

## PERFORMANCE AND HEALTH STATUS OF ARBOR ACRES BROILER CHICKENS RAISED WITH ROUTINE ADMINISTRATION OF FLUOROQUINOLONES

### ABSTRACT

**Aim:** The study was carried out to evaluate the effect of routine administration of fluoroquinolones on performance, haematology, and serum biochemistry indices of Arbor Acres broiler chickens.

**Study Design:** The experiment employed a complete randomized design; all data generated were subjected to analysis of variance,  $P=0.05$ .

**Place and Duration of Study:** The study was carried out at the Teaching and Research Farm, University of Ibadan, Ibadan, Nigeria, between February and April, 2014.

**Methodology:** One hundred and eighty unsexed one-day old Arbor Acres broiler chicks were used in a 48-day study. Broiler chicks were distributed into four experimental treatments viz; control, enrofloxacin, ciprofloxacin and norfloxacin. Birds were administered with 10 mg/kg body weight of the selected fluoroquinolones for 3 days on week 2, 4, and 6. On Day 39, 3 birds per treatment were randomly selected and blood collection was done through jugular puncture. Selected haematological and serum biochemistry parameters were analyzed to determine the health status of the birds. Growth Performance of the experimental birds were evaluated on day 48.

**Results:** Performance results of the experimental birds showed significant differences ( $P\leq 0.05$ ) for daily weight gain, daily feed intake and feed conversion ratio. The group supplemented with ciprofloxacin had the best performance. Selected fluoroquinolones had no influence on haematological indices evaluated. Serum indices showed significant ( $P\leq 0.05$ ) differences for Aspartate Amino Transferase (AST) among the treatments. Control had the highest mean value for AST ( $85.32\pm 5.12$  I.U/L) compared to other treatments. Biochemical indices were within the normal range of a physiological healthy broiler chicken.

**Conclusion:** The results obtained in this study indicated that routine administration of fluoroquinolones had effect on performance and health status of Arbor Acres chickens when compared with the control.

**Keywords:** Ciprofloxacin, norfloxacin, growth performance, hematology, serum biochemical indices, broilers

## 36 1. INTRODUCTION

37 Recently, broiler out-growers are pressurized to increase the growth rate, feed efficiency and  
38 size of breast muscle with the use of Antibiotics Growth Promoters (AGPs) [1, 2]. Antibiotic  
39 growth promoter may destroys or inhibits bacteria when administered to broilers as  
40 prophylaxis [3]. Antimicrobial agents could be used and as feed additives as well as with  
41 drinking water for not only therapeutic but also prophylactic purposes [4]. Antibiotics promote  
42 growth by interacting with intestinal microbial population and stimulating feed intake [5].  
43 Another important benefit of antibiotic growth promoters lies in their ability to control  
44 important zoonotic pathogens such as *Salmonella* spp., *Campylobacter* spp. and *E. coli* [6].

45 One of the most commonly used groups of AGPs in Nigerian broiler industry is  
46 fluoroquinolone [7]. Fluoroquinolones are bactericidal agents, they are effective against  
47 Gram-negative organisms and some mycobacteria [8]. Introduction of the first fluorinated  
48 quinolone, norfloxacin lead to the development of other members of this group, such as  
49 enrofloxacin and ciprofloxacin [9]. Ciprofloxacin has wide clinical applications, better safety  
50 profile and good in vitro effectiveness against resistant pathogenic organisms as compared  
51 to other classes of antibiotics [10].

52 Fluoroquinolones are often recommended for respiratory tract infections, gastrointestinal  
53 tract infections and urinary tract infections caused by *Campylobacter*, *E. coli*, *Haemophilus*,  
54 *Mycoplasma*, *Pasteurella* and *Salmonella* species [11, 12]. The routine administration of  
55 enrofloxacin, ciprofloxacin and norfloxacin to broilers during growth may lead to changes in  
56 blood profile. The report on the effects of fluoroquinolones on growth performance and health  
57 status of Arbor Acres broiler chickens is limited in Nigeria. The study was carried out to  
58 evaluate the effects of routine administration of fluoroquinolones on performance,  
59 haematology, and serum biochemistry indices of Arbor Acres broiler chickens.

## 60 2.0 MATERIALS AND METHODS

### 61 Location and Duration of the Study

62 The study was carried out at the broiler unit of the Teaching and Research Farm, University  
63 of Ibadan for a period of 48 days.

