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COMPARATIVE GROWTH CHARACTERISTICS OF TWO BROILER STRAINS RAISED IN THE WET HUMID TROPICS

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Target Audience: Broiler producers, animal physiologists, Poultry breeders

ABSTRACT

A total of 49 broiler chicks (25 Lohmann Brown and 24 Anak strains) were used in the comparative evaluation of their growth characteristics from day old to 56 days of age. Weekly body weights were taken as well as some linear body measurements such as chicken height, body length, thigh length, shank length, wing length, head circumference and body circumference. Anak broiler chickens showed superiority in growth of body weight and linear measurements in the 0-56 day study period. Prediction equations relating body weight (Y) to each of the linear body measurements (x) were established for each of the two broiler strains using the simple linear ($Y = a + bx$) and the allometric ($Y = ax^b$) functions.

Correlation coefficients (r) between some of the linear body measurements at 7, 21 and 35 days and the terminal (56 - day) body weights were also established. The terminal body weight was best predicted by 35 - day measurements for both strains. Body circumference and shank length were better predictors of 56 - day body weights for the two strains. Under similar conditions of management Anak broiler chickens tended to be superior over the Lohmann Brown strain in body weight and linear body growth.

Key words: Growth, broiler strains, live weight prediction

DESCRIPTION OF PROBLEM

The Nigerian poultry industry has over the years witnessed the introduction of different broiler strains into the country. The realization of the full growth potentials of these imported strains is largely expected to depend on the nutritional and climatic variables, subject however to the genotypic traits which in turn set a ceiling on their productive capacity. The implication is that the broiler producer should select stock which have the genetic potential for fast growth rate and the attainment of market eight early enough under the existing climatic conditions. Within the last one decade, there has been an intensification of studies (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12) on the genetic, physiological, nutritional and growth performance of such imported hybrids

as Cobb, White Ross, Lohmann Brown, Hypercom Hubbard, Anak, Shaers, and Perdue among others. Most of these studies were focussed on individual strains. More studies involving the com-parison of the responses of two or more broiler strains to the same level of physiological or nutritional treatment will furnish producers with dependable information on the choice of broiler strains for table meat production. The present study was aimed at comparing the growth characteristics of the Lohmann Brown and Anak commercial broiler chickens. The liveweight predictive ability of the various linear body measurements was also investigated.

MATERIAL AND METHODS

Forty-nine (25 Lohmann Brown and 24 Anak) broiler chicks used in this study were purchased from a local distributor in Calabar. The birds were individually weighed and wing - tagged for ease of identification in subsequent body measurements.

The two broiler strains were allocated to separate pens and reared on the deep litter system. The birds were fed *ad libitum* with the commercial broiler starter ration containing 21% crude protein for the first five weeks of life, followed by the finisher mash containing 19% crude protein. Water was made available constantly. Routine medication was administered at the appropriate time.

Data Collection: Body weight and linear body measurements were obtained from each bird on a weekly basis. The linear body measurements taken were: chicken height, body length, shank length, thigh length, wing length, body circumference and head circumference. Body weight was taken in grams using a top loading Mettler Balance (0-16kg range) while the linear body measurements were taken using a tape rule, ruler and thread.

Statistical Analysis: The data collected were analysed as follows:

(i) Simple linear regression and correlation analyses of the type $Y = a + bx$ were carried out where

Y = body weight or linear body measurement;

a = constant in the regression equation (intercept);

b = regression coefficient;

x = age of the bird in days.

(ii) The exponential equation $Y = a\,x^b$ (5) was employed to examine the relationship between the body weight Y and individual linear body measurements. The equation $Y = a\,x^b$ was transformed to its linear form, $\log Y = \log a + b \log x$ and the constants `a' estimated by least squares procedure.

(iii) Regression and correlation analyses were carried out to establish which of the linear body measurements best predicted the terminal body weight from the values obtained at 7, 21 and 35 days of age.

