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Evaluation of the Dietary Inclusion of Aloe Vera as an Alternative to Antibiotic Growth Promoter in Broiler Production

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Abstract: An experiment was conducted to evaluate the effects of dietary inclusion of Aloe vera as an alternative to antibiotic growth promoter on the performance and the haematological characteristics of the broiler chickens. The experiment involved one hundred and twenty day-old Abor-Acre broiler chicks which were distributed to three treatment groups. The treatment groups comprised the following: T1 = control (basal feed), T2 = basal feed + Aloe vera, T3 = basal feed + Teramycin soluble powder (antibiotic growth promoter). Fourty day-old chicks were assigned to each treatment group in a Completely Randomized Design (CRD) and each treatment was replicated four times with each replicate having ten birds. The experiment lasted 56 days (8 weeks) during which the following parameters were collected:- initial body weight at day old, weekly body weights and body weight gains. At the end of the experiment, 8 birds were randomly collected from each experimental group and bled to obtain blood samples to determine the blood characteristics of the birds. All the data collected were subjected to analysis of variance (ANOVA) using SAS (2002) package. Results obtained indicated that body weights and body weight gains were significantly ($p>0.05$) higher in the birds fed diets containing Aloe vera supplement (T2) than the birds fed control diet (T1) but there were no significant ($p<0.05$) differences T2 and T3. With respect to the results of the haematological analysis, it was observed that while the blood characteristics of the birds in T1 did not significantly ($p>0.05$) differ from those birds in T2, there were significant ($p<0.05$) differences between the birds in T2 and T3. Based on these results, it was concluded that while those birds in T2 compared very well with the birds placed on antibiotics growth promoter (T3) in respect of growth parameters, the birds on T2 (Aloe vera supplement) showed remarkable superiority in blood characteristics over the birds in T3 (antibiotics supplement). This is an indication that Aloe vera can be used to replace antibiotics growth promoters while avoiding the development of drug resistance associated with antibiotic growth promoters.

Key words: Aloe vera, dietary inclusion, growth promoters, drug resistance, haematological parameters

INTRODUCTION

Nigeria, like many other countries belonging to the Low-Income Food Deficit Countries (LIFDC), is faced with the problems animal protein deficiency (Igene *et al*., 2007; Mmereole, 2008). For more than three decades, large scale poultry production has been identified as the fastest and the cheapest means of bridging the animal protein deficiency gap (Sonnaiya *et al*., 1977). Consequently, the poultry sub-sector in Nigeria has experienced tremendous growth in the last three decades (Ekenyem, 2007). Unfortunately poultry production in Nigeria has been inundated by certain critical problems such as lack of high quality parent-stock, stunted growth, high feed costs, diseases and absence of organized marketing channels. The major factors that can dictate the success or failure of any poultry venture include the ability to stock breeds of high genetic potentials, balanced nutrition and adequate health status. However, there is a greater need to produce high quality meat and eggs at the shortest possible time and at the lowest possible cost, hence the use of antibiotic supplements in poultry production as growth promoters. Antimicrobial agents have been used as feed supplements in poultry feeds to enhance growth. Unfortunately, in the recent years , there has been growing concern about the use of these antibiotics as growth promoters especially in broiler production due to possible development of both drug resistance, cross resistance and multiple resistance (Neu, 1992; Sinurat *et al*., 2002; Rangasamy and Kalaiarasil, 2007; Mehala and Moorthy, 2008; Abd El-Hakim *et al*., 2009). As a consequence, attempts have been made to replace antibiotics with possible alternative growth promoters such as probiotics, prebiotics and additives of plant origins such as herbs, spices and various plant extracts. A search for such alternative growth prompters has stimulated great interest on the use of herbs as feed supplement in broiler diet. Various edible herbs have studied for their antimicrobial and growth promoting abilities (Cross *et al*., 2002; Demir *et al*., 2003; Cross *et al*., 2007). The utilities of these herbs have been felt mainly in human medicine. For example, Aloe vera has been credited with several remedies such as its effect on dental health, healthy digestion, immune support, growth enhancement and repair of collagen and elastin (Ernst *et al*., 2002). However, only a little and limited