### 64 2.1 Management of birds and Experimental Design

65 A total of one hundred and eighty (180) 1-day old Arbor Acres broiler chicks procured from  
66 a commercial farm in Ibadan, Oyo State were used for the study. The birds were reared on  
67 deep litter in an open-sided poultry house. One hundred watt electric bulbs were used as  
68 source of heat and lighting. Feed and water were given *ad-libitum*. Medication, vaccinations  
69 and other routine management practices were given to birds according to recommendations.

70 The chicks were distributed randomly into four experimental treatments viz; control,  
 71 enrofloxacin, ciprofloxacin and norfloxacin respectively. Experimental treatment contained 45  
 72 birds, 3 Replicates per treatment and 15 birds per replicate. All birds were treated alike  
 73 except from the type of antibiotics used.

74

## 75 2.2 Administration of Antibiotics

76 Birds were administered with 10 mg/kg body weight of the selected fluoroquinolones on  
 77 week 2, 4, 6 for 3 days. Birds in the control group received water without antibiotics  
 78 throughout the experiment.

79

Ingredients	Starter 1-21 d	Finisher 22-48 d
Maize	57.00	61.00
Soybean meal	32.00	29.00
Fish meal	2.50	0.00
Wheat offal	5.50	7.00
DCP	2.00	2.00
Salt	0.25	0.25
DL-Methionine	0.20	0.20
L-Lysine	0.05	0.05
Broiler premix	0.25	0.25
Mycofix	0.25	0.25
<b>Total</b>	<b>100.00</b>	<b>100.00</b>

80

**Table 1. Gross composition of experimental diet**

81

82 Calculated Nutrients: Crude Protein: 22.79% and 19.47%; Digestible

83 Energy (kcal/kg): 3005 and 3229; Calcium (%) 0.95 and 1.02;

84 Available Phosphorus%: 0.45 and 0.50 for starter and finisher

85 phases respectively.

86

## 2.3 Feed intake

87 The feed consumed was obtained by weighing the feed given per replicate and the leftover.  
 88 Daily feed intake was calculated by the difference in feed intake and left over. Weekly  
 89 records of feed consumption per bird were obtained for each replicate by dividing the total  
 90 amount of feed consumed by the number of birds in each replicate.

91

## 2.4 Body weight and weight gain

92 The chicks were weighed at the beginning of the trial and were subsequently weighed  
 93 weekly throughout the ten week period. The weekly weight gain was obtained by subtracting  
 94 the weight of the preceding week from that of the present. The value gave the weekly weight  
 95 gain per chick and from this; the daily weight gain was calculated.

96 Average daily body weight gain =  $\frac{\text{Weekly weight gain} \times \text{Number of birds in the group}}{7}$   
 97

## 98 2.5 Feed Conversion Ratio

99 This was calculated as the ration of feed consumed to the body weight change

100 FCR=  $\frac{\text{Average Daily Feed Intake}}{\text{Average Daily body weight gain}}$   
 101

## 102 2.6 Mortality

103 Death in each replicate was recorded against the replicate.

104

## 105 2.7 Haematological Indices

106 Samples of complete blood were collected randomly from one broiler per replicate, following  
 107 the last doses given. Twenty four hours after the last dosage (Day 39), 3 birds per treatment  
 108 were selected randomly and blood collection was done through jugular puncture into  
 109 heparinized and non-heparinized bottle. The red blood cell (RBC) and white blood cell  
 110 (WBC) counts were determined by haemocytometer method using Natt-Herrick solution.  
 111 Haematocrit (Hct) or packed cell volume (PCV) and haemoglobin (Hb) values were  
 112 measured by microhaematocrit and Sahli's methods [13] respectively. The percentages of  
 113 peripheral blood leukocyte were determined using blood smears stained by May Grunwald-  
 114 Giemsa stain [13]. Data were presented as mean  $\pm$  SE and were analysed statistically by  
 115 ANOVA. Duncan multiple range test was used to test the significance of differences between  
 116 the experimental groups ( $p \leq 0.05$ ).

