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Growth Performance of Three Genotype Chickens Under The Influence Of Garlic And Ciprofloxacin Reared In The Derived Savannah

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Abstract

The effects of genotype and treatments on growth performance were investigated. A total of Three hundred and sixty F_1 (360) chicks were allotted into NINE groups in a 3 × 3 factorial design with 3 genotypes: exotic (White Leghorn), local (Nigerian Heavy Ecotype) chicken and their crosses AND three treatments: Control (water + No extract), Cipro (water + ciproflxacin) and garlic (water + *Allium sativum* extract). Genotype and treatment affected performance parameters: namely feed intake (FI), feed conversion ratio (FCR), body weight (BW) and body weight gain (BWG), The result of the interaction effect showed that at 2 months, exotic birds fed control had the highest significant ($p < 0.05$) body weights with a mean value of 850.00 g while the least body weight mean (400g) values were obtained in local birds fed control, ciproflxacin and garlic. The highest weight value was obtained in exotic birds fed ciproflxacin at 4 and 6 months (1350.0 and 2025 g, respectively). The total weight gain of exotic birds fed ciproflxacin and garlic (2004 and 1979 g, respectively) were significantly ($p < 0.05$) the best, whereas, the least weight gain were recorded for local birds fed control and ciproflxacin (1113.00 and 1158.00 g respectively). The best feed conversion ratio was seen in exotic birds fed garlic (2.94) while local birds fed control recorded the poorest (4.93). The results suggest that crossbreeding exotic birds with the Nigerian Heavy Ecotype can help improve body weights of Nigerian Heavy Ecotype. Also, farmers can use *Allium sativum* extract at a dose of 800 mg/ml as an alternative to antibiotics in poultry diets.

Keywords: Chickens, Crossbred Ciprofloxacin, Garlic, Growth Traits,

Introduction

The average intake of animal protein has been reported to be 64.8g in the developed world, while in Nigeria, it has been reported to be 45.4g. Malnutrition is still prevalent in Nigeria as a result of the decline in protein intake owing to scarcity and unaffordable price of animal protein food sources (Attia *et al*., 2022). The costs of production of livestock are very high in terms of housing and feeding. Poultry productions are cheaper sources of animal proteins which provide high quality, affordable and animal protein in Nigeria. In developing countries indigenous chickens are more abundant with Nigeria having the most among sub savannah countries (Oyeniran *et al*., 2022). Heavy ecotype chicken is one of the indigenous breeds of poultry found in Nigeria. It is well adapted to the harsh tropical environment and poor nutritional setups with excellent resistance against certain diseases (Ndofor-Foleng *et al.*, 2015; Ikeh *et al.*, 2020). The genetic resource base of the Nigerian indigenous chickens could form the basis for genetic improvement through crossbreeding with the exotic breed to produce breeds adapted to local conditions (Fulla, 2022).

In spite of the advantages of crossbreeding, lack of feed and feed ingredients has continual to be a major constraints to the survival of crossbred chickens (Olorunwa, 2018). A major feed additive that has been extensively used is in poultry feed is antibiotics (Kumar *et al.*, 2018), which incidentally could end up in human food chain if the withdrawal period is not maintained. Natural medicinal products originating from herbs and spices have been used as feed additives for farm animals (Singh and Gaikwad, 2020) in place of antibiotics. It has been reported that, the use of phytobiotics such as *Allium sativum* (garlic) extract could be a major asset in the fight against bacterial infections antifungal, antimicrobial, antioxidant, insecticidal, antiprotozoal and antitumor (Tchoupou Tchoupou *et al*., 2022). Therefore, this study aimed at evaluating the growth performance of three genotype chickens under the influence of garlic and ciproflxacinfloxacin reared in the derived savannah.

Materials and Methods

Chicks and Management:

The trial was conducted for 6months in University of Nigeria, Nsukka animal Research in an environmentally controlled poultry house. A total three hundred and twenty (320) day old chicks of heavy ecotype (HE), exotic chicken and crossbred (HE X EC) were individually weighed and wing-tagged. They were allotted to 3 treatments (control, ciprofloxacin, garlic), each treatment had 40 birds replicated 4 times with 10 chicks per replicate. Administration of the treatment lasted for 6 months. Birds were fed ad-libitum with the same commercial Chikun chicks feed and layer mash of Hybrid Feeds Limited. Birds were raised in the same conditions of humidity, ventilation, and temperature. Feed intake and bodyweight were measured monthly while body weight gain and feed conversion ratio were calculated. The study was carried out after having consulted the institutional guideline on the use of animals for scientific research and obtaining ethical clearance.