documented data are available on the effects of these herbs on broiler performance when used as feed supplement in broiler diets. Rangasamy and Kalaiarasil, (2007) conducted an experiment to evaluate the effects of *Panchagarya and Andrographis* paniculata (herb) as alternatives to antibiotics growth promoters on the haematological, serum biochemical parameters and immune status of broilers and they concluded that dietary inclusion of *A. paniculata in* the broiler diet did not only enhance growth but also improved the immune status and the overall performance of the birds. Mehala and Moorthy (2008) conducted similar experiments to evaluate the effects of dietary inclusion of Aloe vera and Curcuna longa, both separately and in their various combinations on the performance characteristics of the broiler chickens. They also concluded that those birds fed diets containing Aloe vera supplement performed significantly ($p<0.05$) better than those fed diets containing other feed supplements in most of the characteristics evaluated. This experiment was, therefore designed to test the effectiveness of Aloe vera as a growth promoter as well as to evaluate its effects on the haematological parameters and the overall performance characteristics of the broiler chickens. If the results of this experiment are positive, it is expected that the data generated will assist the farmers to cut down costs of production. This will result in the production of high quality broiler meat at affordable prices.

MATERIALS AND METHODS

The study was conducted for a period of 56 days (8 weeks) at the Teaching and Research Farm, Department of Animal Science, Delta State University, Asaba Campus, Asaba-Delta State of Nigeria. There were three diet groups:

Diet 1 (T1) : Control diet = basal feed without any feed supplement.
Diet 2 (T2) : Basal feed + 1% Aloe vera leaf powder.
Diet 3 (T3) : Basal diet + 1% Teramycin powder (antibiotic growth promoter)

All the diets were formulated to be iso-nitrogenous and iso-caloric. Aloe vera leaf powder was purchased from a local dealer on ''Forever'' products. The powder was submitted to the Laboratory to determine the nutrient and the chemical contents. The Teramycin powder was purchased from a local reputable Veterinary store. The experimental birds made up of one hundred and twenty day-old Abor-Acre broiler chickens were purchased from a highly reputable Hatchery based here in Delta State of Nigeria. On arrival, fourty birds were assigned to each of the 3 experimental diet groups in a Completely Randomized Design (CRD) and each experimental unit was further replicated four times with each replicate receiving ten birds. The birds were weighed at day old to determine the initial body weight and subsequently weighed weekly to determine the weekly body weights and body weight gains. At the of the experiment, eight birds were randomly selected from each experimental group and bled to obtain blood samples for haematological analysis. The blood samples were sent to the laboratory where the following parameters were Determined:-red Blood Cell Count (RBC), White Blood Cell Count (WBC), Haemoglobin content (Hb) and Packed Cell Volume (PCV). From these base parameters, the following parameters were calculated using the appropriate formulae:- Mean Corpuscular Haemoglobin (MCH), Mean Corpuscular Haemoglobin Concentration (MCHC) and Mean Corpuscular Volume (MCV). All the data collected were subjected to analysis of variance (ANOVA) using SAS (2002). Significant means were separated by means of Duncan's Multiple Range Test of the same package.

RESULTS

Analytic profile of Aloe vera is presented on Table 1 while the formulations of the experimental diets are presented on (Table 2a and 2b). From these tables, it can be observed that the composition of the diets shows that the diets are iso-caloric and iso-nitrogenous both in the starter and in the finisher phases. The results on the weekly body weights of the experimental birds are presented on Table 3. From the table it can be observed that during the first week of the starter phase, the birds on control diet performed significantly ($p<0.05$) better than those on the other diet groups. However, this early advantage was lost from the second week as those on diet containing Aloe vera supplement (T2) started to perform significantly ($p<0.05$) better than the birds in the other diet groups. The lead performance by the birds in T2 continued to the end of the 7^{th} week. At the end of the experiment (8 weeks), the final body weight of the birds in T2 (2775.76±41.75 g) compared favourably well with the birds in T3 (2773.35±41.35 g) but significantly ($p<0.05$) superior to the birds on control diet (T1 = 2528.26±40.25 g).

The results of weekly body weight gains of the experimental birds are presented in Table 4. The results indicate that the highest gain was recorded in week 7 during which period the birds on T3 diet group (antibiotics) had significantly ($p<0.05$) higher weight gain (603.82±6.20 g) than the other diet groups.

The results of the haematological analysis of the experimental birds are presented in Table 5. From the table it can be observed that there were significant ($p<0.05$) differences in the haematological parameters among the different diet groups. The RBC values in T2 was significantly ($p<0.05$) higher than the RBC values in T3. However, the RBC values in T1 and T2 did not differ significantly ($p>0.05$). This same trend followed in PCV, WBC, MCH, MCV and MCHC respectively.

