INTERRELATIONSHIPS OF LIVE BODY MEASUREMENTS OF BROILER CHICKENS IN A HUMID TROPICAL ENVIRONMENT

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ABSTRACT

The interrelationships of live body measurements of Lohmann Brown broilers (LMB) in a humid tropical environment were studied. Body parameters used for the study were body weight (BDW), body girth (BDG), body length (BDL), keel length (KLL), shank length (SHL), and width (SHW). The correlation matrix showed generally that correlations and interrelationships of most live body measurements at 3 and 12 weeks of age were weak and non-significant ($P>0.05$). SHW was the highest and only positively correlated ($P<0.01$) estimator of BDW at 3 weeks. At 6 and 9 weeks BDW positively correlated ($P<0.01$) with all the body parameters studied, having r values ranging from 0.34 to 0.74. However, at 12 weeks, BDW was positively correlated (P) with BDG (R=0.59), KLL (r=0.55) and SHW (r=0..31). Trait combinations and standard partial regression coefficients showed that at 3 weeks, only SHW could predict final BDW. SHW contributed 46.2% of the total variability in BDW. At 12 weeks the variability in final BDW was attributed to BDG ($r^2=0.347$), SHW ($r^2=0.149$), SHL ($r^2=0.041$) and KLL ($r^2=0.030$).

Keywords: Interrelationships, Correlation, body measurements, Broiler, tropics

INTRODUCTION

Poultry breeders have tried to establish the relationships that exist between body weight and physical characteristics. (body conformation) as this information reflects on the feed efficiency as well as performance of the broiler birds. Besides, this will help the breeders to organise the breeding programme in order to achieve an optimum combination of body weight and good conformation for maximum economic returns (Adeniji and Ayorinde, 1990). Monsi (1992) noted that interrelationships among body measurements, can be applied speedily in selection and breeding. Chambers and Fortin (1984) however added that the importance of evaluating interrelationships and productivity traits in poultry lies in their usefulness as predictors of characteristics like body weight and chemical composition of carcass. Information on the interrelationships among live body measurements in broiler birds in the country is limited (Monsi, 1992) as most studies have been done with turkeys (Asmubdson and Lerner, 1942, Asmundson, 1948; Johnson and Asmundson, 1957; Macneji, 1969). This study was carried out to examine the relationships among live body measurements at different ages and to also assess their ability to predict final body weight in broiler chickens.

MATERIALS AND METHODS

One hundred day-old Lohmann Brown broiler chicks obtained from Agro Feeds (Nig.) Limited Hatchery, Calabar were used for the study. The birds were housed in floor pens which provided space allowance of 729cm^2 per bird. The pen had natural ventilation through sides and roof shutters. The chicks were managed under deep litter condition using wood shavings as litter material. The experiment was carried out at the Facutlty of Agriculture Poultry Farm, University of Calabar, Calabar, in South Eastern Nigeria.

Birds were brooded (0-6 weeks) and reared (7-12 weeks) with commercial broiler starter mash (22% CP) and finisher mash (20% CP)

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rations respectively. Water was provided fresh each day *ad libitum*. All experimental birds were vaccinated against Newcastle disease and Gumboro when due. Vitalyte, a vitamin supplement was administered through fresh drinking water daily.

All birds were weighed on arrival on the first day and wing banded on the third day in the farm. Thereafter, measurements of individual body weight (BDW) was done weekly while those of body parameters were at three weekly intervals (3rd, 6th, 9th and 12th weeks). Body parameters measured where keel length (KLL), shank length (SHL), shank width (SHW), body length (BDL) and body girth (BDG). Body measurements were carried out early in the morning before feeding and watering.

All leg measurements (i.e shank length; from the hock joint to the tarsometarsus or digit 3 joints and width; thickness) were done to the right leg on each bird. The BDG was measured after the wings were kept flat against the birds body. All body measurements (in cm) except SHW and BDG, were determined with a tape rule. Body weight were measured with a weighing balance and SHW with a pair of Venier Callipers.

Correlations among live body measurements were subsequently estimated. A stepwise multiple regression analysis was used to determine the interrelationships among live body measurements. The procedures of Statistical Analysis System (SAS) Barr *et al.* (1967) were used in analysing all data obtained during the experimental period.