RESULTS AND DISCUSSION

The means and standard errors in respect of the body weight and linear body measurements in respect of the Lohmann Brown and Anak broiler strains are shown in Table 1. The values obtained for each of the broiler strains increased progressively from day old to 56 days of age. The Anak broiler chickens exhibited consistent superior body weight difference over the Lohmann Brown at each age group, a trend that was similarly reflected with the linear body measurements.

Liveweight increases at 28-day were 6.21 and 6.09 times their 7-day old values for the Lohmann Brown and Anak strains respectively, while increases at 56-day related to 28-day were 2.94 and 2.87 times for the Lohmann Brown and Anak respectively. The decline in body weight growth from 6 - fold in the first 4 weeks to 3 - fold in the last 4 weeks agrees with observations reported earlier (2,13) that the chick doubles its body weight 3 to 5 times before 6 weeks of age. The results also confirm the fact that the genotype sets a ceiling on the body weight capacity since in this present study nutrition and other environmental factors were uniform.

Significant genotype differences in weight gain among different broiler genotypes and strains at the same protein level have been reported (7,14). The growth coefficient `b' relating body weight to age (Table 2) has further highlighted the superiority of the Anak strain ($b = 28.70$ v 26.48, $r^2 = 0.9841$ v 0.9800) over the Lohmann Brown. Growth coefficient values for body length, thigh length, body circumference, and head circumference were numerically ($P>0.05$) higher for Anak broilers.

Body weight prediction from each of the linear body measurements using the exponential function, $Y = a\ x^b$ is shown in Table 3. The correlation coefficient (r) values in respect of each of the predictors were highly significant ($P<0.001$) indicating the dependability of the model used. In addition, the values show the high contribution of each parameter to body weight development. The growth coefficient `b' (ranging from 2.49 to 4.71 with average 3.08 ± 0.16) strongly reflects the trend when one and three dimensional parameters are regressed together. The results obtained in this study reveal the superiority of the allometric function in relating body weight prediction. The r^2 values obtained are much higher than those reported (4) using the simple linear model.

Within each linear body parameter the growth coefficient `b' and coefficient of determination `r^2' were consistently similar and did not show any strain differences. Generally, while 7 - day old linear body measurements did not assist in predicting 56-day body weight of chickens for both strains, the 35-day values gave good predictive ability of terminal body weights with the Anak strains showing higher numerical `r^2' and highly significant ($P<0.001$) values

Table 1: Mean Body weight and linear body measurements of Lohmann Brown and Anak broiler strains at different ages*