## 117 2.8 Serum Biochemistry

118 The blood was allowed to clot and the serum was separated immediately by  
 119 centrifugation at 2000 revolutions per minute for 10 minutes. Total protein was estimated by  
 120 the biuret reaction [14]. Creatinine was determined by the Jaffe reaction method [15]. Serum  
 121 concentration of cholesterol were determined using the procedure described by Kaneko [16].  
 122 Alanine transaminase (ALT), aspartate transaminase (AST) and alkaline phosphatase were  
 123 determined calorimetrically using reagent kits (Randox Lab., Ltd., Co. Antrim, UK). Sodium

124 oxalate fluoride was used for glucose preservation. The blood glucose was determined by  
125 enzymatic colorimetric test (GOD-PAP method) Quimica Clinica Aplicada, S.A. Kit.

## 126 2.9 STATISTICAL ANALYSIS

127 The experiment was arranged in a completely randomized design. Data collected were  
128 subjected to analysis of variance (ANOVA) using SAS v. 9.3 (2011) package [17]. Significant  
129 difference was set to 5%. The means were compared using Duncan multiple range test of  
130 the same software.

## 131 3.0 RESULT AND DISCUSSION

### 132 3.1 Performance of the experimental birds

133 Table 2 shows the effect of fluoroquinolones on the performance of Abor Acres broiler chicks  
134 over a period of 48 days. There was significant ( $P<0.05$ ) difference in average daily feed  
135 intake, average daily gain and feed conversion ratio amongst the treatments. T4 had the  
136 lowest FCR (1.88) followed by T2 (1.90). The control was not significantly ( $P>0.05$ ) different  
137 from T3 (2.06). T3 (2508g) had the highest average weight gain. The control had the lowest  
138 mean value ( $43.45\pm 0.72$ ) for average daily gain when compared to other treatments.

139 Performance results (Table 2) from the present study indicated that supplementing  
140 enrofloxacin, ciprofloxacin norfloxacin in water for Abor Acres broiler chicks had no effect on  
141 final body weight. However, ciprofloxacin treated birds had similar feed conversion ratio  
142 compared with the control. These observations are in accordance with [18] who indicated  
143 that antibiotics are known to produce no significant improvement on growth performance  
144 under cleaner environment despite administration in low doses. The result from the study  
145 may be due to strict biosecurity measures followed during the experiment. Further, [19 ]  
146 documented that ciprofloxacin did not have any influence on body weight in healthy broilers  
147 and suggested that fluoroquinolones has influence in increasing body weight only in  
148 infection, not in healthy condition. Also it was reported by [20] that enrofloxacin  
149 administration through drinking water did not have any effect on mean body weights and  
150 feed conversion ratio. Droppings of all the birds were semisolid, dark green and with a white  
151 uric acid deposition on the top. These findings were in conformity with [21], who studied the  
152 safety evaluation of levofloxacin following repeated oral dose administration in white Leghorn  
153 layer birds and reported similar observations.

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158 **Table 2. Performance of the experimental birds**

Parameters	T1	T2	T3	T4	SEM
Average Initial Body weight (g)	48.00	47.00	50.00	46.00	1.16
Average Final Body weight (g)	2135.00	2358.00	2508.00	2450.00	13.14
Average Weight gain(g)	2087.00	2311.00	2458.00	2404.00	9.63
Average Daily Feed Intake(g)	89.42 <sup>b</sup>	91.38 <sup>b</sup>	105.83 <sup>a</sup>	94.08 <sup>b</sup>	1.65
Average Daily Gain(g)	43.45 <sup>b</sup>	48.14 <sup>b</sup>	51.21 <sup>a</sup>	50.08 <sup>b</sup>	0.72
Feed Conversion Ratio	2.06 <sup>a</sup>	1.90 <sup>b</sup>	2.06 <sup>a</sup>	1.88 <sup>b</sup>	0.08

159 <sup>a-c</sup> Means along the same row with similar superscripts are not significant (P>0.05). T1=

160 Control;

161 T2= Enrofloxacin; T3= Ciprofloxacin; T4=Norfloxacin

162 **3.2 Haematological indices of the experimental birds raised with routine**  
 163 **administration of fluoroquinolones.**

164 Haematological constituents usually reflect the physiological responsiveness of the animal to  
 165 its external or internal environments and thus serve as a veritable tool for monitoring animal  
 166 health. The impact of fluoroquinolones on the haematological indices of Arbor Acres broilers  
 167 is shown in Table 3. There were no significant (P≥0.05) differences in the parameters  
 168 amongst the treatments. The result of haematological parameters shown in Table 3  
 169 indicated that the birds in all treatments were healthy and not severely influenced by the  
 170 routine administration of fluoroquinolones. However, the non-significant increase in mean  
 171 value for basophil in T1, T2 and T4 treated birds may indicate infection and inflammation.  
 172 Basophils play a role in both parasitic infections and allergies. However it is unusual for it to  
 173 be found in the peripheral blood of a healthy broiler chicken. Selected fluoroquinolones used  
 174 in this study had no adverse effect on blood parameters.