Table 1: Analytical profile of Aloe vera leaves

Tests	Units	Minimum	Maximum	Average
Solid	%	0.75	1.5	0.9
Water	%	98.0	99.25	98.3
Glucose	mg/dl	28.0	103.0	62.5
Purine	mg/dl	0.1	5.6	2.75
Urea-Nitrogen	mg/dl	1.0	1.0	1.0
Creatinine	mg/dl	0.1	1.5	0.8
Sodium	meq/l	4.0	13.0	8.5
Potassium	meq/l	10.0	22.5	16.3
Chloride	meq/l	1.0	11.0	6.0
Co_2	meq/l	1.0	7.0	4.0
Calcium	mg/dl	19.4	48.5	34.0
Magnesium	mg/dl	3.2	4.7	3.9
Zinc	mg/dl	14.0	77.0	45.5
Phosphorus	mg/dl	0.6	0.4	0.5
Total Protein	mg/dl	0.1	0.5	0.3
Albumin	mg/dl	0.1	0.2	0.15
Globulin	mg/dl	0.0	0.1	0.05
Alkaline Phosphatase	mg/dl	1.0	5.0	3.0
Lactic Dehydrogenase	mg/dl	0.0	9.0	4.5
Amylase	mg/dl	0.0	0.2	0.1
Lipase	mg/dl	0.0	0.2	0.1
Cholesterol	mg/dl	4.0	12.0	8.0
Triglycerides	mg/dl	1.0	12.0	6.5
Iron	meq/l	3.0	30.0	16.5
B_{12}	pg/ml	141.0	403.0	272.0
Folic acid	mg/ml	2.7	20.0	11.4
Osmolarity	mOsm/kg	43.0	67.0	55.0

Table 2a: Proximate composition of the experimental diets (g)

	Treatments					
	T1		T2		T3	
Ingredients	Starter	Finisher	Starter	Finisher	Starter	Finisher
Aloe Vera Leaf Meal(ALM)			1.00	1.00	=	=
Teramycin Sol. Powder (T/M)		=	=	=	1.00	1.00
Maize	45.90	60.75	44.90	59.75	44.9	59.75
Soya Bean Meal (SBM)	40.50	30.50	40.50	30.50	40.5	30.50
Beniseed meal	5.00	5.00	5.00	5.00	5.0	5.00
Wheat offal	5.00	=	5.00	=	5.0	=
Bone meal	3.00	3.00	3.00	3.00	3.0	3.00
V/Premix	0.30	0.25	0.30	0.25	0.3	0.25
Salt	0.30	0.50	0.30	0.50	0.3	0.50

Table 2b: Calculated nutrient analysis

	Treatments					
	T1		T2		T3	
Nutrients	Starter	Finisher	Starter	Finisher	Starter	Finisher
CP (%)	23	20.44	23.02	20.00	23.21	20.04
ME (kcal/kg)	2864	2965	2786	2978	2865	2908
CF (%)	3.58	3.65	3.79	3.81	3.65	3.69
Total ash(%)	6.65	6.72	6.72	6.78	6.60	6.67
EE (%)	2.65	2.60	2.72	2.75	2.69	2.71
NFE (%)	64.68	66.65	63.80	65.63	64.64	66.24
Calcium (%)	1.07	1.12	1.12	1.09	1.18	1.07
Total Phos. (%)	0.63	0.71	0.82	0.87	0.64	0.73
Lysine (%)	1.59	1.62	1.62	1.59	1.59	1.63
Methionine (%)	0.38	0.35	0.38	0.39	0.35	0.37

Table 3: Weekly body weights of the experimental broiler chickens (g)

Age (weeks)	T1 (Control)	T2 (Aloe vera leaf meal)	T3 (Antibiotics)
Day-old	46.49±0.43	46.35±0.35	48.05±0.56
1	166.52^{a}±1.64	161.06^{c}±2.05	164.25^{b}±2.10
2	372.09^{b}±4.28	379.36^{a}±4.51	374.28^{b}±3.74
3	719.67^{b}±9.75	732.15^{a}±10.51	721.69^{b}±8.75
4	1122.16^{c}±9.95	1159.35^{a}±10.57	1142.56^{b}±10.65
5	1469.95^{b}±26.85	1499.75^{a}±26.75	1495.76^{a}±19.65
6	1856.36^{c}±27.75	1995.75±35.55	1992.54±21.66
7	2128.35^{b}±33.75	2592.35^{a}±40.25	2590.36^{a}±35.24
8	2528.26^{b}±40.25	2775.76^{a}±41.75	2778.85^{a}±39.85

