Original Article

Life Science

Effect of Age and Cage Position on the Growth Traits of Harco-black Cockerel Chicken in the Derived Savanna Zone of Nigeria

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ABSTRACT [ENGLISH/ANGLAIS]

The study was conducted to determine the effect of age and cage position on the growth traits of harco-black cockerel chicken. Two hundred and fifty birds were used for the study and were randomly placed equally in the upper and the lower tier cage for the period of sixteen weeks. The parameters taken were body length (BLT), comb length (CLT), Keel length (KLT), Drumstick (DSK), Shank length (SLT) and Chest girth (CGT). Significant effect ($p < 0.05$) of cage tier and age on DSK, KLT, SLT, CGT and CLT of Harco-black cockerel were observed. The upper tier cage shows higher significance for most of the growth traits measured. The correlation coefficients at 9th week of age were only highly positively significant ($p < 0.001$) correlation between CGT and KLT while that of 14th week of age shows a highly negatively significant ($p < 0.001$) correlated between the BLT and SLT at the upper diagonal. At the upper diagonal of the 19th week of age, CLT against DSK shows a highly positively significance ($p < 0.001$) correlation, while a high negatively significant ($p < 0.05$) correlation exist between BLT and KLT.CLT against SLT also shows a highly negatively significance ($p < 0.001$) correlation. The high positively significant ($p < 0.05$) correlations exist between BLT and SLT, KLT and SLT respectively at the upper diagonal. At the lower diagonal, a high positively significant ($p < 0.05$) relationship occurred between SLT and DSK with a highly negatively significant ($p < 0.05$) correlation between CGT and DSK all the 24 weeks of age. Generally, the correlated coefficients were low to high and positive; it can therefore be concluded that cage tier and age are strong determinant of growth traits in harco-black cockerels.

Keywords: Cockerel, growth trait, cage position, correlation coefficient, derived savanna

RÉSUMÉ [FRANÇAIS/FRENCH]

L'étude a été menée afin de déterminer l'effet de l'âge et la position de la cage sur les caractères de croissance de poulet coq Harco-noir. Deux cent cinquante oiseaux ont été utilisés pour l'étude et ont été placés au hasard aussi dans le haut et le bas de la cage de palier pour la période de seize semaines. Les paramètres pris ont été la longueur du corps (BLT), longueur de peigne (CLT), la longueur de quille (KLT), le pilon (DSK), longueur de la tige (SLT) et Tour de poitrine (CGT). effet significatif (P <0,05) de la cage de palier et de l'âge sur DSK, KLT, SLT, la CGT et de la CLT-coq Harco noirs ont été observés. La cage de palier supérieur montre plus grande importance pour la plupart des caractères de croissance mesurée. Les coefficients de corrélation à la 9e semaine de l'âge n'ont été que très positivement significative (P <0,001) corrélation entre la CGT et KLT tandis que celle de la 14e semaine d'âge montre une (p <0,001) très négative importante corrélation entre le BLT et SLT à la diagonale supérieure . À la diagonale supérieure de la 19e semaine de l'âge, CLT contre DSK montre un très positive significative (p <0,001) de corrélation, tandis qu'un haut négative significative (p <0,05) la corrélation existant entre BLT et SLT KLT.CLT contre montre également une très négative significative (p <0,001) de corrélation. La haute positive significative (p <0,05) des corrélations existent entre les BLT et SLT, KLT et SLT respectivement à la diagonale supérieure. Au bas de diagonale, une relation positive forte significative (p <0,05) ont eu lieu entre les modèles SLT et DSK avec un (p <0,05) très négative importante corrélation entre la CGT et DSK toutes les 24 semaines d'âge. En général, les coefficients de corrélation ont été faible à élevé et positif, il peut donc en conclure que la cage de palier et l'âge sont fort déterminant les caractères de croissance chez le coq Harco-noir.

Mots-clés: Coq, le trait de croissance, position de la cage, coefficient de corrélation, dérivée de savane

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Accepted/Accepté: June, 2011

Full Citation: Ojedapo LO, Adedeji TA, Amao SR, Ameen SA. Effect of age and cage position on the growth traits of harco-black cockerel chicken in the derived savanna zone of Nigeria. World Journal of Life Sciences and Medical Research 2011;1(3):60-5.