RESULTS AND DISCUSSION

The mean body weight and other body measurements at 3, 6, 9, 12 weeks of age are presented in Table 1. The results showed an increase in the different live body measurements as the birds matured indicating a direct positive relationships between body weight and different ages. The mean body weight of 2550±43.08g obtained at the end of 12 weeks was higher than the 1762.50±36.71g, 1807.86 (male broiler chickens) and 1278.48g (female broiler chickens) for Cobb broiler strain for the same 12 weeks reported by Adeniji and Ayorinde (1990) and Monsi (1992) respectively. It was also higher than the mean body weight of 1800g for Starbro strain of broiler chickens at 12 weeks reported by Ibe (1989). The relatively higher mean body weight of Lohmann Brown broiler chickens could be attributed to strain superiority and differences in genetic composition and the feed conversion. It may also be due to differences in the management systems and/or in ecological conditions (Monsi, 1992). The result agrees with the views of Okorie (1977), Nayor (1981). Bhagwat (1982) that hybrid broilers are capable of fast growth, better feed conversion efficiency and development of good body conformation.

Ibe and Nwakalor (1987) reported a lower KLL of 10.70±0.077cm (10 weeks) and 11.80±0.071cm (12 weeks) for Starbro strain of broiler chickens compared to 14.35±0.18cm (9 weeks) and 17.63±0.15.15cm (12 weeks) obtained for Lohmann Brown broiler chickens in this experiment (Table 1). This result again reveals the superiority of Lohmann Brown broiler strain over Starbró strain in terms of body measurement.

The coefficient of variation in Table 1 which reveals an estimate of the relative variation among the parameters measure was higher than those of the Cobb broiler strain reported by Adeniji and Ayorinde (1990). The generally high values of coefficient of variability for all parameters studied indicate that these traits varied higher within the strain (Table 1). This result is in contrast with that of Gibreath and Upp. (1952) that obtained low values except for the third week that has its greatest variability for males in Dark Cornish fowl at the same age.

The cumulative weight gains from 0-3, 3-6, 6-9 and 9-12 weeks were 226.42g, 351.88g, 875.25g and 1057.87g respectively. The overall cumulative weight gain was 2511.42g from 0 to 12 weeks of age. Rate of gain, increased with increase in age up to 9 weeks of 125.46g for 3-6 weeks; 523.37g for 6-9 weeks and 182.62g for 9-12 weeks (a decrease). The rate of

TABLE 1 BODY MEASUREMENTS OF BROILER CHICKENS AT 3, 6, 9, 12 WEEKS OF AGE (MEAN±S.E).

Age	3 Weeks		6 Weeks		9 Weeks		12 Weeks	
Character	Mean±S.E	CV	Mean±S.E	CV	Mean±S.E	CV	Mean±S.E.	CV
Body Weight (g)	265±6.32	15.08	616.88±16.52	16.93	1492.13±30.59	12.97	2550±43.08	10.68
Body Length (cm)	10.23±0.12	7.16	15.52±0.23	9.40	19.70±0.21	6.62	25±0.21	5.20
Body Girth (cm)	15.59±0.08	3.22	22.59±0.26	7.25	31.13±0.26	5.21	37.08±0.24	4.16
Keel Length (cm)	7.00±0.68	4.53	9.99±0.10	6.40	14.35±0.18	7.82	17.63±0.15	5.25
Shank Length (cm)	3.96±0.30	4.11	5.14±0.04	5.12	7.60±0.06	4.92	10.00±0.29	18.57
Shank Width (cm)	0.70±0.02	15.51	1.05±0.01	7.92	1.50±0.02	8.66	1.74±0.04	16.12

TABLE 2: INCREASE IN BODY MEASUREMENTS OF BROILER CHICKENS AT 3, 6, 9, 12 WEEKS OF AGE

Body Measurement[1]		3 Weeks		6 Weeks		9 Weeks	12 Weeks
	% of BDW	% Increase Over 3-6 Weeks	% of BDW	% Increase Over 6-9 Weeks	% of BDW	% Increase Over 9-12Weeks	% ofBDW
BDW	-	132.78	-	141.88	-	70.90	-
BDL	3.86	51.71	2.52	26.93	1.32	26.90	0.98
BDG	5.88	44.90	3.66	37.80	2.09	19.11	1.45
KLL	2.64	42.71	1.62	43.64	0.96	22.86	0.69
SHL	1.49	29.80	0.83	47.86	0.51	31.58	0.39
SHW	0.26	50.00	0.17	42.86	0.10	16.00	0.07

