Original Research Article

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 Acre broiler chickens.

Study Design: The experiment employed a completely 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 March, 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≤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≤0.05) differences for Aspartate Amino Tranferase (AST) among the treatments. Control had the highest mean value for AST (85.32±5.12 I.U/L) compared to other treatments.

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

Keywords: Ciprofloxacin, norfloxacin, performance, blood profile, broilers

1. INTRODUCTION

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

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

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

2.0 MATERIALS AND METHODS

Location and Duration of the Study

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

2.1 Management of birds and Experimental Design

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

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

2.2 Administration of Antibiotics

Birds were administered with the selected fluoroquinolones on week 2, 4, 6 for 3 days. The treatments were for prevention purposes and administered at 1ml / 2 litres of drinking water for 3 days (10 mg /kg body weight). Birds in the control group received water without antibiotics throughout the experiment. The treatments were used in a likely way that Nigerian broiler farmers administered it to their birds. However, withdrawal period of 10 days was observed, which was sufficient enough in reducing concentration of the drugs in blood and tissues below Maximum Residue Limits according to recommendations by drug manufacturers.

Table 1. Gross composition of experimental diet (%)

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
Total	100.00	100.00

Calculated Nutrients: Crude Protein: 22.79% and 19.47%; Digestible Energy (kcal/kg): 3005 and 3229; Calcium (%) 0.95 and 1.02; Available Phosphorus%: 0.45 and 0.50 for starter and finisher phases respectively.

2.3 Feed intake

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

2.4 Body weight and weight gain

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

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

2.5 Feed Conversion Ratio

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

$$\text{FCR} = \frac{\text{Average Daily Feed Intake}}{\text{Average Daily Body Weight Gain}}$$

2.6 Mortality

Death in each replicate was recorded against the replicate.

2.7 Haematological Indices

Twenty four hours after the last dosage (Day 39), 3 birds per treatment were selected randomly and blood collection was done through jugular puncture into heparinized and non-heparinized bottle. The red blood cell (RBC) and white blood cell (WBC) counts were determined by haemocytometer method using Natt-Herrick solution. Haematocrit (Hct) or packed cell volume (PCV) and haemoglobin (Hb) values were measured by microhaematocrit and Sahli's methods [13] respectively. The percentages of peripheral blood leukocyte were determined using blood smears stained by May Grunwald-Giemsa stain [13]. Data were presented as mean ± SE and were analysed statistically by ANOVA.

Duncan multiple range test was used to test the significance of differences between the experimental groups ($p \leq 0.05$).

2.8 Serum Biochemistry

The blood was allowed to clot and the serum was separated immediately by centrifugation at 930.7g for 10 minutes. Total protein was estimated by the biuret reaction [14]. Creatinine was determined by the Jaffe reaction method [15]. Serum concentration of cholesterol were determined using the procedure described by Kaneko [16]. Alanine transaminase (ALT), aspartate transaminase (AST) and alkaline phosphatase were determined calorimetrically using reagent kits (Randox Lab., Ltd., Co. Antrim, UK). Sodium oxalate fluoride was used for glucose preservation. The blood glucose was determined by enzymatic colorimetric test (GOD-PAP method) Quimica Clinica Aplicada, S.A. Kit.

2.9 STATISTICAL ANALYSIS

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

3.0 RESULT AND DISCUSSION

3.1 Performance of the experimental birds

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

Performance results (Table 2) from the present study indicated that supplementing T2, T3, and T4 in water for Abor Acres broiler chicks had no effect on final body weight. These observations are in accordance with [18] who indicated that antibiotics are known to produce no significant improvement on growth performance under cleaner environment despite administration in low doses. The result from the study may be due to strict biosecurity measures followed during the experiment. Further, [19] documented that ciprofloxacin did not have any influence on body weight in healthy broilers and suggested that fluoroquinolones has influence in increasing body weight only in infection, not in healthy

condition. Also it was reported by [20] that enrofloxacin administration through drinking water did not have any effect on mean body weights and feed conversion ratio. However, the best feed conversion ratio shown in T4 is in agreement with study of [21], which indicated that antibiotic group showed superior FCR compared with the control and probiotics used. Also, the significant effect of antibiotics observed on FCR in this study, were in agreement with the report of [22](Mehdi, 2011). This may be due to the broad spectrum antibacterial effect of T4 and T2, leading to a more balanced micro flora population in gut, greater feed efficiency and improved FCR.

Table 2. Performance of the experimental birds raised with routine administration of fluoroquinolones.

