium sativum* (Sultan *et al*., 2009) and aqueous extract of *Zingiber officinale* (Rajab *et al*., 2013). Highest body weight gain (38.73g) was obtained on broilers fed neem leaves extract which is statistically similar with other phytogenic leaf extracts but better than the control diet (P<0.05). The results of present study are in agreement with the findings of (Farman *et al*., 2009) who reported increase in weight gain of broilers chicken was observed when fed with extract of *Trigonella foenum graecum.* The overall feed conversion ratio was better on birds fed *Commiphora kerstingii* leaves extract (2.39), these results agree with the earlier reports of Abdel-Azem, 2006; Ademola *et al*., 2009 who reported improve in feed conversion efficiency of broiler chicken when fed with *Allium sativum* and *Zingiber officinale* supplemented diets respectively. The economics of production is shown in Table 6. Results showed that total feed cost was lowered at birds fed phytogenic leaf extracts than the control diets. The cost of gain followed the same trend being lowered in birds fed phytogenic leaf extracts, with the lowest value in birds fed *Commiphora kerstingii* (₦ 223.88).

Conclusion and recommendations

It can be concluded that the phytogenic plants improve the performance of broiler chickens. It can be recommended that out of the three phytogenic plants, *Commiphora kerstingii* leaf extract gave the highest performance, it can be used as source feed additive for broiler production in the tropics; this will provide availability of the materials since they are sourced locally in the environment and reduce the cost of production in buying synthetic feed additives.

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

Parameters	**Control 1**	**Azandiracta leaves 2**	***Guerra* leaves 3**	***Commiphora kerstingii* leaves 4**
Maize	42.35	42.35	42.35	42.35
Soyabean	41.75	41.75	41.75	41.75
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	2809	2809	2809
Crude fibre	6.25	6.25	6.25	6.25

* 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**	**Azandiracta leaves 2**	***Guerra* leaves 3**	***Commiphora kerstingii* leaves 4**
Maize	58.71	58.71	58.71	58.71
Soyabean	22.29	22.29	22.29	22.29
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**	**2860**	**2860**	**2860**
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 3: Growth performance of broilers fed phytogenic leaf extract at the starter phase (1-5 weeks of age)

Parameters	**Control 1**	**Azandiracta leaves 2**	***Guerra* leaves 3**	***Commiphora kerstingii* leaves 4**	**SEM**
Initial weight (g)	106.23	106.50	105.90	106.67	0.06NS
Final weight (g)	955.19	855.22	936.94	881.15	0.54NS

Daily feed intake (g)	57.66	57.84	57.84	57.57	0.18NS
Daily weight gain (g)	31.32	26.74	29.68	27.06	*4.60
Feed conversion ratio	1.84	2.17	1.94	2.14	*0.59
Feed efficiency ratio	0.55	0.46	0.52	0.48	0.09NS
Mortality	0	0	0	0	NS

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

Table 4: Growth performance of broilers fed phytogenic leaf extract at the finisher phase (5-8 weeks of age)

Parameters	**Control 1**	**Azandiracta leaves 2**	***Guerra* leaves 3**	***Commiphora kerstingii* leaves 4**	**SEM**
Initial weight (g)	955.19	855.22	936.94	881.15	0.54NS
Final weight (g)	1050 [c]	1200.00 [b]	1350.00 [a]	1450.00 [a]	*150.20
Daily feed intake (g)	106.70	108.67	107.03	107.13	1.87NS
Daily weight gain (g)	42.15 [b]	38.88 [b]	46.56 [a]	46.63 [a]	*4.78
Feed conversion ratio	3.03 [b]	3.12 [b]	2.80 [a]	2.64 [a]	*1.22
Feed efficiency ratio	0.43	0.44	0.52	0.57	*1.34
Mortality	0.50	0.25	0.25	0.00	*0.51

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

Table 5: Overall performance of broilers fed phytogenic leaf extract (1-8 weeks of age)

Parameters	**Control 1**	**Azandiracta leaves 2**	***Guerra* leaves 3**	***Commiphora kerstingii* leaves 4**	**SEM**
Initial weight (g)	106.23	106.50	105.90	106.67	NS
Final weight (g)	1050.00 [c]	1200.00 [b]	1350.00 [a]	1450.00 [a]	*150.20
Daily feed intake (g)	71.29 [b]	82.38 [a]	82.38 [a]	82.52 [a]	*10.87
Daily weight gain (g)	34.69 [b]	38.73 [a]	36.38 [a]	36.85 [a]	*2.34
Feed conversion ratio	2.63 [a]	2.77 [b]	2.49 [a]	2.39 [a]	*0.50
Feed efficiency ratio	0.49	0.45	0.52	0.52	*1.20
Mortality	0.50 [b]	0.25 [a]	0.25 [a]	0.00 [a]	*0.50

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

Table 6: Economic analysis of broilers fed phytogenic leaf extract (1-8 weeks of age)

Parameters	**Control 1**	**Azandiracta leaves 2**	***Guerra* leaves 3**	***Commiphora kerstingii* leaves 4**	**SEM**
Initial weight (g)	106.23	106.50	105.90	106.67	NS
Final weight (g)	1050.00 [a]	1200.00 [b]	1350.00 [a]	1450.00 [a]	*150.20
Daily feed intake (g)	71.29 [b]	82.38 [a]	82.38 [a]	82.52 [a]	*10.87
Daily weight gain (g)	34.69 [b]	38.73 [a]	36.38 [a]	36.85 [a]	*2.34
Feed cost (₦)	97.26	80.41	81.97	80.21	NSA

Total weight gain (kg)	1.94	2.17	2.04	2.06	NSA
Total feed cost (₦)	510.00	462.41	475.26	461.89	NSA
Feed cost/kg (₦/gain)	262.87	243.09	224.15	223.88	NSA

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

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