EVALUATION OF THE OPTIMUM LEVEL OF COMMERCIAL BLENDED ORGANIC ACIDS (BIOTRONIC® TOP FORTE) AS A REPLACEMENT FOR ANTIBIOTIC GROWTH PROMOTER ON THE PERFORMANCE OF GROWER PULLETS

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Abstract

This study was conducted to evaluate the efficacy of combined organic acids and their salts (Biotronic® Top Forte) as alternatives to the conventional antibiotics used in poultry production on the performance of growing pullets. Six hundred and nine (609) grower pullets were used for the study and were intensively managed. The pullets were randomly assigned into seven treatment groups in a complete randomized design and administered as 0,100,200,300,400,500g of Biotronic® Top Forte, oxytetracycline as positive control and defined as T1, T2, T3, T4, T5, T6 and T7 respectively. Results showed a significant ($p<0.05$) influence of Biotronic® Top Forte on weight gain, feed intake, feed/gain ratio, feed cost/kg gain age at 1st lay, weight of 1st egg and age at 10% lay. Birds on 500g inclusion of Biotronic® Top Forte had better weight gain (1359.83g), feed/gain ratio (3.71) and feed cost/Kg gain (₦364.92) when compared with birds on 0 inclusions, oxytetracycline and birds on other treatments. Haematological indices measured were within the normal range for healthy birds in all treatment groups. There was no mortality recorded in this study. It was concluded that Biotronic® Top Forte inclusion at 500g enhanced growth performance growing pullet from 9 weeks to 18weeks compared to birds on 0 inclusion diets, birds on oxytetracycline diets and birds on other treatments. Inclusion of of Biotronic® Top Forte at 100, 200, 300, 400 and 500g reduced the cost of production by 6.41, 8.36, 3.27, 0.00 and 12.45% respectively.

Keywords: organic acids, Biotronic® Top Forte, oxytetracycline, pullet and Haematological.

Introduction

High levels of production and efficient feed conversion are the need of the modern poultry industry, which to a certain extent could be achieved by the use of specific feed additives. Antibiotic feed additives as growth promoters have long been supplemented to poultry feed to stabilize the intestinal microbial flora, improve the general performances and prevent some specific intestinal pathology (Hassan *et al*., 2010). Young animals are highly susceptible to various stressors, including bacterial diseases, resulting in compromised growth performance and high mortality (Barton, 2000). Antibiotics have long been used at sub-therapeutical levels in swine, poultry, aquaculture and ruminant diets for better growth performance (Randrianarivelo *et al* 2010; Allen *et al.*, 2012). However, due to the emergence of microbes resistant to antibiotics which are used to treat human and animal infections, the European Commission (EC) decided to phase out, and ultimately ban (1 January 2006), the marketing and use of antibiotics as growth promoters in feed (EC Regulation No.1831/2003). There have been a significantly increased number of studies focused on searching for alternatives to antibiotics with similar antimicrobial and growth-promoting effects without inducing bacterial resistance and potential side effects to animals. Organic acids (Eckel *et al.*, 1992; De Lange *et al.*, 2010), enzymes (Bedford and Cowieson, 2012), prebiotics (Gibson *et al.*, 2004), probiotics (Musa *et al.*, 2009), antimicrobial peptide (Choi *et al*., 2013) and phytogenic compounds (Yang *et al.*, 2007; Windisch *et al.*, 2008; Randrianarivelo *et al.*, 2010; Gong *et al.*, 2014) have been widely recognized as potential alternatives to antibiotics in feed. Among these alternatives, dietary organic acids have gained greater attention because of their antimicrobial activity against pathogenic bacteria and the fact that these compounds can induce a pH reduction in the gastrointestinal tract (GIT), which can improve nutrient utilization in poultry diets (Eidelsburger *et al.*, 1992).

Organic acid treatments composed of individual acids and blends of several acids have been found to perform antimicrobial activities similar to those of antibiotics (Wang *et al*., 2009).

The European Union allowed the use of organic acids and their salts in poultry production because these are generally considered safe (Adil *et al*., 2010). The Biotronic® Top Forte combines selected organic acids and their salts with a phytochemical and the unique Biomin® Permeabilizing Complex fully utilizing a unique synergism in their mode of action. The Biomin® Permeabilizing

Complex boosts the activity of the active ingredients (the organic acids and the phytochemical) and facilitates their entry by permeating the outer membrane of Gram-negative bacteria (Biomin, 2018). Increasing worldwide concentration and growing competition in the poultry industry requires efficient pullets to satisfy specific market requirements. Lohmann Tierzucht offers a wide range of high quality pullet strain "bred in Germany" to meet these demand. Lohmann brown-classic is well known for their efficient production of quality brown eggs (Lohmann brown-lite management guide, 2018) Body weight and body conformation are the two important parameters for measuring growth in chickens, as growth and reproduction is the most important aspect of poultry production (Addisu, 2013).

The aim of this work therefore is to evaluate optimum inclusion levels of Biotronic® Top Forte (commercial blended organic acid) on grower pullets performance.