The experimental design used was a 3x3 factorial (3genotype x 3 treatment groups) in a completely randomized design according to the model:

$$Y_{ijk} = u + A_i + B_j + (AB)_{ij} + e_{ijk}$$

Y_{ijk} is individual observation,
u is population mean,
Ai is effect of Local, Exotic and Crossbred,
Bj is effect of treatment
$(AB)_{ij}$ is interaction effect of breed
e_{ijk} is the experimental error.

Data collected were subjected to analysis of variance and where means were found to be significant; Duncan's New Multiple Range test was used to separate the means.

Results

Effect of genotype on growth traits

Growth Performance Table 1 and 2 presents the productive performance of chicks as effect of genotype and treatment respecticvely. During the overall phase, all performance parameters (Feed

intake and bodyweight, body weight gain and feed conversion ratio) were significantly affected by the main factor genotype ($p < 0.05$). From the result of this study, BW, BWG, FI, and FCR differ significantly between all genotypes. The FI, and FCR significantly differed among all genotypes, with an increased intake in exotic and a decrease in local genotype The exotic genotype obtained the most efficient FCR, while local genotype had the poorer value in this study. At 2 months of age, feed intake was highest in exotic genotype with a mean value of 1720.00g followed by local and crossbred genotypes with respective values of 1634.00g and 1548.00g. At 4 months, the Local genotype recorded the lowest feed intake (1066.50g), while the exotic genotype had the highest mean value of 1474.67g followed by a value of 1211.33g expressed by the crossbred chickens. Feed intake at 6 months showed that exotic and crossbred groups were statistically similar ($P>0.01$) recording values of 3182.00g and 3136.85g respectively but were significantly ($P<0.01$) different from the value of 2580.00g recorded for genotypes. The best overall fed conversion ratio during the study period were obtained in exotic genotype (3.27) followed by crossbred (3.82) and local (4.62). Differences in FCR have already been reported among different genotypes. The total weight gain showed significantly ($P<0.01$) different means. The exotic genotype (1954.50g) had the highest weight gain compared to crossbred (1549.75g) and Local genotype (1143.58g).

Effect of treatment on growth traits

Treatment effect on feed intake and feed conversion ratio were highly significant ($P<0.01$) across 2 months, 4 months, 6 months and on the total feed intake (table 1). Birds on the control at 2 months of age ate the most (1720.00g) while those fed garlic ate the least (1548.00 g). At 4 months of age, control (1211.33g) and Ciprofloxacin (1211.33g) groups recorded the lowest feed intake values while the highest value of 1329.83g were obtained from the garlic group. At 6 months of age, birds on the control group recorded the highest feed intake of 3096.00g followed by Ciprofloxacin (2921.85g) and garlic (2881.00g). Total feed intake showed that the highest feed intake value of 6027.33g was recorded on birds on t control when compared to those on Ciprofloxacin and garlic groups which were similar with respective values of 5767.18g and 5758.83g. Table 4.1.5 shows the effect of treatment on weight and weight gain of the birds. In the current study, birds on the control group or Ciprofloxacin treated had higher weights than birds receiving garlic during the first two months, but this trend waned so that by the end of the six-month period, birds receiving garlic had the greatest weight compared to those receiving the control, while those receiving Ciprofloxacin were intermediates

Interaction effect of genotype x treatment on growth traits

The interaction effect of genotype x treatment on feed intake and FCR are presented on table 3. The interaction effect of genotype x treatment led to significant differences in feed intake at 2 months, 4 months , 6 months of age and in the total feed consumed. On the total feed intake, exotic genotypes fed control had the highest mean value of 6840.00g among the interaction groups. Whereas, the least mean values were recorded in local genotype fed Ciprofloxacin (5205.00g) and local genotype fed garlic (5144.50g). For the overall feed conversion ratio, the highest value (4.93) was obtained in local genotype fed control. Whereas, the best feed conversion ratio in exotic genotype fed garlic was statistically similar to the value of 2.94 .in the crossbred genotype fed control. The interaction effect of genotype and treatment on body weight (table 3), showed that weights at 2 months, 4 months and 6 months of age were significantly ($P<0.01$) different among the interaction groups. The results on weight gain during the months studied and total weight gain were highly significant ($P<0.01$) among the interaction groups.