INTRODUCTION

Poultry rearing are now ahead of all other livestock in terms of economic importance (such as meat production, income generation, jobs creation, provision of industrial raw materials and creations of opportunities for scientific research) in many countries [1]. The most widely spread

and most reared is the domestic fowl and they can be classified based on their origin and according to [2], a livestock population survey in 1991 shows that chickens has a population of 82.4 million and other livestock put together are just 31.9 million. This shows that poultry keeping out -numbers all other forms of livestock keeping in Nigeria.

Geneticist in their concern to improve supply of animal protein developed breeds of animals like the cockerels in the avian species and cockerel rearing and management is easier than the broiler production particularly in the rural areas where modern facilities including electric supply is not available. It is also believed that cockerels are less susceptible to diseases as compared to broilers [3].

Cages are usually constructed in single, double or triple stages which are respectively described as 1-tier, 2-tier and 3-tier. From the past studies, the performance of chicken have been observed to vary with a number of factors such as feed utilization and body weight [2], water availability [4], tier of cages [5], infection [6] and ambient temperature [7].

The management system in terms of the cages to which birds are subjected to affects and determines their quality [8] and the cage position to which they are kept determines the quality of their performance [6]. Several factors both genetic and environmental have been adduced to be factors that affect their growth. Therefore, it is essential for researchers to continue to look for ways to enhance the well being of animals while keeping production at high levels. Recent advancement in technology which includes the use of automated management system in poultry has had a great influence on poultry industries at large, this led to the introduction of housing system which can be deep litter system, battery cage system or both and other management techniques [9]. Housing of birds have increased productivity and has made poultry more attractive than when they are been reared in a free range system. Therefore, the aim of this study was to estimate the effect of age and cage position on the growth traits of Harco black cockerel chicken in derived savanna zone of Nigeria.

MATERIALS AND METHODS

Experimental Site

The experiment was carried out at the Layers House of the Teaching and Research Farm, Ladoke Akintola University of Technology, Ogbomoso. Ogbomoso is a derived savanna lies on longitude 4^0 15^1 East of Greenwich Meridian and latitude 8^0 15^1 North of the equator while the mean temperature and annual mean rainfall are 27^0C and 1247 mm respectively [10].

Experimental Unit

The section of the layer house used has 9 units of cages with 2-tier (upper and lower tier) cages. Each unit of the cages has seven cells each both at the upper and the lower tier. The section was disinfected with a suitable disinfectant to prevent infection before the introduction of the birds.

Experimental Birds and their Management

A total number of two hundred and fifty birds were used for the study. Two birds were placed or housed in each cell of a unit and this makes up a total number of twenty-eight birds per unit on both the upper and the lower tier. The birds were managed under intensive system and the experiment lasted sixteen weeks. They were fed with standard growers marsh containing 15.85% Crude protein and 2400.8kcal/kg ME for the period of the experiment (16 weeks). The birds were fed and watered under the same condition throughout the experiment period

Data Collection

Birds were collected from different units systematically on a weekly basis i.e. the nine units of the cages were divided into odd and even numbers and birds were taken from even number units in particular week and them from odd number units the following week). For each week, the selected birds were weighed and the measurements of drumstick length (thigh), body length, keel length, shank length, chest girth, and comb length (all in cm) were taken.

Statistical Analysis

Data was subjected to the analysis of variance of [11] in a Completely Randomized Design (CRD). Duncan Multiple Range Test of the same statistical software was used to determine the significant differences observed among means.

The statistical model for the analysis is as follows

$$Y_{ijk} = \mu + S_i + A_j + (SA)_{ij} + E_{ijk}$$

Where,

Y_{ijk} = individual measurement of each birds

μ = overall mean

S_i = effect of i^{th} age (i= 9, 14, 19 and 24)

A_j = effect of j^{th} cage position (j = 1, 2)
$(S*A)_{ij}$ = interaction between age i^{th} and cage position j^{th}
E_{ijk} = random error which is assumed to be normally and independently distributed with a mean of zero and variance of σ^2.

RESULTS

Table 1 shows the means of growth traits of Harco-black cockerels to different cage tiers within ages. There were significant ($p < 0.05$) effect of cage tier on the Drumstick (DSK),Keel length (KLT).Shank length (SLT), Chest girth (CGT) and comb length (CLT) at speculated ages. Significant ($p < 0.05$) difference were observed in the DSK of the Harco-black cockerels at weeks 9, 14 and 19 of age while the CGT were significantly ($p < 0.05$) affected at ages 19 and 24 weeks. However, the KLT, CLT and SLT were significantly ($p < 0.05$) affected at 14, 19 and 24 week respectively. The higher values of DSK, CLT and CGT were obtained at the 9, 19 and 24 weeks of age in Harco-black cockerel reared at the lower cage tier. Generally, the upper tier had the higher values of growth traits understudy.