Materials and Methods

This study was carried out at the Poultry Unit, Teaching and Research Farm, Department of Animal Science, Faculty of Agriculture, Ahmadu Bello University, Zaria. Six hundred and nine (609) grower pullets were allocated to seven dietary treatments with 3 replicates of 29 birds 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 12 weeks period of the experiment. Left over feed was weighed to calculate feed intake. Birds were weighed at the beginning and end of experiment, to calculate weight gain. Birds were cared for according to guidelines established by the University Animal Care Committee. Seven diets were formulated. Table 1 shows the proximate composition of the common diet used. The Biotronic® Top Forte was added as non-inclusive part of the diets. Diet 1: (Control diet) – without Biotronic® Top Forte and oxytetracycline, Diet 2: 100g of Biotronic® Top Forte /100 Kg diet, Diet 3: 200g of Biotronic® Top Forte /100 Kg diet, Diet 4: 300g of Biotronic® Top Forte /100 Kg diet, Diet 5: 400g of Biotronic® Top Forte /100 Kg diet, Diet 6: 500g of Biotronic® Top Forte /100 Kg diet, Diet 7: Oxytetracycline at 0.8g/100Kg diet (as recommended by manufacturer). Recommended dosage for Biotronic® Top Forte is 1.85 – 4.50 kg/tonne of feed. Proximate analysis of the sample of experimental diets was done at the Biochemical Laboratory, Department of Animal Science, Faculty of Agriculture, Ahmadu Bello University Zaria according to methods described by A.O.A.C. (2005) At the end of 18 weeks of the feeding trial, 2mls of blood sample were collected from each of the three birds per treatment (that is one bird per replicate) via the wing veins into sterile tubes containing an anticoagulant (ethylene diamine tetra acetic acid, EDTA) for the determination of some haematological parameters. This was carried out at the Clinical Pathology Laboratory, Ahmadu Bello University Zaria. All data obtained were statistically analysed using the General Linear Model Procedure of Statistical Analysis Systems (SAS, 2002). Significant difference between treatments means were separated using Dunnett's test in the SAS package.

Results and Discussion

Table 2 shows the growth performance characteristics of grower pullet fed diets containing graded levels of Biotronic® Top Forte (9-18weeks) to replace antibiotic as growth promoter. There were significant ($P < 0.05$) differences in final weight, weight gain, feed intake and feed/gain ratio. No mortality was recorded. Significant ($P < 0.05$) difference in final weight, weight gain, feed intake, feed/gain ratio, feed cost/gain, age at 1st lay, weight of 1st egg and age at 10% lay was as a result of the organic acid (Biotronic® Top Forte) used to enhance effectiveness of nutrients and improved growth performance through establishment of low gastro intestinal tract (GIT) pH condition by supporting endogenous digestive enzymes, reducing undesired gut micro-organisms and exert their effects in the gut or on the gut wall cells of the bird. This is an indication that the birds effectively utilized their feed components. Acidifiers constitute an important component of modern feeding strategies without antibiotics. This result agrees with the report of Van Immerseel *et al.*, 2006 and Naseri *et al.*, 2012, that addition of organic acids in diet can have a beneficial effect on the performance of poultry by decreasing pathogenic bacteria. Higher organic acid inclusion resulted to lower feed intake, higher weight gain, better feed to gain ratio because the organic acids aid in the effective feed utilization in the gut which resulted in better growth performance thereby reducing amount of feed consumed and reduce cost of production. This agrees with the study of Patten and Waldroup, (1988) who reported reduction in feed intake and increased body weight due

to higher acid concentration. No mortality was recorded, is an indication that the birds effectively utilized the feed nutrient because of the organic acid included in the feed which help to lower the pH of the feed, gut and microbial cytoplasm thereby inhibiting the growth of pathogenic intestinal microflora. This agrees with the report of Avitech, 2004 that the inhibition of the growth of pathogenic intestinal microflora by the inclusion of organic acid reduces the microflora competing for the host nutrient and result in better growth and performance of the birds. Inclusion of Biotronic® Top Forte in the diets of grower pullets at 100, 200, 300, 400 and 500g reduced the cost of raising grower pullets by 6.41, 8.36, 3.27 and 12.45% respectively. The result of haematological indices of grower pullets (9-18 weeks) fed diets containing graded levels of Biotronic® Top Forte is shown in Table 3. Haematological indices are essential in monitoring feed toxicity especially with feed constituents that affect the formation of blood (Aro and Akinmoyegun,2012). Significant differences were observed on haematological values obtained among treatment groups, though significantly different, their values fell within the normal range of Pollack *et al.*(2005);Cray, (2000); Jain, 1986 and Simraks *et al* 2004 which defines that the birds were in complete normal state of health.

