CRINA® POULTRY PLUS AS REPLACEMENT FOR ANTIBIOTIC GROWTH PROMOTERS IN BROILER CHICKENS PRODUCTION

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ABSTRACT
A total 396 day old Ross broiler chicks were used in a feeding trial to evaluate the response of broiler chickens fed diets supplemented with different levels of CRINA® Poultry Plus, as replacement for antibiotic growth promoters (AGPs). The chicks were allotted randomly to six dietary treatments each replicated thrice, with 22 chicks per replicate. CRINA® Poultry Plus was included at 0g, 30g, 35g and 40g/100 Kg diet representing T1-T4 respectively while T5 and T6 had Oxytetracycline and water-grade Neocyril plus respectively. Diets were fed to chicks for 28 days. Data was collected on growth performance, liver function and bone quality indices. All data collected were subjected to analysis of variance and significant differences among treatment means were compared using the Dunnett test of significance. In the starter phase, broilers fed diet containing Oxytetracycline had significantly ($P<0.05$) highest values for final weight, weight gain, feed consumption, and better feed conversion ratio. No trend was observed for birds fed different levels of CRINA® Poultry Plus. Significant ($P<0.05$) differences were observed for albumin and blood urea nitrogen while ALT, ALP AST were not significantly ($P > 0.05$) different. Birds fed levels of CRINA® Poultry Plus had significantly higher bone dry matter (72.12-74.71 %) and bone ash (34.63-35.97 %) as compared to birds in the control group (70.64 % DM and 30.62% ash) and on antibiotics (71.28% DM and 31.32 % ash). CRINA® Poultry Plus did not improve growth in broiler chickens,but significantly lowered the cost of production at 35g/100 Kg feed than the control and AGPs. It also improved liver health and bone strength which is of major advantage to modern breeds of broiler chickens.
Keywords: CRINA® Poultry Plus, Oxytetracycline, Neocyril plus, Broiler chickens, essential oils.

INTRODUCTION
A simple way to help overcome the health problems caused by antibiotic resistance is to stop adding antibiotics to animal feed. In January 2006, the EU placed a total ban on the use of feed antibiotics. The alternatives to antibiotics being currently promoted probiotics, prebiotics, organic acids and essential oils (Broz and Paulus, 2015).

Essential oil compounds are a group of feed additives showing a potential for the replacement of antibiotics growth promoters (AGPs). They are active ingredients present in various plants and spices. Due to their antibacterial activity they might be able to modify the composition of intestinal microbiota and to exert beneficial effects on performance of poultry (Mitsch *et al.*, 2004; Hume, 2011; Broz and Paulus, 2015). CRINA® Poultry Plus is a feed additive from DSM Nutritional products that acts to promote eubiosis in the gastro-intestinal-tract of broilers. The product is a blend of eubiotics, a combination of benzoic acid and essential oil compounds (thymol, eugenol and piperine) (DSM, 2013). The aim of this work therefore was to evaluate the efficacy of CRINA® Poultry Plus as alternative to the conventional antibiotics used as growth promoters in poultry production. The specific objective was the Evaluation of the optimum level of CRINA® Poultry Plus in broiler diets under field conditions and the effect on growth performance, liver function and bone quality characteristics.

MATERIALS AND METHODS
Experimental Design and management of birds: Three hundred and ninety six (396) day-old Ross broiler chicks were allocated to six (6) dietary treatments, each replicated three times with 22 chicks per replicate each in a completely randomized design (CRD). The birds were housed in deep litter pens and managed with all

necessary routine management practices and routine vaccinations.

Experimental diets : Six maize-soya beans cake based diets were formulated at both the starter and finisher phases of the feeding trial to meet standard requirements of broiler chickens as recommend by NRC (1994) and Olomu (2011). CRINA® Poultry Plus was added as non-inclusive part of the diets as shown below.