Age (days)	Broiler Strain	Body Weight (g)	Chicken Height (cm)	Body Length (cm)	Shank Length (cm)	Thigh Length (cm)	Wing Length (cm)	Body Circumference (cm)	Head Circumference (cm)
7	Lohmann Brown[LB]	75.66 ± 1.04	8.72 ± 0.11	16.01 ± 0.11	3.01 ± 0.06	3.64 ± 0.07	7.77 ± 0.09	14.59 ± 0.07	6.69 ± 0.08
	Anak [AN]	85.66 ± 0.89	9.07 ± 0.09	16.10 ± 0.12	3.14 ± 0.05	3.14 ± 0.05	7.16 ± 0.12	14.14 ± 0.14	6.32 ± 0.07
14	LB	173.56 ± 6.75	11.60 ±0.25	19.81 ± 0.23	4.34 ± 0.09	3.92 ± 0.05	10.22 ± 0.20	18.12 ± 0.22	6.84 ± 0.13
	AN	206.07 ± 7.50	12.41 ± 0.18	20.77 ± 0.29	4.38 ± 0.08	4.07 ± 0.07	11.05 ± 0.14	19.67 ± 0.38	6.56 ± 0.18
21	LB	303.74 ± 11.10	14.05 ± 0.14	23.54 ± 0.29	5.58 ± 0.06	5.11 ± 0.14	12.84 ± 0.25	22.19 ± 0.39	7.91 ± 0.18
	AN	336.51 ± 13.40	13.14 ± 0.16	23.69 ± 0.32	5.77 ± 0.11	5.10 ± 0.12	13.37 ± 0.24	21.78 ± 0.34	7.73 ± 0.16
28	LB	469.85 ± 17.49	15.86 ± 0.22	26.20 ± 0.36	6.20 ± 0.09	5.88 ± 0.12	14.02 ± 0.19	25.95 ± 0.45	8.88 ± 0.09
	AN	520.16 ± 18.78	15.63 ± 0.17	26.62 ± 0.43	6.14 ± 0.10	5.74 ± 0.08	14.58 ± 0.23	25.75 ± 0.43	8.02 ± 0.12
35	LB	674.87 ± 23.36	17.43 ± 0.19	29.78 ± 0.35	7.30 ± 0.11	6.87 ± 0.11	15.49 ± 0.25	30.46 ± 0.52	9.60 ± 0.09
	AN	788.66 ± 24.74	17.57 ± 0.17	30.54 ± 0.42	7.28 ± 0.09	6.90 ± 0.09	16.00 ± 0.25	30.33 ± 0.59	9.66 ± 0.10
42	LB	890.32 ± 27.98	19.30 ± 0.16	34.70 ± 0.44	8.10 ± 0.11	7.38 ± 0.12	17.87 ± 0.23	33.29 ± 0.34	10.14 ± 0.09
	AN	999.70 ± 26.98	19.27 ± 0.12	34.93 ± 0.35	8.89 ± 0.09	7.62 ± 0.09	17.86 ± 0.16	33.83 ± 0.46	10.37 ± 0.11
49	LB	1067.16 ± 35.07	20.70 ± 0.18	36.78 ± 0.43	8.71 ± 0.13	7.98 ± 0.09	18.87 ± 0.19	34.18 ± 0.59	10.56 ± 0.09
	AN	1162.08 ± 30.57	20.25 ± 0.16	30.09 ± 0.35	8.69 ± 0.10	8.35 ± 0.12	19.46 ± 0.15	36.34 ± 0.46	10.60 ± 0.09
	LB	1380.67 ± 42.45	22.86 ± 0.23	40.26 ± 0.47	9.92 ± 0.13	9.03 ± 0.14	20.40 ± 0.28	38.72 ± 0.59	11.51 ± 0.11
	AN	1490.44 ± 28.19	23.12 ± 0.13	41.08 ± 0.37	10.03 ± 0.07	9.16 ± 0.13	20.92 ± 0.13	40.86 ± 0.37	11.51 ± 0.09

* Means between strains are not significantly different

Table 2: **Age - dependent (x) changes of body weight and linear body measurements of Lohmann Brown and Anak broiler chickens using the simple linear equation**

Dependent variable	Broiler strain	Prediction equation	r	r^2
Body weight	Lohnman Brown (LB) Anak (AN)	Y = -204.51 + 26.48x	0.9899***	0.9800
		Y = -205.30 + 28.70x	0.9920***	0.9841
Chicken height	LB	Y = 7.65 + 0.275x	0.9942***	0.9883
	AN	Y = 7.86 + 0.271x	0.9957***	0.9913
Body length	LB	Y = 12.75 + 0.497x	0.9987***	0.9974
	AN	Y = 12.96 + 0.509x	0.9991***	0.9982
Shank length	LB	Y = 2.41 + 0.134x	0.9932***	0.9865
	AN	Y = 2.53 + 0.131x	0.9952***	0.9903
Thigh length	LB	Y = 2.70 + 0.112x	0.9954***	0.9908
	AN	Y = 2.65 + 0.116x	0.9735***	0.9437
Wing length	LB	Y = 6.85 + 0.261x	0.9863***	0.9728
	AN	Y = 6.45 + 0.259x	0.9889***	0.9778
Body Circumference	LB	Y = 11.81 + 0.488x	0.9906***	0.9814
	AN	Y = 11.17 + 0.529x	0.9970***	0.9940
Head Circumference	LB	Y = 5.82 + 0.101x	0.9874***	0.9749
	AN	Y = 5.31 + 0.112x	0.9834***	0.9071