Table 1: Effect of genotype on feed intake (g), feed conversion ratio, body weight and body weight gain F_1 offspring of local x local, exotic x exotic

Parameter		Local Genotype	Exotic Genotype	Crossbred Genotype	P. Value
day old	BW(g/bird)	32.25±0.16 c	45.50±0.11a	36.92±0.14 b	0.00 **
2months	Feed intake	1634.00±11.76 b	1720.00±11.76 a	1548.00±0.00 c	0.00**
	FCR	4.44±0.03 a	2.31±0.03 c	2.83±0.03 b	0.00**
	BW (g/bird)	400.00±0.00 c	800.00±7.89 a	591.67±6.19 b	0.00**
	TWG	367.75±0.16 c	754.50±7.96 a	554.75±6.17 b	0.00**
4months	Feed intake	1066.50±9.09 c	1474.67±7.20 a	1211.33±14.40 b	0.00**
	FCR	5.74±0.07 a	3.24±0.12 b	5.61±0.15 a	0.00**
	BW (g/bird)	588.33±2.67 c	1300.00±7.89 a	823.33±3.60 b	0.00**
	TWG	188.33±2.67 c	500.00±12.48 a	231.67±6.19 b	0.00**
6months	Feed intake	2580.00±22.77 b	3182.00±31.11 a	3136.85±35.09 a	0.00**
	FCR	4.41±0.04 b	4.55±0.04 a	4.15±0.05 c	0.00**
	BW (g/bird)	1175.83±3.58 c	2000.00±7.89 a	1586.67±12.06 b	0.00**
	TWG	587.50±3.16 c	700.00±0.00 b	763.33±10.32 a	0.00**
Total	Feed intake	5280.50±24.74 c	6376.67±41.36 a	5896.18±43.20 b	0.00**
	FCR	4.62±0.03 a	3.27±0.03 c	3.82±0.03 b	0.00**
Total weight gain	(g/bird)	1143.8 ±3. 50c	1954. 50 ± 7.89a	1549. 75 ±12.02b	0.00**

[abc]: Means on the same row with different superscripts are significantly different (*P ≤ 0.05; **P ≤ 0.01)

Table 2: Effect of treatment on feed intake (g), FCR, Weight (G) and weight gain of the 3 genotype studied

Parameter		Control	Ciprofloxacin	Garlic	P Value
2months	**Feed intake**	1720.00±11.76 [a]	1634.00±11.76 [b]	1548.00±0.00 [c]	0.00**
	FCR	3.35±0.11 [a]	3.13±0.08 [b]	3.10±0.09 [b]	0.00**
	BW (g/bird)	608.33±18.28 [a]	600.00±15.79 [a]	583.33±16.19 [b]	0.00**
	TWG	570.17±17.76 [a]	562.17±15.29 [a]	544.67±15.76 [b]	0.00**
4months	**Feed intake**	1211.33±14.40 [b]	1211.33±25.96 [b]	1329.83±13.17 [a]	0.00**
	FCR	4.89±0.13 [a]	5.05±0.19 [a]	4.65±0.16 [b]	0.01**
	BW (g/bird)	881.67±26.03 c	906.67±31.67 b	923.33±29.18 a	0.00**
	TWG	273.33 ± 10.12	306.67 ± 19.08	340.00 ± 15.71	
6months	**Feed intake**	3096.00±49.88 [a]	2921.85±23.42 [b]	2881.00±39.22 [b]	0.00**
	FCR	4.60±0.05 [a]	4.34±0.04 [b]	4.16±0.05 [c]	0.00**
	BW (g/bird)	1555.00±31.59 [c]	1588.33±36.19 [b]	1619.17±32.68 [a]	0.00**
	TWG	673.33±9.01 [b]	681.67±9.98 [a]	695.83±9.03 [a]	0.03*
total	**Feed intake**	6027.33±63.40 [a]	5767.18±54.38 [b]	5758.83±49.20 [b]	0.00**
	FCR	4.09±0.06 [a]	3.86±0.06 [b]	3.77±0.06 [c]	0.00**
Total weight gain	(g/bird)	1516.83±31.09 [c]	1550.50±35.65 [b]	1580.50±32.18 [a]	0.00**

[abc]: Means on the same row with different superscripts are significantly different (*P ≤ 0.05; **P ≤ 0.01)

Table 3: Interaction effect of genotype and treatment on feed intake (g) and FCRody weight (g) and weight gain