The means of growth traits of Harco-black cockerels reared at different ages within cage tier is as shown in Table 2. There were significant ($p < 0.05$) difference of age on the DSK, KLT, SLT, CGT and the CLT of birds reared at the upper tier except the BLT. Harco-black cockerels at the lower cage tier had the highest KLT and CLT at 24 weeks of age while the highest values of the DSK and the CLT occurred at the 9th and 19th weeks of age respectively.

TABLE 1

Table 1 shows the growth traits (mean ± SEM) of Harco-Black cockerels reared at different cage tiers within ages

Age (Weeks)	Cage tier	n	DSK (cm)	BLT (cm)	KLT (cm)	SLT (cm)	CLT (cm)	CGT (cm)
9	Upper	20	14.65 ± 0.23^{b}	24.45 ± 0.39	10.75 ± 0.19	10.15 ± 0.03	4.36 ± 0.06	5.98 ± 0.14
	Lower	20	15.63 ± 0.28^{a}	24.20 ± 0.34	10.86 ± 0.16	9.39 ± 0.10	4.61 ± 0.14	5.76 ± 0.21
14	Upper	20	16.11 ± 0.16^{a}	24.13 ± 0.22	13.08 ± 0.31^{a}	9.02 ± 0.13	6.31 ± 0.16	6.44 ± 0.25
	Lower	20	15.30 ± 0.15^{b}	24.75 ± 0.32	10.90 ± 0.16^{b}	9.17 ± 0.04	6.02 ± 0.12	6.53 ± 0.15
19	Upper	20	15.53 ± 0.17^{a}	24.86 ± 0.23	11.55 ± 0.21	9.23 ± 0.16	6.10 ± 0.11^{a}	6.40 ± 0.16^{b}
	Lower	20	15.03 ± 0.09^{b}	24.65 ± 0.22	11.51 ± 0.11	9.33 ± 0.27	4.68 ± 0.14^{b}	7.99 ± 0.12^{a}
24	Upper	20	15.86 ± 0.23	24.17 ± 0.63	11.72 ± 0.15	9.83 ± 0.14^{a}	5.26 ± 0.15^{b}	7.24 ± 0.20
	Lower	20	15.38 ± 0.13	24.97 ± 0.39	12.02 ± 0.20	9.30 ± 0.07^{b}	6.33 ± 0.21^{a}	7.04 ± 0.12

^{ab} Means of values in the same column within ages with different superscripts are significantly different ($p < 0.05$) n: Number of observations, DSK: Drumstick, BLT: Body Length, KLT: Keel Length, SLT: Shank Length, CGT: Chest girth, CLT: Comb Length

TABLE 2

Table 2 shows the growth traits (mean ± SEM) of Harco-Black cockerels reared at different ages within cage tiers

Cage tier	Age (Weeks)	n	DSK (cm)	BLT (cm)	KLT (cm)	SLT (cm)	CLT (cm)	CGT (cm)
Upper	9	20	14.65 ± 0.23 ^{b}	24.45 ± 0.39	10.75 ± 0.19 ^{c}	10.15 ±0.03 ^{a}	4.36 ± 0.06 ^{c}	5.98 ± 0.14 ^{b}
	14	20	16.11 ± 0.16 ^{a}	24.13 ± 0.22	13.08 ± 0.31^{a}	9.02 ± 0.13 ^{b}	6.31 ± 0.16 ^{a}	6.44 ± 0.25 ^{b}
	19	20	15.53 ± 0.17 ^{a}	24.86 ± 0.23	11.55 ± 0.21 ^{b}	9.23 ± 0.16 ^{b}	6.10 ± 0.11 ^{a}	6.40 ± 0.16 ^{b}
	24	20	15.86 ± 0.23 ^{a}	24.17 ± 0.63	11.72 ± 0.15 ^{b}	9.83 ± 0.14 ^{a}	5.26 ± 0.15 ^{b}	7.24 ± 0.20 ^{a}
Lower	9	20	15.63 ± 0.28 ^{a}	24.20 ± 0.34	10.86 ± 0.16 ^{c}	9.39 ± 0.10	4.61 ± 0.14 ^{b}	5.76 ± 0.21 ^{b}
	14	20	15.30 ± 0.15 ^{ab}	24.75 ± 0.32	10.90 ± 0.16 ^{c}	9.17 ± 0.04	6.02 ± 0.12 ^{a}	6.53 ± 0.15 ^{c}
	19	20	15.03 ± 0.09 ^{b}	24.65 ± 0.22	11.51 ± 0.11 ^{b}	9.33 ± 0.27	4.68 ± 0.14 ^{b}	7.99 ± 0.12 ^{a}
	24	20	15.38 ± 0.13 ^{ab}	24.97 ± 0.39	12.02 ± 0.20 ^{a}	9.30 ± 0.07^{b}	6.33 ± 0.21	7.04 ± 0.12 ^{b}

