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Effect of a Commercial Blend of Essential Oils and Organic Acids on Growth Performance and Liver Function of Broiler Chickens

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Abstract
Five hundred and forty (540) day old Ross broiler chicks were used in a feeding trial to evaluate the optimum levels of a commercial blend of essential oils and organic acids, Biostrong® Forte and the effects on growth and liver enzymes. The birds were randomly distributed into five treatments, each replicated thrice with 36 chicks in each replicate. T1 :control; T2, T3 and T4 had 50g, 75g and 100g Biostrong® Forte per 100kg feed respectively while T5 had Oxytetracycline. The five diets formulated and were supplied *ad libitum* to birds for 42 days. Growth parameters measured included final weight, weight gain, feed/gain ratio and feedcost/Kg weight gain. Blood samples were analysed for Alanine aminotransferase (ALT), Aspartate aminotransferase (AST) and Alkaline Phosphatise (ALP). Data obtained were subjected to ANOVA and means separated by DMRT. Final weight and weight gain were best for the 50g Biostrong® Forte per 100 Kg diet which compared with the antibiotic group. The cost of producing meat was similarly best for 50g Biostrong® Forte per 100 Kg diet, which was similar to the control. Highest cost of production was observed for the antibiotic group. Non-significant (P > 0.05) difference was observed for ALT and ALP. AST however significantly (P >0.05) differed across the treatments. The pattern of these liver enzymes in the blood of birds indicates a non-impairment in the health of the liver. It may be concluded that Biostrong® Forte, have positive and growth promoting effect on broiler chickensandtherefore can effectively replace antibiotics in broiler diets.

Keywords: Essential oils, organic acids, broiler chickens, growth performance, liver functions

Introduction

An antibiotic is any substance that can destroy or inhibit the growth of bacteria and similar microorganisms, also Antibiotics is widely known to be that chemotherapeutic agents used for the clinical management of infectious diseases in humans, plants and animals However a matter of interest is the fact that a sizeable fraction of antibiotics produced every year all over the world is used for non-therapeutic purposes. In US alone, about 24.6 million pounds of antibiotics are used in animal agriculture annually and as stated earlier a substantial portion of this is used as growth promoters and not for the treatment of infections (Oliver *et al*., 2011). The benefits of antibiotics in animal feed include increasing efficiency and growth rate, and preventing or reducing the incidence of infectious disease.

However, using antibiotics as growth promoters rather than just for therapeutic use increases emergence of antibiotic- resistant strains in these livestock and the challenge of residual antibiotics in animal products is a serious public health threat. In a 2014 study by Center for Science and Environment (CSE) found residues of multiple medically important antibiotics in chicken meat samples from Delhi. Also The CSE report estimates that by 2050, antimicrobial resistance – which includes resistance to antibiotics as well as antifungals, antivirals etc can lead to 10 million deaths per year and lost outputs worth $100 trillion globally (CSE, 2017).It is therefore important to find a way to solve this challenge and save the livestock industry as a whole andthat solution is to stop the use of antibiotics as growth promoters in animal feed.

Some promising alternatives to antibiotics that are already available commercially include Eubiotics. Eubiotics as used in the feed industry refers to agents that ensure a healthy balance of the micro-flora in the gastrointestinal tract. Feed additives such as probiotics, prebiotics, essential oils and organic acids are often referred to as Eubiotics (Jacob, 2015, Ravindran, 2016).Biostrong® Forte is a phytogenic eubiotic formulation from Delacon Nutritional Company, which is a blend of essential oils and organic acids.

The aim of this work is to evaluate the optimum levels of this commercial blend of essential oils and organic as an alternative to the conventional antibiotics used as growth promoters in broilers raised under field conditions. The specific objectives are; evaluation of the optimum level of Biostrong® Forte in broiler diet and its effect on growth performance and liver function enzymes.

Materials and Methods

Experimental site: The experiment was conducted at the Poultry Unit of Animal Science Departmental Teaching and Research farm, Ahmadu Bello University, Zaria, Kaduna State, Nigeria. Zaria is located in the Northern Guinea Savannah Ecological zone on longitude 11˚ 09′ 01.78′′N and latitude 7˚39′14.79′′E 671m above sea level. The climate is characterized by a well-defined dry and wet seasons and relatively dry with a range annual rainfall of 700-1400mm (Ovimaps, 2017).

Experimental Design and management of birds: Five hundred and forty (540) day old Ross broiler chicks was allocated to five (5) dietary treatments, each replicated three times with 36 chicks each in a completely randomized design (CRD). The birds were housed in deep litter pens and managed with all necessary routine management practices. Feed and water were provided *ad libitum* for the 42 days period of the experiment.

Experimental diets: Five diets were formulated at both the starter and finisher phases of the feeding trial and Biostrong® Forte was added as non-inclusive part of the diets as shown below.

Diet 1: 0 g Biostrong® Forte per100 Kg diet (Control)
Diet 2: 50g Biostrong® Forte per100 Kg diet
Diet 3: 75g Biostrong® Forte per100 Kg diet
Diet 4: 100g Biostrong® Forte per100 Kg diet
Diet 5: Oxytetracycline at 60g/100Kg diet

Growth study: Initial and final weights of birds were taken at the beginning and at the end of the study. Weight gain and feed intake were measured weekly while feed/gain ratio and cost per Kg gain were computed. Mortality was recorded as they occur.