- Diet 1: 0 g of CRINA® Poultry Plus/100kg diet (Control)
- Diet 2: 30g of CRINA® Poultry Plus /100 Kg diet
- Diet 3: 35g of CRINA® Poultry Plus /100 Kg diet
- Diet 4: 40g of CRINA® Poultry Plus /100 Kg diet
- Diet 5: Oxytetracycline at 120g/100Kg diet (as recommended by manufacturer)
- Diet 6: Control diet but birds were given water-grade Neocyril at recommended levels

The manufacturer's recommendation for CRINA® Poultry Plus is 300g/ton of feed.

Growth Study: Initial and final weights of birds were taken at the beginning and at the end of both starter and finisher phases. Feed intake was measured weekly while, weight gain feed/gain ratio and cost per Kg gain were computed for both phases. Mortality was recorded as they occur.

Liver Function Test: At the end of the starter phase, 2 mls of blood samples were taken from 1 chicken per replicate that is three birds per treatment into sterilised sample bottles containing no anticoagulant and were allowed to cloth and then centrifuged and serum was separated and stored at -20°C at the Clinical Pathology laboratory of the Ahmadu Bello University Teaching Hospital for determination of parameters related to liver function; blood glucose, blood urea nitrogen, alanine aminotransferase (ALT), albumen (ALB), aspartate aminotransferase (AST) and alkaline phosphatise (ALP), according to the methods described by Lamb (1991).

Bone Quality determination: Two birds selected to represent the average weight of the each replicate group were used for the tibia bone analysis. The tibia bones of the birds were removed carefully after slaughtering procedures. They were weighed in grammes using a top loading digital scale to obtain fresh weight of bones. The length of the tibia bones was measured in cm using a graduated ruler. The fresh bones were oven dried at 100 ^{0}C until a constant weight was obtained.The dry bones were ashed at 550 ^{0}C in a muffle furnace for 6 hours to obtain the percent ash content of the bone (AOAC, 1990). Bone density was calculated as bone weight/bone length.

Data Analysis: All data collected were subjected to analysis of variance and significant differences among treatment means were compared using the Dunnett test of significance according to the GLM procedures of SAS (2002).

RESULTS AND DISCUSSION

Table 1 shows the growth performance of broiler chicks fed different levels of CRINA® Poultry Plus. There were significant ($P<0.05$) differences in all the parameters measured. Birds on Oxytetracycline had significantly highest values for final weight, weight gain, feed consumption and better feed conversion ratio. No trend was observed for growth parameters measured for birds fed different levels of CRINA® Poultry Plus. The observed high performance by the AGP (Oxytetracycline) shows that antibiotic in animal feed increases feed efficiency and growth rate. Many authors have speculated that antibiotics had effect on growth and feed efficiency through the action of microorganism in the intestinal tract. This study agrees with the report of Vogt (1990), who fed caged broilers a mixture of essential oils or 20 mg/kg Virginiamycin. Addition of Virginiamycin resulted in improved growth and feed conversion but no significant response to the mixture of essential oils was noted. Chlortetracycline, Oxytetracycline and penicillin also show an improved growth rate when supplemented in animal feed (Anonymous, 2015).

In contrast however, Jamroz *et al.* (2003) supplemented a wheat-barley diet for broilers with avilamycin or 150 or 300 ppm of a plant extract containing capsaicin, carvacrol, and cinnamic aldehyde. Administration 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. CRINA® Poultry Plus did not

improve growth performance above the control diet.

Table 2 shows the results of the liver function tests of starter broiler chickens fed different levels of CRINA® Poultry Plus. Significant ($P<0.05$) differences were observed for albumin and blood urea nitrogen. The albumin value range (41.67-54.3g/l), fell within the normal range reported by Mitruka and Rawnsley (1997). Serum albumin is a strong predictor of health; a low albumin concentration is a sign of poor health and predictor of bad outcome. The higher the value of albumin the higher the clotting ability of blood, hence prevention of haemorrhage. The mean value for blood urea nitrogen showed significant differences across the treatment groups with values ranging between 4.60-7.67mg/dl which is within the normal values (1.50- 8.30mg/dl) as reported by Mirtuka and Rawnsley (1997).ALT is more specific to the liver and it's a better parameter for detecting liver injury, mean values for ALT showed no significant difference and also caused no injury to the liver since the values were within the normal range of 9.50 -37.20 as reported by Mirtuka and Rawnsley (1997).It was observed that dietary treatment had no significant effect on the plasma glucose, which indicated that carbohydrate metabolism was not affected by the diet as chickens used carbohydrates as energy source rather than free fatty acid.