^{a,b,c}Means within the same row but not sharing the same superscripts are significantly different (p<0.05)

Table 4: Weekly body weight gains of the experimental birds (g)

Age (weeks)	T1 (Control)	T2 (Aloe vera)	T3 (Antibiotics)
1	120.03^{a}±2.01	114.73^{b}±1.78	116.20^{b}±1.92
2	205.57^{c}±3.49	218.28^{a}±3.85	210.03^{b}±3.24
3	347.58^{b}±3.96	352.79^{a}±4.10	347.28^{b}±4.18
4	402.49^{c}±4.28	427.20^{a}±4.37	421.00^{b}±3.98
5	337.79^{b}±3.54	340.40^{b}±3.21	420.87^{a}±3.41
6	386.41^{c}±3.67	496.75^{a}±4.28	496.78^{a}±4.10
7	271.99^{c}±3.08	596.60^{b}±5.12	603.82^{a}±6.20
8	399.91^{a}±3.89	183.41^{b}±2.27	182.03^{b}±3.61

^{a,b,c}Means within the same row but sharing different superscripts are significantly (p>0.05)

Table 5: Haematological parameters of the experimental broilers

Parameters	T1 (Control)	T2 (Aloe vera)	T3 (Antibiotic)
RBC (x10^{6}/ml)	2.95^{a}±0.04	2.98^{a}±0.10	2.81^{b}±0.03
Hb (g/dl)	9.70^{a}±0.18	9.72^{a}±0.21	9.42^{b}±0.01
PCV (%)	29.65^{a}±0.06	29.67^{a}±0.08	27.25^{b}±0.14
MCHC (%)	37.78^{a}±0.06	37.75^{a}±0.07	33.65^{b}±0.05
MCH (pg)	35.07^{a}±0.34	35.25^{a}±0.38	33.53^{b}±0.06
MCV (fl)	9.75^{a}±0.12	9.85^{a}±0.23	8.87^{b}±0.02
WBC (x10^{6}/ml)	9.73^{a}±0.11	9.75^{a}±0.16	9.15^{b}±0.01

^{a,b,c}Means within the same row but not sharing the same superscripts are significantly different (p>0.05)

DISCUSSION

The food nutrients and other chemical constituents of Aloe vera as identified in this study (Table 1) appear to be basically in agreement with the findings of Klein and Penneys (1988). This result, however, does not agree with the observation made Reynolds (1989) who concluded that there are lots of conflicts existing in most of the documented proximate analysis of Aloe vera and therefore suggested that there is a critical need to set up a clinical experiment to isolate the main active ingredients responsible for all the medical and nutritional activities credited to Aloe vera.

The results of the body weights and body weight gains indicated that the birds in T2 performed significantly (p<0.05) better than the birds in T1. The results further showed that as a growth promoter, Aloe vera compared favourably very well with antibiotic growth promoter. These results appear to confirm the observations made by Mehala and Moorthy (2008). They observed that at 1% dietary inclusion of Aloe vera leaf meal, there was a significant (p<0.05) difference in the body weights and weight gains of birds fed Aloe vera feed supplement and those on control diet. Kumar *et al*. (2005) also obtained similar results when they compared the body weights and weight gains of birds fed on diets containing Aloe vera feed supplement and those fed on diets containing antibiotic growth promoter. The results of this study also showed that during growing phase of the birds (2-7 weeks), the birds fed on diet containing Aloe vera leaf meal (T2) had significantly (p<0.05) higher body weights than their counterparts fed on diet containing antibiotic growth promoter (T3), but both body weights equalized at the end of the experiment. It may be suggested that this significant difference observed in the body weights of the treated birds during the growing phase may due to the differential release of the growth factors by the two growth promoters, but at the end of the experiment when the final weight was taken, it appears that the cumulative release of the growth factors was the same for the different growth promoters hence their final body weights equalized.