Liver function test: At the end of the starter phase, 2 mls blood samples were taken from three birds per treatment into sterilised sample bottles containing no anticoagulant and taken to the Clinical Pathology Laboratory of the Ahmadu Bello University Teaching Hospital for determination of liver function enzymes; Alanine aminotransferase (ALT), Aspartate aminotransferase (AST) and Alkaline Phosphatise (ALP) according to the methods described by Lamb (1991).

Statistical analysis: All data obtained from the feeding trial were each statistically analysed using the General Linear Model Procedure of Statistical Analysis systems software package. Significant differences between treatments means were separated using Tukey Test (SAS, 2002).

Results and Discussion

The growth performance of broiler chickens fed different levels of the commercial essential oil and organic acid blend, Biostrong® Forte, is shown in table 1. Significant ($p< 0.05$) differences were observed for final live weight, weight gain, feed intake, and feed cost/Kg weight gain across the treatments. Final weight and weight gain were best for the 50g Biostrong® Forte per 100 Kg diet. This performance showed a significant improvement over birds fed the control diet and at par with the performance of birds fed tetracycline as a growth promoter. The conversion of feed to meat followed the same pattern though not with statistical significance. The blend of essential oils and organic acids therefore, have positive effects on the growth performance of broiler chickens.

Table 1: Growth performance of Broiler chicken fed different levels of commercial essential oil and organic acid blend for 42 days

Parameter	T1	T2	T3	T4	T5	SEM
Initial wt (g/b)	44.7	45.6	44.5	44.4	44.7	0.56
Final wt (g/b)	2113.2^{b}	2229.1^{a}	2083.5^{b}	2018.2^{b}	2231.4^{a}	37.35
Wt gain (g/b)	2068.5^{b}	2183.4^{a}	2038.9^{b}	1973.8^{b}	2186.8^{a}	37.40
Feed intake (g/b)	4025.8^{a}	4080.0^{a}	3900.0^{b}	3728.7^{c}	4099.7^{a}	54.71
Feed/gain ratio	1.9	1.8	1.9	1.9	1.8	0.02
Feed cost (₦/Kg)	109.2	113.1	114.1	115.1	152.7	0
Feed cost/Kg wt gain (₦/Kg gain)	208.0^{a}	207.1^{a}	213.7^{b}	212.8^{b}	280.6^{c}	2.71

Mortality	0.9	0.9	1.9	0.9	0.0	0.84

a,b,c, Means with different superscripts on the same row are significantly different (P<0.05)

This agrees with the report of Jamroz *et al.* (2003) who supplemented a wheat-barley diet for broilers with avilamycin or 150 or 300 ppm of a plant extract containing capsaicin, carvacrol, and cinnamic aldehyde and reported that theadministration of the antibiotic and the two levels of the plant extract improved body weight by 4.7, 5.4, and 8.1% and improved feed conversion by 5.8, 3.1, and 7.1%, respectively. The observation in the current research however, disagrees with the report of some other authors who conducted experiments with broilers and did not find statistical differences in the growth performance parameters of birds fed diets supplemented with different types, concentrations, or combinations of plant extracts as reported by Onimisi *et al*. (2017). The blend of essential oils and organic acids may be a superior formulation. It may also be a function of the breed of birds, quality of feedstuffs used and the environment. The cost of producing meat was similarly best for T2- 50 g Biostrong® Forte per 100 Kg diet, which was similar to the control. Highest cost of production was observed for the antibiotic group.

Table 2 shows the results of liver function tests of broiler chickens fed levels of Biostrong® Forte. Non-significant (p>0.05) difference was observed for alanine aminotransferase (ALT) and Alkaline phosphatase (ALP). Aspartate amino tranferase (AST) however significantly (p>0.05) differed across the treatments. Higher values were observed for the control, T2 and T4 and were all at par but above the values observed for T3 and T4. These differences may not be related to the growth promoters used as the control group was among the highest. These enzymes which were produced by the liver and the amounts present in the blood is indicative of the integrity of the liver. It is reported that if alanine amino tranferase (ALT) and Aspartate aminotranferase (AST) are found together in elevated amounts in the blood, liver damage is most likely present (WebMed, 2016).Thus, the pattern of these liver enzymes (AST, ALT, ALP) in the blood of birds fed levels of Biostrong® Forte indicate a non-impairment in the health of the liver and showed that the material does not impair the liver in its function. Such impairment or damage to the liver would have caused a leakage of these enzymes, leading to high levels in the blood. Thus this material (Biostrong®Forte) has no toxic or damage-causing effect on the liver.

Table 2:Liver function Enzymes of Broiler chickens fed different levels of commercial essential oil and organic acid blend at 0-42 days

Parameter	T1	T2	T3	T4	T5	SEM
AST(U/L)	36.7^{a}	35.7^{a}	34.3^{b}	40.0^{a}	30.0^{b}	2.18
ALT(U/L)	49.3	51.3	48.7	50.0	42.3	2.83
ALP(U/L)	69.7	62.7	62.3	67.7	66.3	3.68

a,b,c, Means with different superscripts on the same row are significantly different (p<0.05)

Conclusion and Recommendation

It may be concluded that Biostrong® Forte, a blend of essential oils and organic acids have positive and growth promoting effect on broiler chickens without impairing liver functions and therefore can effectively replace antibiotics in broiler diets. Farmers and feed millers can include 50g of Biostrong® Forte, a commercial blend of essential oils and organic acids in the diets of broiler chickens for optimal performance and to completely replace antibiotics as growth promoter

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