^{ab} Means of values in the same column within ages with different superscripts are significantly different ($p < 0.05$) n: Number of observations, DSK: Drumstick, BLT: Body Length, KLT: Keel Length, SLT: Shank Length, CGT: Chest girth, CLT: Comb Length

Table 3 shows the correlation coefficient among growth traits of Harco-black cockerels reared at 9 weeks of age within different cage tiers. The correlation shows that there were more positive relationship than negative. The relationship between the KLT and SLT, CGT and SLT were positively low. However, between the CGT and the DSK, CLT and the SLT were positive relationship than negative and these values ranges from low to high. There was a highly significant ($p < 0.01$) positive correlation between the CGT and the KLT while the relationship between CLT and the SLT was positively low.

The correlation coefficients among growth traits of Harco-black cockerels reared at 14 weeks of age within different cage tiers as shown in table 4 shows that at the upper diagonal depicts a very high negatively significance ($p < 0.001$) between the SLT and the BLT. The DSK and BLT show a low positive relationship while the KLT, BLT and CLT have a positive correlation.

Table 5 shows the correlation coefficients among growth traits of Harco-Black cockerels reared at 19 weeks of age. Generally, it was observed that the values obtained range from low to high and also there were positive correlation than negative. There was a negatively high significance ($p < 0.05$) between the KLT and BLT and CGT and CLT. A highly positive significance ($p < 0.001$) correlation was also observed between the DSK and the CLT. A highly negatively significant ($p < 0.001$) correlation exist between CGT and CLT.

Table 6 reveals the correlation coefficients among growth traits of Harco-black cockerels reared at 24 weeks of age within different cage tiers. Generally, the values obtained were from low to high. At the lower diagonal, the correlation between the SLT and the DSK was positively high and significant ($p < 0.05$) while the correlation between the CGT and the DSK was negatively high and significant ($p < 0.05$). At the upper diagonal, the correlation between the SLT and BLT, SLT and KLT were positively high and significant ($p < 0.05$). The interaction between the age and cage tiers shows a very high significance ($p < 0.05$) correlation in the DSK, KLT, SLT, CGT and the CLT.

TABLE 3

Table 3 shows the correlation (coefficients) among growth traits of Harco-black cockerels reared at 9 weeks of age within different cage tiers

Cage tier	DSK (cm)	BLT (cm)	KLT (cm)	SLT (cm)	CLT (cm)	CGT (cm)
DSK (cm)		0.269	-0.423	-0.415	-0.168	-0.362
BLT (cm)	-0.139		0.38	0.168	-0.264	-0.443
KLT (cm)	-0.164	0.184		-0.143	0.620**	-0.083
SLT (cm)	-0.105	0.087	0.026		-0.389	0.006
CLT (cm)	0.382	-0.413	0.144	0.008		-0.051
CGT (cm)	-0.072	-0.258	0.190	0.404	0.193	

*Upper diagonal represents 9th week of age, cage tier 2; Lower diagonal represents 9th week of age, cage tier 1; ** ($p < 0.001$);*
DSK: Drumstick, BLT: Body Length, KLT: Keel Length, SLT: Shank length, CGT: Chest girth, CLT: Comb length

TABLE 4

Table 4 shows the correlation (coefficients) among growth traits of Harco-black cockerels reared at age of 14 weeks within different cage tiers

Cage tier	DSK (cm)	BLT (cm)	KLT (cm)	SLT (cm)	CLT (cm)	CGT (cm)
DSK (cm)		0.028	0.290	0.205	0.137	0.420
BLT (cm)	0.120		0.431	0.295	-0.296	-0.518**
KLT (cm)	0.174	0.008		0.399	-0.264	0.290
SLT (cm)	-0.213	-0.069	-0.119		0.296	-0.156
CLT (cm)	-0.253	-0.109	0.088	-0.020		-0.293
CGT (cm)	0.119	-0.340	0.187	0.287	-0.148	