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^{b}	91.38^{b}	105.83^{a}	94.08^{b}	1.65
Average Daily Gain(g)	43.45^{b}	48.14^{b}	51.21^{a}	50.08^{b}	0.72
Feed Conversion Ratio	2.06^{a}	1.90^{b}	2.06^{a}	1.88^{b}	0.08

$^{a-c}$ Means along the same row with similar superscripts are not significant (P>0.05). T1= Control; T2= Enrofloxacin; T3= Ciprofloxacin; T4=Norfloxacin

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

Haematological constituents usually reflect the physiological responsiveness of the animal to its external or internal environments and thus serve as a veritable tool for monitoring animal health. The impact of fluoroquinolones on the haematological indices of Arbor Acres broilers is shown in Table 3. There were no significant (P≥0.05) differences in the parameters amongst the treatments. The PCV, Hb and WBC values in this study were similar to those reported by [23] for 40 days old broilers treated with enrofloxacin at dose of 10 mg/kg body weight. The non-significant monocyte values in this study are higher than those reported by [24] for Arbor Acres broilers. The haematologic profile observed in this study may be as a result of high correlation between age and haematological parameters contents of broiler strains as described by [24] and indicate that blood profiles of chickens is affected by age. The result of haematological parameters shown in Table 3 indicated that the birds in all treatments were healthy and not severely influenced by the routine administration of fluoroquinolones. However, the non-significant increase in mean value for basophil in T1, T2 and T4 treated birds may indicate infection and inflammation. Basophils play a role in both parasitic infections and allergies. However, it is usually found in the peripheral blood of a healthy broiler chicken within the range of 0.0% to 2.0%. Birds in T3 had 0.0% basophil,

which indicates non-significant levels of infection and may be as a result of broad spectrum antimicrobial activities of T4. Heterophil and Lymphocyte value are considered as sensitive haematological indicators of stress response among chickens' populations [25] and as a general biomarker relevant to immune function [26] in poultry. The non-significant lymphocyte values in this study were similar to those reported by [27] and may be indicative of heat stress during the day and exposure to yellow light from 100 watt bulbs used as heat source at night.

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

PARAMETER	T1	T2	T3	T4	SEM
PCV (%)	22.00	26.00	23.67	28.67	1.16
RBC(10^6ul)	3.64	3.68	3.45	3.43	0.06
WBC(10^3ul)	19.23	19.13	18.28	19.38	0.35
Hb	7.33	8.67	7.90	9.57	0.39
Heterophil (%)	68.23	71.05	70.85	67.95	1.98
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

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

SEM = Standard error of means

Table 4. Serum biochemical indices of the experimental birds raised with 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^a	56.25^b	52.46^b	49.28^b	5.12
ALT(I.U/L)	4.16	3.57	4.11	5.71	0.52

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

3.3 Serum analysis of the experimental birds raised with routine administration of fluoroquinolones.

The impact of fluoroquinolones on the serum parameters of Arbor Acres broiler chicks is shown in Table 3. Serum biochemical indices are used as indicators to conditions that cannot be readily noticed by performance indices [28]. The Aspartate Amino Transferase (AST) level of the treated groups were significantly ($P \leq 0.05$) different from the control (T1). This may indicate that selected fluoroquinolones used prevented liver damage and loss of liver enzyme to the peripheral blood. This view was supported by [29] who stated that antibiotic prophylaxis effectively prevents not only the development of bacterial infections but also further decompensation (variceal bleeding, hepatorenal syndrome) and improves survival. There were no significant differences in all other parameters taken. Reported AST value in this study is lower than those reported by [30], who concluded that use of fluoroquinolones in broiler production may lead to elevated AST and ALT levels. Also, mean values for TP, ALB, GLU, CHOL, HDL LDL and ALT in this study were lower and not consistent for a 38 days old broiler chicken; higher values were reported by [31] on day 35. Hepatotoxicity is indicated by the rising activities of the enzymes AST and ALT as a result of the malfunction of the sites of their production [31]. However, the result from this study were lower but within range of a physiologically normal broiler chicken. Decreased levels of these enzymes may be expressed as less liver and skeletal muscle damage of fluoroquinolone used. It may also be as a result of the routine mode of drug application employed during the study.

4. CONCLUSION

The study showed that routine administration of fluoroquinolones does not have negative influence on the hematological and serum biochemistry parameters of treated broiler chickens. Broiler chickens raised under strict biosecurity conditions may have body weight gain not significantly different from those treated with antibiotics growth promoters after 48 days rearing period. However, there is need to further investigate the effects of selected fluoroquinolones used in this study blood serum parameters.

ETHICAL APPROVAL

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

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