Table 3 showed the result of tibia bone analysis of broiler chickens fed levels of CRINA®Poultry Plus. Significant ($P<0.05$) differences were observed for bone dry matter and ash content. Birds fed levels of CRINA® Poultry Plus had significantly higher bone dry matter and bone ash as compared to birds on the control group and on antibiotics. CRINA® Poultry Plus showed a good potential to increase bone quality of bird. Burton *et al* (1981) reported that tibia is the fastest growing bone in the chicks while Driver *et al* (2006) stated that the tibia ash is a very sensitive tool used to evaluate calcium and phosphorus requirement based on the degree of mineralization. Improved bone quality, particularly faster mineral deposition is a critical need in modern day broiler breeds that have been bred for very rapid growth and high weight gain and need bones to develop fast enough to bear the weight which prevent leg deformities and the resultant poor performance and degraded chicken meat.

CONCLUSION

CRINA® Poultry Plusused as natural growth promoter in feed, did not significantly improve growth of broiler chickens above the control, but significantly lowered the cost of production at 35g/100 Kg feed than the control and AGPs. It also improved liver health and bone strength.

REFERENCES

AOAC (1990). Official Method of Analysis, 15th Edition. Association of Analytical Chemists. Washington D.C.

Anonymous, (2015). Effects of Antibiotics on Animal Feed. *http://www.udel.edu/chem/C465/senior/fall97/feed/present.html*

Broz, J and Paulus, C. (2015). Eubiotics: Definitions and concepts. DSM Nutritional products.*http://www.dsm.com/animal-nutrition-health*

Burton, R. W., Sheridan A. K., and Howlett C. R. (1981). The incidence and importance of tibialdyschondroplasia to commercial broiler industry in Australia. *Bri. J. Poult. Sci,*222:153–160.

Driver, J. P., G. M. Pesti, R. I. Bakalli, and H. M. Edwards, Jr. (2006). The effect of feeding calcium- and phosphorus-deficient diets to broiler chickens during the starting and growing-finishing phases on carcass quality. *Poult. Sci* .85:1939-1946.

DSM, (2013). CRINA® Poultry Plus – ensuring gut health in broilers. DSM Nutritional products. *http://www.dsm.com/animal-nutrition-health.*

Hume, M.E. (2011). Historic perspective: Prebiotics, probiotics, and other alternatives to antibiotics. *Poult. Sci.* 90:2663-2669

Lamb, G.N. (1991). Manual of Veterinary laboratory technique. CIBA-GEIGY, Kenya, PP: 96-107.

Mitruka, B.M. and Rawnsley, H.M. (1997). Clinical Biochemical and Heamatological references values in normal experimental animal. Masson Publishing U.S.A. Inc .New York.

Mitsch, P. Zitterl-Eglseer, K. Kohler, B. Gabler, C. Losa, R. and Zimpernik, I. (2004). The effect of two different blends of essential oil

components on the proliferation of *Clostridium perfringens* in the intestines of broiler chickens. *Poult. Sci*. 83:669-675.

NRC, (1994). Nutrient Requirements of Poultry. (9th revised edition.). National Research Council.National Academy Press. Washington, D.C., USA.

Olomu, J.M. (2011). Monogastric Animal Nutrition. Principles and Practice. Jachem publishers Nigeria. Pp 68-69.

S.A.S., (2002). Statistical Analysis System Institute, User's Guide. Version 9 for Windows. North Carolina, U.S.A.