GxT		local fed control	exotic fed control	crossbred fed control	local fed cipro	exotic fed cipro	crossbred fed cipro	local fed garlic	exotic fed garlic	crossbred fed garlic	P Value
	FI	1806.00±0.00 ^{a}	1806.00±0.00 ^{a}	1548.00±0.00 ^{b}	1548.00±0.00 ^{b}	1806.00±0.00 ^{a}	1548.00±0.00 ^{b}	1548.00±0.00 ^{b}	1548.00±0.00 ^{b}	1548.00±0.00 ^{b}	0.00**
	FCR	4.91±0.00 ^{a}	2.25±0.02 ^{f}	2.90±0.04 ^{c}	4.21±0.00 ^{b}	2.48±0.03 ^{e}	2.68±0.07 ^{d}	4.22±0.00 ^{b}	2.18±0.06 ^{f}	2.90±0.05 ^{c}	0.00**
2 month	**BW**	400.00±0.00^{e}	850.00±8.45 ^{a}	575.00±7.32 d	400.00±0.00 ^{e}	775.00±7.32 ^{b}	625.00±14.02 ^{c}	400.00±0.00 ^{e}	775.00±18.42 ^{b}	575.00±7.32 ^{d}	0.00**
	BWG	368.00±0.24^{e}	804.50±8.62^{a}	538.00±7.22d	368.00±0.24^{e}	729.75±7.39^{b}	588.75±13.77^{c}	367.25±0.32^{e}	729.25±18.59 ^{b}	537.50±7.56 ^{d}	o.oo**
	FI	1106.00±0.00 ^{d}	1422.00±0.00 ^{b}	1106.00±0.00 ^{d}	948.00±0.00 ^{e}	1580.00±0.00 ^{a}	1106.00±0.00 ^{d}	1145.50±11.56 ^{c}	1422.00±0.00 ^{b}	1422.00±0.00 ^{b}	0.00**
4 month	FCR	6.14±0.00 ^{b}	4.27±0.28 ^{e}	4.27±0.10 ^{e}	5.27±0.00 ^{d}	2.80±0.06 ^{f}	7.08±0.24 ^{a}	5.82±0.19 ^{bc}	2.64±0.06 ^{f}	5.49±0.13 ^{cd}	0.00**
	BW	580.00±0.00 ^{g}	1225.00±14.02 ^{c}	840.00±0.00 ^{d}	580.00±0.00 ^{g}	1350.00±8.45 ^{a}	790.00±8.45 ^{e}	605.00±7.32 ^{f}	1325.00±7.32 ^{b}	840.00±0.00 ^{d}	0.00**
	BWG	180.00±0.00 ^{de}	375.00±18.42 ^{b}	265.00±7.32	180.00±0.00 ^{de}	575.00±14.02 ^{a}	165.00±7.32 ^{e}	205.00±7.32 ^{d}	550.00±14.64 ^{a}	265.00±7.32	0.00**
	FI	2580.00±0.00 ^{g}	3612.00±0.00 ^{a}	3096.00±87.22 ^{c}	2709.00±37.77 ^{f}	3096.00±0.00 ^{c}	2960.55±37.44 ^{d}	2451.00±48.76 ^{h}	2838.00±0.00 ^{e}	3354.00±0.00 ^{b}	0.00**
6month	FCR	4.57±0.01 ^{b}	5.16±0.00 ^{a}	4.08±0.06 ^{d}	4.59±0.04 ^{b}	4.42±0.00 ^{bc}	4.01±0.10 ^{d}	4.06±0.11 ^{d}	4.05±0.00 ^{d}	4.37±0.09 ^{c}	0.00**
	BW	1145.00±1.46 ^{f}	1925.00±14.02 ^{b}	1595.00±14.02 ^{c}	1170.00±5.21 ^{f}	2050.00±8.45 ^{a}	1545.00±27.71 ^{d}	1212.50±4.69 ^{e}	2025.00±7.32 ^{a}	1620.00±16.90 ^{c}	0.00**
	BWG	565.00±1.46^{d}	700.00±0.00^{b}	755.00±14.02^{a}	590.00±5.21^{cd}	700.00±0.00^{b}	755.00±21.96^{a}	607.50±6.02^{c}	700.00±0.00 ^{b}	780.00±16.90 ^{a}	
total	FI	5492.00±0.00 ^{f}	6840.00±0.00 ^{a}	5750.00±87.22 ^{d}	5205.00±37.77 ^{g}	6482.00±0.00 ^{b}	5614.55±37.44 ^{e}	5144.50±47.12 ^{g}	5808.00±0.00 ^{d}	6324.00±0.00 ^{c}	0.00**
	FCR	4.93±0.01 ^{a}	3.65±0.03 ^{f}	3.69±0.03 ^{ef}	4.57±0.02 ^{b}	3.24±0.01 ^{g}	3.76±0.07 ^{e}	4.37±0.05 ^{c}	2.94±0.01 ^{h}	4.01±0.04 ^{d}	0.00**
Total	**BWG**	1113.00±1.48 ^{f}	1879.50±14.04 ^{b}	1558.00±14.07 ^{c}	1138.00±5.08 ^{f}	2004.75±8.32 ^{a}	1508.75±27.51 ^{d}	1179.75±4.38 ^{e}	1979.25±7.49 ^{a}	1582.50±16.99 ^{c}	0.00**