The results of the haematological analysis indicate that there were no significant (p>0.01) differences between the birds on control diet (T1) and those on diet containing Aloe vera leaf meal (T2) in all the parameters evaluated. However, there were significant (p<0.05) differences between the birds in T2 and T3 in all the parameters evaluated. All the parameters evaluated were significantly (p<0.05) higher for birds in T2 than for birds in T3. These results, so far, indicate that dietary inclusion of Aloe vera in the broiler diets not only improved their growth rate but also improved their well-being by preserving the qualities of their blood system and improving their immune system. These results are consistent with those obtained by Rangasamy and Kalaiarasil (2007) who evaluated the effects of *Panchagavya and Andrographis paniculata* as alternatives to antibiotic growth promoter on the haematological, serum biochemical parameters and immune status of broilers. They concluded that these herbal growth promoters not only improved the growth rate of the birds but also had immunomodulatory effects on the broilers. Mehala and Moorthy (2008) also obtained similar results and concluded that Aloe vera in the diets of broilers is capable of enhancing growth as in the case of antibiotic growth promoters but unlike antibiotics it does not have any deleterious effect on the overall health status of the birds. Based on these results, it can be concluded that it is advisable to use Aloe vera leaf meal as a replacement to antibiotics growth promoter in broiler production.

REFERENCES

Abd El-Hakim, A.S., G. Cherian and M.N. Ali, 2009. Use of organic acid, herbs and their combinations to improve the utilization of commercial low protein broiler diets. Int. J. Poult. Sci., 8: 14-20.

Cross, D.E., R.M. McDevitt, K. Hillman and T. Acamovie, 2007. The effects of herbs and their associated essential oils on the performance, dietary digestibility and gut microflora in chickens from 7-28 days of age. Br. Poult. Sci., 48: 496-506.

Cross, D.E., T. Acamovie, S.G. Deans and R.M. McDevitt, 2002. The effects inclusion of herbs and their volatile oils on the performance of growing chickens. Br. Poult. Sci., 45: 533-535.

Demir, E., S. Sarica, M.A. Ozcan and M. Suicmez, 2003. The use of natural feed additives as alternatives to antibiotic growth promoters in broiler diets. Br. Poult. Sci., 44: 544-545.

Ekenyem, B.U., 2007. Effects of dietary inclusion of Ipomea ascarifolia leaf meal on the performance and organ characteristics of grower pigs. Advances in Sci. Technol., 1: 87-91.

Ernst, E., M.H. Pitler and C. Stevenson, 2002. Complementary Alternative Medicine in Dermatology. Am. J. Clinical Dermatol., 3: 341-342.

Igene, F.U., F.U.C. Mmereole and S.O. Obuh, 2007. Evaluation of antinutrtional factors in raw, boiled and roasted water yam (*Discorea alata*) for their potentials as energy source for livestock. J. Anim. Prod. Res., 19: 1-7.

Klein, A.D. and N. Penneys, 1988. Aloe vera. Am. J. Acad. Dermatol., 18: 714-720.

Kumar, M., R.S. Choudhary and J.K. Vaishnar, 2005. Effect of supplemented prebiotic, probiotic and turmeric in diet on the diet of broiler chicks during summer. Ind. J. Poult. Sci., 40: 137-141.

Mehala, C. and M. Moorthy, 2008. Production Performance of Broilers fed with *Aloe vera and Curcuma longa* (Turmeric). Int. J. Poult. Sci., 7: 852-856.

Mmereole, F.U.C., 2008. Effect of replacing groundnut cake with rubber seed meal on the haematological and serological indices of broiler. Int. J. Poult. Sci., 7: 622-624.

Neu, H.C., 1992. The crisis in antibiotic resistance. Sci., 257: 1064-1073.

Rangasamy, Mathivaan and Kaliappan Kalaiarasil, 2007. Panchagavya and Andrographis paniculata as alternatives to antibiotic growth promoters on haematological serum biochemical parameters immune status of broilers. The J. Poult. Sci., 44: 198-204.

Reynolds, J.E.F., 1989. The Extra Pharmacopeia. ed. Martindale. The Pharmaceutical Press, London. pp: 1074-1075.

S.A.S. Institute, 2002. S.A.S. Users Guide, Cary, NC., USA pp: 949.

Sinurat, A.P., T. Purwadara, M.H. Togotorop, T. Dasaribu, I.A.K. Bin tang, S. Sitompul and J. Rosida, 2002. Responses of broilers to Aloe vera bioactives as feed additives: the effects of different forms and levels of the bioactives on performance of broilers. J. ILmu. Ternak dan Veteriner, 7: 69-75.

Sonnaiya, E.B., O.A. Atumbi and A.C. Dare, 1977. An assessment of health and production costs for smallholder poultry in South Western Nigeria. In: Sustainable Rural Poultry Production in Africa. African Network for Rural Poult. Development, pp: 89-93.