*** r values are significant at P<0.001

Table 3: **Relationships between Linear Body Measurements (x) and Body weight (Y) using the Allometric function ($Y = ax^b$)**

Independent variable	Broiler Strain	Predictor Equation	Correlation Coefficient (r)	r^2
Chicken Height	LB	$Y = 0.083X^{2.16}$	0.995	0.990
	AN	$Y = 0.095X^{2.07}$	9.999	0.998
Body Length	LB	$Y = 0.022X^{2.01}$	0.993	0.985
	AN	$Y = 0.017X^{2.07}$	0.994	0.989
Shank Length	LB	$Y = 4.290X^{2.56}$	0.995	0.990
	AN	$Y = 4.70X^{2.49}$	0.998	0.996
Thigh Length	LB	$Y = 3.29X^{2.78}$	0.990	0.980
	AN	$Y = 2.38X^{2.94}$	0.986	0.971
Wing Length	LB	$Y = 0.31X^{2.77}$	0.991	0.982
	AN	$Y = 0.27X^{2.81}$	0.996	0.992
Body Circumference	LB	$Y = 0.065X^{2.73}$	0.995	0.990
	AN	$Y = 0.032X^{2.93}$	0.998	0.995
Head Circumference	LB	$Y = 0.064X^{2.14}$	0.951	0.915
	AN	$Y = 0.015X^{2.71}$	0.964	0.929

LB = Lohmann Brown

AN = Anak

r^2 = Coefficient of Determination

*** = r - values are significant at P 0.001

than Lohmann Brown. More of the 21-day linear body values could be used in the prediction of terminal body weights in Anak than in Lohmann Brown strain. The results of this study are similar to those (10) which showed that body measurements at 1 d of age were of limited value for predicting final body weigh at 84-day. The Cobb broiler strain was reported (10) to have a better prediction of terminal body weight using 42-day body measurements.

Using linear body measurements at 35-day of age as the predictor of 56-day broiler weight, the `r^2' comparisons between the Anak and the Lohmann Brown strains are as follows:

BL (0.450 v 0.200); SL (0.568 v. 0.181); TL (0.506 v. 0.565); WL (0.611 v. 0.113); BC (0.668 v. 496).

Table 4: Prediction equations for terminal Body weights of Broiler chickens using body linear measurements at 7, 21 and 35 days

Broiler Strain	Predictor (x)	Age (days)	Prediction equation	Correlation coefficient (r)	r^2	Significance of `r' in equation
Lohmann Brown	Body Length	7	Y = 937.8 + 34.2X	0.135	0.018	N.S
		21	Y = 668.6 + 34.9X	0.368	0.136	N.S
		35	Y = 522.5 + 31.9X	0.448	0.200	*
		7	Y = 618.5 + 275.2X	0.423	179	*
		21		0.439	.193	*
		35	Y = 459.1 + 34.2X	0.425	0.181	*
		7	Y = 865.1 + 179.9X	0.317	0.100	N.S
		21	Y = 998.7 + 97.0X	0.390	0.152	N.S
		35	Y = -16.81 + 219.5X	0.752	0.565	***
		7	Y = 1518.1 + 3.8X	0.016	-	N.S
		21	Y = 1186.5 + 22.8X	0.203	0.041	N.S
		35	Y = 899.5 + 36.9X	0.337	0.113	N.S
		7	Y = 803.5 + 48.4X	0.218	0.048	N.S
		21	Y = 527.6 + 44.5X	0.517	0.267	**
		35	Y = 459.1 + 34.2X	0.704	0.496	***
Anak	Body Length	7	Y = 2694.1 - 82.1X	0.207	0.043	N.S
		21	Y = 120.4 + 53.5X	0.367	0.134	N.S
		35	Y = 1055.1 + 81.7X	0.671	0.450	***
	Shank Length	7	Y = 1806.7 - 141.3X	-0.209	0.044	N.S
		21	Y = -460.1 + 330.1X	0.465	0.216	*
		35	Y = -669.9 + 280.9X	0.753	0.568	***
	Thigh Length	7	Y = 1922.0 - 75.5X	-0.127	0.016	N.S
		21	Y = 723.1 + 128.7X	0.434	0.188	*
		35	Y = -519.9+ 275.7X	0.712	0.506	***
	Wing Length	7	Y = 2554.3 - 163.7X	0.343	0.118	N.S
		21	Y = -314.6 + 83.0X	0.497	0.247	*
		35	Y = -695.0 + 134.0X	0.782	0.611	***
	Body Circumference	7	Y = 1989.8 - 35.3X	-0.086	0.008	N.S
		21	Y = -87.7 + 66.2X	0.612	0.374	**
		35	Y = -656.1 + 66.9X	0.817	0.668	***