175 **Table 3. Haematological indices of the experimental birds raised with routine**  
 176 **administration of fluoroquinolones.**

PARAMETER	T1	T2	T3	T4	SEM
PCV (%)	22.00	26.00	23.67	28.67	1.16
RBC(10 <sup>6</sup> ul)	3.64	3.68	3.45	3.43	0.06
WBC(10 <sup>3</sup> ul)	19.23	19.13	18.28	19.38	0.35
Hb	7.33	8.67	7.90	9.57	0.39
Lymphocyte(%)	67.33	70.67	69.67	66.67	1.94
Monocyte (%)	1.67	2.33	2.67	3.33	0.36
Eosinophils(%)	3.00	3.33	3.33	2.67	0.43
Basophils(%)	0.33	0.67	0.00	0.67	0.19
Platelet(%)	120.67	130.00	138.00	136.33	5.17

177 T1= Control; T2= Enrofloxacin; T3= Ciprofloxacin; T4=Norfloxacin

178 SEM = Standard error of means

179 **Table 4. Serum biochemical indices of the experimental birds raised with**  
 180 **routine administration of fluoroquinolones.**

PARAMETER	T1	T2	T3	T4	SEM
TP(g/dl)	3.31	3.05	3.19	3.29	0.11
ALB(g/dl)	1.90	1.80	1.93	2.04	0.10
GLU(mg/dl)	149.42	186.70	193.89	184.52	10.71
CHOL(g/dl)	85.55	100.57	85.10	95.79	3.82
HDL(g/dl)	38.23	46.68	48.27	41.63	2.06
LDL(g/dl)	45.73	48.50	47.13	54.14	2.75
AST(I.U/L)	85.32 <sup>a</sup>	56.25 <sup>b</sup>	52.46 <sup>b</sup>	49.28 <sup>b</sup>	5.12
ALT(I.U/L)	4.16	3.57	4.11	5.71	0.52

181 Means along the same row with similar superscripts are not significant ( $P \geq 0.05$ ) different.  
 182 T1= Control; T2= Enrofloxacin; T3= Ciprofloxacin; T4=Norfloxacin; GLU=Glucose; AST=  
 183 Aspartate amino transferase; ALP= alanine amino transferase; HDL= high density  
 184 lipoprotein; ALB= albumin; CHOL= Cholesterol; LDL=Low density Lipoprotein; TP= Total  
 185 protein.

186

### 187 **3.3 Serum analysis of the experimental birds raised with routine administration of** 188 **fluoroquinolones.**

189 The impact of fluoroquinolones on the serum parameters of Arbor Acres broiler chicks is  
 190 shown in Table 3. Serum biochemical indices are used as indicators to conditions that  
 191 cannot be readily noticed by performance indices [22]. The Aspartate Amino Transferase  
 192 (AST) level of the treated groups were significant ( $P \leq 0.05$ ) different from the control (T1).  
 193 This may indicate that selected fluoroquinolones used prevented liver damage and loss of  
 194 liver enzyme to the peripheral blood. This view was supported by [23] who stated that  
 195 antibiotic prophylaxis effectively prevents not only the development of bacterial infections but  
 196 also further decompensation (variceal bleeding, hepatorenal syndrome) and improves  
 197 survival. There were no significant differences in all other parameters taken. However, all  
 198 parameters were within the physiological range of a healthy broiler.

## 199 **4. CONCLUSION**

200 The study showed that routine administration of fluoroquinolones does not have negative  
 201 influence on the hematological and serum biochemistry parameters of treated broiler  
 202 chickens. All the parameters were within the range of a physiological normal chicken. Broiler  
 203 chickens raised under strict biosecurity conditions may have growth performance not  
 204 significantly different from those treated with antibiotics growth promoters.

205

## 206 **ETHICAL APPROVAL**

207

208 Authors hereby declare that principle of laboratory animal care (NIH publication no. 85-23.  
 209 Revised 1985) were followed, as well as specific national laws where applicable.

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