Table 1: Proximate Composition of Experimental Diets for Grower Pullets (9 – 18weeks)

Parameters (%)	Composition
Dry matter	93.12
Crude protein	22.28
Ash	8.14
Crude fibre	6.41
Ether Extract	2.01
Nitrogen free Extract	61.16

Table 2: Growth Performance of Grower Pullets Fed Diets Containing Different Levels of Biotronic® Top Forte Grower (9 – 18 weeks)

	Levels of Biotronic® Top Forte (g)							
Parameters	**0**	**100**	**200**	**300**	**400**	**500**	**Oxytet**	**SEM**
Initial Weight (g/bird)	719.78	711.17	726.15	708.91	722.20	701.04	719.43	13.09
Final Weight (g/bird)	1919.67^{ab}	1984.41^{ab}	2042.72^{a}	1926.51^{ab}	1881.11^{b}	2060.87^{a}	1937.78^{ab}	81.84
Total Weight Gain (g/bird)	1199.67^{ab}	1273.24^{ab}	1316.57^{a}	1217.60^{ab}	1158.91^{b}	1359.83^{a}	1218.35^{ab}	81.87
Total Feed intake (g/bird)	5077.82^{a}	5044.83^{a}	5068.05^{a}	4968.16^{b}	5040.00^{a}	4971.03^{b}	5040.34^{a}	47.48
Feed/Gain Ratio	4.24^{b}	3.96^{ab}	3.88^{ab}	4.10^{b}	4.43^{b}	3.71^{a}	4.15b	0.28
Feed Cost/Kg Gain	416.79	390.08	381.96	403.15	435.60	364.92	414.09	27.44
Cost of Total feed intake (g/bird/₦)	499.74^{b}	496.51^{b}	488.97^{a}	488.97^{a}	496.05^{b}	489.27^{a}	502.51^{c}	4.69
Age at 1st Lay (days)	116.67^{b}	116.67^{b}	114.33^{b}	116.33^{b}	115.67^{b}	112.00^{a}	117.33^{c}	1.77
Weight of 1st egg (g)	38.92^{ab}	28.31^{c}	41.71^{a}	33.17^{b}	38.99^{a}	43.68^{a}	43.68^{a}	4.18
Age at 10% Lay (days)	124.00^{c}	123.67^{b}	121.33^{a}	123.00^{b}	122.67^{b}	118.67^{a}	124.00^{c}	1.65

^{abc} = means with different superscripts on the same row differ significantly (P<0.05), Oxytet:Oxytetracycline.
SEM: Standard Error of Means

Table 3: Haematological Indices of Grower Pullets Fed Diets Containing Different Levels of Biotronic® Top Forte (9- 20weeks)

	Levels of Biotronic® Top Forte (g)								
Parameters	**0**	**100**	**200**	**300**	**400**	**500**	**Oxytet**	**SEM**	**REF. V**
PCV (%)	20.00[b]	39.80[a]	39.80[a]	26.10[b]	47.60[a]	28.20[b]	49.50[a]	3.94	23.00–55.00[+]
Hb (g/dL)	8.00[d]	10.00[c]	13.10[a]	7.30[d]	10.00[b]	7.80[d]	9.50[c]	0.47	7.0 – 18.60[+]
RBC (x10^6 /uL)	2.45[b]	3.70[a]	2.47[b]	2.35[c]	3.70[a]	2.48[b]	1.19[d]	0.05	1.30 -4.50[+]
WBC (x10^3 /uL)	0.98[d]	1.12[a]	1.01[c]	0.91[e]	1.01[c]	1.07[b]	0.91[e]	0.01	0.90 – 3.20[+]
Heterophils (%)	9.10[c]	12.10[a]	7.20[e]	5.17[f]	11.10[b]	4.10[g]	8.10[d]	0.15	15.00–50.00[+]
Lymphocytes (%)	90.30[a]	77.80[d]	84.20[b]	90.30[a]	80.20[c]	92.30[a]	77.90[e]	0.09	40.00–100[++]
Monocytes (%)	0.60[f]	6.80[b]	5.60[c]	3.50[d]	5.57[c]	2.80[e]	7.90[a]	0.04	0 – 7.00[+]
Eosinophils (%)	0.00[f]	2.50[b]	2.10[c]	1.20[d]	2.10[c]	0.70[e]	4.20[a]	0.07	0 – 16.00[+]

[abcdefg] = means with different superscripts on the same row differ significantly (P<0.05),Oxytet: Oxytetracycline; SEM: Standard Error of Means. Ref.v: Reference values: [+]Pollack *et al.*,(2005), [+]Cray, (2000), [++]Jain 1986, [+++] Simarak et al.,(2004).

CONCLUSION AND RECOMMENDATION

Birds on 500g Biotronic® Top Forte inclusion significantly lowered the cost of production than the 0 inclusion and the AGPs treatments to 12.45%.

It can be finally concluded that the addition of the balanced acidifier product Biotronic® Top Forte, containing an organic acid blend of formic acid, propionic acid and its salts based on an inorganic carrier, increases in the absence of anti-biotic growth promoters the performance grower pullets chicken.

Farmers can use Biotronic® Top Forte feed additives as replacement for antibiotic in grower pullets production at 500g/100kg diets to improve growth, early laying performance and profitability

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