* *Significance of `r' at P<0.05;*
** *Significance of `r' at P<0.01*
*** *Significance of `r' at P<0.001*
N.S *Non-significance P>0.05*

CONCLUSIONS AND APPLICATIONS

1. From this study, the Anak broiler strain has been seen to exhibit superior traits in growth and liveweight predictability using some linear body measurements over the Lohmann Brown.
2. The 35-day linear body measurements used in this study best predicted terminal body weights of both broiler strains.
3. On comparative basis broiler producers may opt for the Anak strain principally for purposes of attainment of market weight earlier.

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REFERENCES

1. Adeleye, I.O.A. and A.A. Odunsi, 1990. Utilization of rubber seed meal as protein supplement in broiler finisher rations. Nig. J. Anim. Prod. 17: 23 -28.
2. Adeniji, F.O. and K.L. Ayorinde, 1990. Prediction of body weight of broilers at different ages from some linear body measurements Nig. J. Anim. Prod. 17: 42 - 47.
3. Agunbiade, J.A. and K. Benyi 1986. Effects of stocking rate on he performance of two hybrids of commercial broilers in the humid tropics. Nig. J. Anim. Prod. 13: 114 - 120.
4. Ayorinde, K.L. 1994. Effects of genotype and dietary energy on performance of broilers.. Nig. J. Anim. Prod. 21: 5 - 10.
5. Huxley, J.S. 1932. Problems of relative growth. London
6. Ibe, S.N. 1990. Effect of feed restriction on principal components measures of body size and conformation in commercial broiler chickens. Nig. J. Anim. Prod. 17 1-5.
7. Ikeobi, C.O.N. and S.O. Peters 1996. Strain differences in the genetic parameter estimated for growth in meat type chicken. Nig. J. Anim. Prod. 23: 103 -106.
8. Laseinde, E.A.O. and J.A. Oluyemi 1994. Effect of sex separation at the finisher phase on the comparative growth performance, carcass characteristics and breast muscle development between male and female broiler chickens. Nig. J. Anim. Prod. 21: 11- 18.
9 Monsi, A. and A.O. Ayodele 1989. Water intake of broilers raised during the rainy season in Rives State of Nig. J. of Anim. Prod. Res. 9: 2 -41.
10. Monsi, A. 1992. Appraisal of interrelationships among live measurement at different ages in meat type chickens. Nig. J. Anim. Prod. 19: 15 - 24.
11. Njike, M.O., A.S. Ahmed and E.S. Haruna 1987. Evaluation of dried yeast protein in broiler diet. Nig. J. Anim. Prod. 14: 83 - 87.
12. Okon, B.I. and B.K. Ogunmodede 1995. Effects of replacing dietary fish-meal with perinwinke flesh on the performance of broiler chickens. Nig. J. Anim. Production, 22: 37 - 43.
13. Oluyemi J.A. and F.A. Roberts 1980. Poultry Production in Warm Wet Climates. Macmilian International, College edition, pp. 16 - 17 121 - 124.
14. Ugwu, D.S. 1991. Response of different genotype of starting broiler chicks to varying dietary protein levels in the Humid Tropics. Nig. J. Nutri. Sci. 12: 69 - 71.