1. BDW = Body Weight, BDL = Body Length, BDG = Body Girth, KLL = Keel Length SHL = Shank Length SHW = Shank Width

increase of body weight and other measurements at different ages are shown in Table 2. The ratios of body measurements to percent body weight were quite low for some parameters except for BDG, KLL and BDL at 3 and 6 weeks. The results, showed a decreasing trend with increasing age of birds (Table 2).

The coefficients of correlation among the body measurements at 3, 6, 9 and 12 weeks are presented in Tables 3 and 4. The correlation matrix at 3 weeks reveals that generally the correlations of live body measurements studies were weak and non-significnat (P > 0.05) with some traits showing negative relationships. BDW was only positively (P < 0.01) correlated with SHW at 3 weeks of age (r = 0.68). On the other hand, BDG at 3 weeks was positively (P < 0.01) correlated with SHL (r = 0.31) (Table 3), The low non-significant values suggest that at this age (3 weeks) BDG, BDL, KLL and SHL may not necessarily be good indicators of body conformation. The data further suggest that SHW, the highest estimator of BDW at 3 weeks, is a good indicator of body development agreeing with the conclusion of Maciejowski and Zieba (1982).

Body weight at 6 and 9 weeks were positively (P < 0.01) correlated with BDG, BDL, KLL, SHL and SHW, with r val;ue ranging from 0.34 to 0..73 (Tables 3 and 4). Whereas at 12 weeks BDW was positively (P < 0.01) correlated with only three of the parameters BDG, KLL and SHW but non-significantly (P > 0.05) with SHL. The correlation value of BDG, KLL and SHW were 0.59, 0.55 and 0.31 respectively. These results suggest that BDW in broiler chicken can be rapidly predicted from these live body measurements at 6, 9 and 12 weeks of age. This agrees with a similar observation by Monsi (1992) with Cobb broiler strain. The highest estimator of BDW at 6, 9, 12 weeeks were SHW (r = 0.73), KLL (r = 0.66) and BDG (r = 0.59) respectively.

It was also generally observed that interrelationships among live body measurements studied were weak and **non-significant (P > 0.05) at 12 weeks. Significant and strong correlations were mostly observed at 6 and 9 weeks of age (Tables 3 and 4). The highest r values among other live body measurements were between BDG and SHW (r = 0.66), BDL and SHL (r = 0.64), BDG and KLL (r = 0.52) for 6, 9 and 12 weeks** of age respectively. The combination of BDG and SHW was observed as the highest estimator of live body weight (BDW) at 3 and 6 weeks of age in the broiler chicken studied. It was further observed from the general correlation results that BDG was a good estimator of live body weight in broiler birds. Leg measurements (SHL, SHW) were positively correlated (P < 0.01) with BDW at 3, 6, 9 and 12 weeks with the exception of SHL at 3 and 12 weeks of age.

Multiple regression analyses were used to determmine trait combinations for best predictor of body weight (Table 5). Trait combinations and standard partial repression coefficients showed that at 3 weeks of age only SHW, can be effectively used to predict the final BDW at that age. This body measurement contributed 46.2% of the total variabillity BDW at this age. This is contrary to the 10.6% contribution by SHW to BDW obtained by Adeniji and Ayorinde (1990) at the same age. At 6 weeks, SHW ($r^2 = 0.54$) again contributed 53.6% while BDG ($r^2 = 0.029$) contributed only 2.9% of the total variability in BDW. But at 12 weeks of age all the five body measurements were involved n predicting the final BDW. That is, the contribution to final BDW were BDG ($r^2 = 0.347$), SHW ($r^2 = 0.149$), SHL ($r^2 = 0.041$) and KLL ($r^2 = 0.030$). However, the highest multiple correlation coefficient ($r^2 = 0.58$) was obtained in the trait combination at 9 weeks.