*Upper diagonal represents 14th week of age, cage tier 2; Lower diagonal represents 14th week of age, cage tier 1; ** ($p < 0.001$);*
DSK: Drumstick, BLT: Body Length, KLT: Keel Length, SLT: Shank length, CGT: Chest girth, CLT: Comb length

TABLE 5

Table 5 shows the correlation (coefficients) among growth traits of Harco-black cockerels reared at 19th weeks of age within different cage tiers

Cage tier	DSK (cm)	BLT (cm)	KLT (cm)	SLT (cm)	CLT (cm)	CGT (cm)
DSK (cm)		-0.80	0.099	0.130	-0.380	0.700**
BLT (cm)	-0.278		-0.477*	-0.313	-0.34	0.043
KLT (cm)	0.239	-0.267		0.263	0.301	-0.029
SLT (cm)	0.023	0.232	0.090		-0.210	0.329
CLT (cm)	0.177	0.102	0.203	0.113		-0.699**
CGT (cm)	0.015	-0.022	0.108	-0.108	-0.093	

*Upper diagonal represents 19th week of age, cage tier 2; Lower diagonal represents 19th week of age, cage tier 1; ** ($p < 0.001$);*
DSK: Drumstick, BLT: Body Length, KLT: Keel Length, SLT: Shank length, CGT: Chest girth, CLT: Comb length

TABLE 6

Table 6 shows the correlation (coefficients) among growth traits of Harco-black cockerels reared at 24 weeks of age within different cage tiers

Cage tier	DSK (cm)	BLT (cm)	KLT (cm)	SLT (cm)	CLT (cm)	CGT (cm)
DSK (cm)		0.012	0.401	-0.068	0.127	0.094
BLT (cm)	0.179		0.191	0.490*	0.216	-0.030
KLT (cm)	0.159	0.009		0.467*	0.135	0.285
SLT (cm)	0.553*	0.102	-0.148		-0.013	0.426
CLT (cm)	-0.493*	0.106	0.104	-0.359		-0.270
CGT (cm)	0.008	0.154	-0.087	0.285	0.183	

*Upper diagonal represents 24th week of age, cage tier 2; Lower diagonal represents 24th week of age, cage tier 1; ** ($p < 0.001$);*
DSK: Drumstick, BLT: Body Length, KLT: Keel Length, SLT: Shank length, CGT: Chest girth, CLT: Comb length

DISCUSSION

The significant effect of cage tier on some of the growth traits is an indication that DSK, KLT, SLT, CGT and CLT responded positively to the upper tier of the cage used in rearing. Cage density plays a major role in determining the well being of birds. [12] reported that greater stocking density reduces feed intake and reduce body weight. In addition, the higher values obtained at the upper tier generally showed that the upper tier could be recommended for the rearing of cockerels. This agrees with the reports of Carmichael et al. [13] who discovered higher performance with the birds reared at upper tier cage. This result might be due to the fact that the cockerels at the lower tier were unavoidably more exposed to the ammonia gas coming from their droppings which might invariably interfere with their metabolic processes.

The significant variations in the growth traits as age of the birds advanced both in the upper and lower theirs agrees with reports of Sonaiya et al. [14] and Pingel et al. [15] that age is also a major factor affecting of growth rate and physiological development. The highest values of majority of the growth traits obtained at advanced ages of the birds in both tiers are reasonable because the feed intake and conversion efficiency of birds had gone up at this period.

Generally the pattern of variation of correlation coefficients amongst the growth traits at all ages agrees with past literatures of Ojedapo et al. [16]. This positive correlation suggests that these traits are under the same gene action and by implication selection for improvement in one trait would bring about a corresponding improvement in the other traits on a correlated response.

CONCLUSION

The result revealed higher values at the upper tier which shows that the upper tier could be recommended for the rearing of cockerels between fourteen and twenty weeks of age. This result might be due to the fact that the cockerels at the lower tier were unavoidably more

exposed to the ammonia gas coming from their droppings which might be interfering with some of their metabolic processes. Therefore, it could be preferable to use the upper tier for rearing harco black cockerels chicken between fourteen and twenty weeks of age. Alternatively persistent (very frequent) replacement of litters and evacuation of the dropping should be done, but this may attract extra-cost

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ACKNOWLEDGEMENT / SOURCE(S) OF SUPPORT

Nil

CONFLICT OF INTEREST

No conflict of interest here was declared by authors.