Table 1 Growth Performance of Broiler chicks fed different levels of CRINA® Poultry Plus at 0-4 weeks

	Level of CRINA® Poultry Plus						
Parameters	**0g**	**30g**	**35g**	**40g**	**Oxytet[1]**	**Neocyr[2]**	SEM
Initial Wt (g/bird)	41.90	42.40	41.90	41.90	43.30	42.70	1.40
Final Wt (g/bird)	1114.20^{b}	1075.90^{b}	1130.00^{b}	1055.00^{b}	1322.70^{a}	1112.30^{b}	26.72
Tot. Wt. Gain (g/bird)	1072.30^{b}	1033.50^{b}	1088.10^{b}	1013.10^{b}	1279.40^{a}	1069.60^{b}	26.46
Daily wt. Gain (g/bird)	38.20^{b}	36.90^{b}	38.80^{b}	36.20^{b}	45.60^{a}	38.20^{b}	0.95
Tot. Feed Con (g/bird)	1798.60^{bc}	1778.40^{bc}	1801.10^{bc}	1689.90^{c}	2073.50^{a}	1833.60^{b}	35.03
Daily feed con. (g/bird)	64.20^{bc}	63.50^{bc}	64.30^{bc}	60.40^{bc}	74.10^{a}	65.50^{b}	1.25
Feed conversion ratio	1.68	1.72	1.66	1.67	1.62	1.72	0.98
Feed cost/Kg gain (₦/Kg)	181.90^{b}	179.46^{a}	172.91^{a}	174.56^{a}	179.86^{b}	189.15^{c}	3.26
Mortality (%)	1.52^{a}	0.00^{b}	1.52^{a}	0.00^{b}	1.52^{a}	1.52^{a}	0.05

a,b,c. Means with different superscript differ significantly across the row (P<0.05)
Oxytet[1]: Oxytetracycline.Neocyr[2]: Neocyril plus. SEM: Standard error of means

Table 2 Liver function indices of broiler chickens fed different levels of CRINA ® Poultry Plus

	Level of CRINA® Poultry Plus						
Parameters	**0g**	**30g**	**35g**	**40g**	**Oxytet**	**Neocyr**	**SEM**
Glucose (mmol/L)	262.0	252.7	252.0	236.7	249.0	255.7	11.05
Albumin (g/L)	44.3^{a}	41.67^{a}	43.67^{a}	38.67^{b}	42.33^{a}	44.00^{a}	2.56
Blood Urea Nitrogen(mmol/L)	7.67^{a}	4.97^{b}	6.73^{ab}	5.33^{b}	4.60^{b}	5.33^{b}	0.65
Aspartate-amino tranferase (µL)	23.33	28.00	29.67	24.33	20.33	26.33	3.94
Alanine-amino tranferase (µL)	12.67	15.67	16.67	13.33	16.00	18.67	2.09
Alkaline phosphatase(µL)	72.00	96.00	125.33	119.67	83.33	91.33	22.57

a,b, Means with different superscript differ significantly across the row (P < 0.05)
Oxytet: Oxytetracycline. Neocyr: Neocyril plus. SEM: Standard error of means

Table 3 Tibia bone characteristics of broiler chickens fed different levels of CRINA®Poultry Plus

	Level of CRINA® Poultry Plus						
Parameters	**0g**	**30g**	**35g**	**40g**	**Oxytet[1]**	**Neocyr[2]**	SEM
Bone length (cm)	10.50	10.80	10.77	10.30	10.47	10.27	0.21
Bone weight (g)	22.33	22.33	23.33	20.67	21.67	20.00	1.02
Bone density (g/cm)	2.13	2.07	2.12	2.17	2.07	1.95	0.09
Bone dry matter %	70.64^{b}	73.21^{ab}	72.12^{ab}	74.71^{a}	71.28^{b}	71.19^{b}	0.46
Bone ash (%)	30.62^{b}	34.63^{a}	34.72^{a}	35.97^{a}	31.32^{ab}	31.27^{b}	1.18

a,b, Means with different superscript differ significantly across the row (P<0.05)
Oxytet[1]: Oxytetracycline. Neocyr[2]: Neocyril plus. SEM: Standard error of means.