^{abc}: Means on the same row with different superscripts are significantly different (*P ≤ 0.05; **P ≤ 0.01)

GxT = INTERACTION EFFECT

Discussion

Treatment effect

The results of the present showed that birds on the garlic extract treatment had a better FCR than birds on the control and Ciprofloxacin treatments throughout the trial. Birds on Ciprofloxacin achieved similar FCR to the garlic extract group during the first 2 months. The lack of significant effects on FCR during the first 2 months is consistent with the result of and Umatiya *et al.* (2018). Similar to the overall observations throughout the study, Raeesi *et al.* (2010) reported that supplementation of garlic powder had a considerable effect on improvement of FCR.. The authors postulated that better FCR by birds on the garlic fortified diet could be attributed to garlic antibacterial properties which lead to better nutrients absorption and hence an improved FCR. Contrary to the current study, several studies have reported that dietary garlic supplementation did not significantly influence the feed intake of chickens (Umatiya *et al.*, 2018).

It has been reported that the lower the FCR, the more efficient the flock was using the feed supplied. It was discovered in this study that FCR favoured birds which were fed garlic throughout the experimental period. The exotic genotype had a lower FCR and better performance than the crossbred local birds. Similarly, it is reported that FI and FCR varies in different genotypes and strains (Khan, 2015) due to their genetic differences, body frame structure and production traits. Hagan and Adjei (2012), likewise, claimed difference in feed intake among different genotypes depicting genotype effect on feed intake. In poultry production, body weight, body weight gain, feed intake and FCR are seen as the main growth parameters for meat-type birds. The increase in body weight for all the chicken genotypes studied from day-old to six months can be explained from the fact that animal growth involves increase in size and changes in functional capabilities of the various tissues and organs of animals from conception through maturity. This observation is consistent with the report of Adedeji *et al.* (2008). Throughout the entire six-month experiment, the exotic genotypes typically gained the most weight, followed by the crossbred chickens and then the local types. According to research reported by Tiamiyu (2021), the parents of Gold-Link chickens put on more weight than the local birds. The crossbred groups gained weight at a rate that was higher than the local chickens.

The implication of the genotype x treatment interaction in this study was that the treatment with garlic used could support the growth of the heavy ecotype, exotic and the crossbred chickens since they finally obtained the required body weight reported in literature. These results corroborate the study of Esan (2009); Aarti and Khusro *et al.* (2020) who stated that bird diet supplemented with garlic showed higher values in their body weight gain compared to the control group without garlic. This conclusion is at variance with report of Ndofor Foleng *et al.* (2015); Fayed *et al.* (2011) and Aarti and Khusro *et al.* (2020) who reported insignificant (P>0.05) breed x diet interaction effect on body weight and weight gain of a cross between heavy ecotype chicken and Anak chicken; Plymouth Rock and local chicken respectively. The differences observed from the study could be as a result of the different test ingredients used and the method of preparation. The improvement of the weight gain of chickens IN THIS STUDY could be attributed to allicin, a bioactive compound found in garlic, has been shown to enhance the intestinal epithelium, increasing the villus height and crypt depth, resulting in an improved digestive system that increases nutrient absorption and assimilation (Prakash *et al.*, 2021).. The major strength of using plant natural products is because of their chemo-diversity, economic sustainability, worldwide distribution or availability, various antibacterial modes of action, and the effectiveness of their extracts from which organic compounds (including phenolic, terpenoids, and alkaloid) are isolated (Porras *et al.*, 2020).

Conclusion

In conclusion, this study highlighted the nutritional advantages of using garlic and Ciprofloxacin in the growth performance in three genotypes (exotic, local and crossbred) chickens. The hybrid impact of crossing naturally low yielding genotypes in the cross contributed to the

crossbreds of this experiment performing better than the heavy ecotype chicken. These reports suggest that the genetic potential of the exotic chickens used in this experiment to develop the F_1 local genotype chickens might be responsible for the higher body weight and weight gain of the F_1 crossbreed. This could be attributed to hybrid vigour and complementarity genes from the parental breeds (Exotic and heavy ecotype chicken). It was also observed that garlic can improved feed conversion ratio in chickens and hence it is recommended that farmers can use garlic as alternative to antibiotics. Additionally, could offer potential health benefits for the animals, as garlic has been known to have antibacterial

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