These results suggest that with Lohmann Brown broiler strain, poultry producers can obtain an approximation of body weight of their birds from some live body measurements without necessarily having to weigh them. The farmers can do this by substituting the body values linear measurements (using either a tape or a meter rule) in the regression

TABLE 3: PEARSON CORRELATION COEFFICIENTS IN LIVE BO[illegible] MEASUREMENTS OF BROILER CHICKENS AT 3 AND 6 WEEKS OF AGE1

Body Measurement[2]	BDW	BDG	BDL	KLL	SHL	SHW
BDW	-	0.270^{NS}	0.185^{NS}	-0.031^{NS}	0.207^{NS}	0.680**
BDG	0.612**	-	0.255^{NS}	-0.146^{NS}	0.309*	0.386**
BDL	0.3597*	0.201^{NS}	-	0.199^{NS}	0.236NS	0.189^{NS}
KLL	0.530**	0.561**	0.342*	-	-0.100NS	-0.189^{NS}
SHL	0.339*	0.069^{NS}	0.247^{NS}	0.334*	-	0.326*
SHW	0.732**	0.661**	0.385**	0.619**	0.430**	-

1. Values above diagonal are correlation coefficients at 3 weeks of age. Values below diagonal are correlation coefficients at 6 weeks of age. 2. Body Measurements as defined in Table 2.
* = P<0.05; ** = P<0.01; NS = P>0.05

TABLE 4: PEARSON CORRELATION COEFFICIENTS IN LIVE BODY MEASUREMENTS OF BROILER CHICKENS AT 9 AND 12 WEEKS OF AGE.

B/MEASUREMENTS[2]	BDW	BDG	BDL	KLL	SHL	SHW
BDW	-	0.616**	0.471**	0.663**	0.476**	0.476**
BDG	0.589**	-	0.467**	0.511**	0.469**	0.490**
BDG	0.589**	-	0.467**	0.511**	0.469**	0.339*
BDL	0.192^{NS}	0.29	-.301*	0.643**	0.365*	0.339*
KLL	0.55**	0.523**	0.000^{NS}	-	-	0.366
SHL	0.253^{NS}	0.045^{NS}	0.149^{NS}	0.082^{NS}	-	-
SHW	0.313*	-0.120^{NS}	-0.360^{NS}	0.183^{NS}	0.057^{NS}	-

1. Values above diagonal are correlation coefficients at 9 weeks of age. Values below diagonal are correlation coefficients at 12 weeks of age. 2. Body Measurements as defined in Table 2
* = P<0.05; ** = P<0.01; NS = P>0.05

TABLE 5: STEPWISE REGRESSION EQUATIONS FOR PREDICTING BODY WEIGHT OF BROILER CHICKENS AT 3, 6, 9, 12, WEEKS OF AGE

Age (Weeks)	Steps	Body Measurement[1]	Intercept (a)	Regression Coefficient (b)	Partial R^2	Model r^2
3	1	SHW	250.00	-1.256	0.462	0.462
6	1	SHW	-347.707	1.704	0.536	0.536
	2	BDG	-477.791	1.330	-	-
		SHW	-	1.570	0.029	0.565
9	1	KLL	-727.495	10.677	0.440	0.440
	2	BDG	-1069.108	9.002	-	-
		KLL	-	8.360	0.104	0.544
	3	BDG	-	8.860	-	-
		BDL	-1294.668	7.453	0.031	0.575
		KLL	-	9.632	-	-
12	1	BDG	1306.360	16.359	0.347	0.347
	2	BDG	-	12.320	-	-
		SHW	-2270.496	6.386	0.149	0.496
	3	BDG	-	8.700	-	-
		SHL	-	5.071	-	-
		SHW	-2478.00	9.630	0.041	0.538
	4	BDG	-	10.320	-	-
		KLL	-	8.635	-	-
		SHL	-	5.321	-	-
		SHW	-2713.448	4.642	0.030	0.5678

1. BDG = Body Girth; BDL = Body Lenght; KLL = Keel Length; SHL = Shank Length; SHW = Shank Width.

equations (Table 5) for the given ages to have a close value of body weight of bird at that particular age.

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