

## Statistical Modeling of Body Weight and Body Dimensions in Four Strains of Meat-type Chickens.

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**Target audience:** Animal Scientists, meat-type chicken producers, farm animal stakeholders

### Abstract

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*This study was conducted to determine relationship between carcass traits and linear body parameters and establish equations for predicting carcass traits using linear body parameters in four strains of meat-type chickens. A total of four hundred (400) day old chicks of one hundred (100) each of Cobb 500, Marshall, Arbor acre and Noiler strains were managed intensively on deep liter system at the Poultry Unit of the Livestock Teaching and Research Farm, Department of Animal Science, University of Maiduguri, Borno State. Data on shank length (cm) shank circumference (cm), keel length (cm), thigh length (cm), back length (cm), chest circumference (cm) and drumstick length (cm) were taken on weekly basis up to nine (9) weeks of age using tailor's measuring tape. Carcass, thigh, drumstick, wing and breast weights were the carcass traits examined using weighing scale in (g) Data were analyzed using SAS(2000). The correlation among carcass traits and linear body parameters were determined using same software. Data were also subjected to simple and multiple linear regression analyses. The better relationship was determined between thigh weight and shank length in Cobb 500 ( $R^2 = 0.87$ ), carcass weight and back length ( $R^2 = 0.86$ ) in Marshall, breast weight and thigh length ( $R^2 = 0.72$ ) in Arbor acre and carcass weight and shank length ( $R^2 = 0.70$ ) in Noiler. The predictive equations showed that there were significant ( $P < 0.01$ ) relationships between body weight and linear body parameters. High  $R^2$  values recorded in this study show that the predictive equations could be used to predict carcass traits with high degree of accuracy, with the multiple regression models being more efficient than the simple regression model.*

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**Keywords:** Cobb 500; Noiler strains; meat-type chickens; body weight; co-efficient of determination.

### Description of problem

Animal scientists developed prediction equation in response to the obstacles normally encountered in field practical

measurements of carcass related parameters from linear body measurements (1;2). Quantitative traits are generally the dimensions of different body parts and

carcass parameters which are directly related to production parameters. Therefore, this strong relationship with carcass parameters is used as a proximate indicator of production in meat type chickens. The proportions of major carcass parts such as wing, thigh, drumstick and breast weight are important parameters in determining broiler carcass quality when it comes to marketing and purchasing decisions for both producers and consumers. A goal of poultry producers is to predict carcass characteristics that are determinants of carcass quality. The major purpose of assessing the interrelationship between carcass traits and linear body parameters in meat type chickens is to predict carcass weight where scientific scales are not available. Regression equations that could be used to predict carcass traits from linear body parameters have been developed. Typically, carcass traits are regressed on linear body parameters to determine a weight prediction. The correlation matrix of each of the linear body parameters could be used in predicting carcass parameters in meat type chickens (3;4). In order to interpret these relationships among traits, linear and multiple regression analysis are required (5). The objectives of this study were to establish the relationship between carcass traits and linear body parameters and to model the relationships between carcass traits and linear body parameters.

### Materials and Methods

The experiment was conducted at the Poultry Unit of Livestock Teaching and Research Farm, Department of Animal Science, Faculty of Agriculture, University of Maiduguri, Maiduguri, Borno State from May to July 2020. The birds were wing-tagged and fed *ad-libitum* with commercial

broiler starter diet containing 21%CP and 3100 KCalME/kg from day old to 4 weeks of age and commercial finisher diet containing 3000 KCalME/kg and 17% CP from 5 to 9 weeks of age. Clean water was supplied throughout the experimental period. Adequate floor and feeding space provided and vaccines were administered as at when due.

### Growth traits

The body weights and body linear traits of individual birds were measured and recorded early in the morning (8:00hr) before feeding on weekly basis. The body weight (BWT) was measured to the nearest gram (g) with a 5 kg digital weighing scale (*Savisto*).

The body linear traits were taken in cm using a measuring tape on a weekly basis. The traits measured included:

1. Shank Length (SL): This was measured from the hock joint to the base of the three toes.
2. Breast Width (BRW): This was measured as the circumference of the breast around its deepest region.
3. Back Length (BL): it was measured as the distance between the bases of the neck to the tip of the tail.
4. Thigh Length (TL): This was measured as distance between the hock joint and the pelvic joint.
5. Keel length (KL): This was measured as the length of the sternum.
6. Chest circumference (CC): This was measured as the round the chest region.
7. Shank circumference: This was measured as the circumference round of the shank.
8. Drum stick length (DSL): This was measured as the length of the drumstick area.

**Carcass traits measured**

At the end of the 9<sup>th</sup> week, 15 birds were randomly selected from each of the four strains making a total of 60 birds. They were fasted overnight and slaughtered for carcass analysis. The carcass weights, thigh weight, drumstick weight, wings weight and breast weight were measured in grams. The dressing % was calculated as dressed weight/final weight X 100 (6).

**Statistical Analyses**

The data generated from growth traits (body weight and body linear measurements) and carcass traits were subjected to Analysis of Variance (ANOVA) using General Linear Model Procedure of SAS (7). Significant differences in means were compared using Duncan's Multiple Range Test (8). The correlation coefficients were used to estimate the association between growth traits (body weight and body linear measurement) and carcass traits from each of the strains using PROC CORR procedure of SAS (7). In addition, regression models were used to predict carcass traits from live body measurements using the following simple and multiple regression models:

$Y = B + \beta x$  (1) Simple regression model

$Y = B + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k$ .....(2)

Multiple regression models

Where Y= dependent variable

Xs= independent variables

B= the intercept

$\beta$ s= the slope

**Results and Discussion**

Table 1 shows the correlation coefficient between carcass traits and linear body measurements for Cobb 500 of meat type chickens. The correlation coefficients ranged from low to high (r=0.073-0.870) among

most body measurements and carcass characteristics were generally high, positive and significant (P<0.01), except shank circumference which had negative and insignificant relationships with carcass traits. The highest coefficient (r= 0.870) was recorded between thigh weight and shank length this implies that improvement for thigh will lead to corresponding improvement in shank length. The carcass characteristics had had very good relationships with linear body measurements except shank circumference. By implication, the carcass traits may be improved by selection for the correlated body measurements. The result agrees with the report of (3).

The correlation coefficients between carcass traits and linear body measurements for Marshall Strain chickens are presented in Table 2. The co-efficients ranged low to high (r=0.080 – 0.862). The highest correlation was observed between carcass weight and back length while the lowest was recorded for shank length and drumstick weight. In general, the relationships were high, positive and significant (P>0.01). Meanwhile, shank length had low to medium relationship with carcass traits. This is in accordance with the report of (9).

The correlation coefficient between some carcass traits and linear body measurements for Arbor acre strain of meat type chicken are presented in Table 3. Similar to the results in Marshall strain, the correlations among the carcass and body traits were ranged from low (r= 0.005) to high (0.724). The highest relationship was recorded between thigh length and breast weight while the least was observed for keel length and thigh weight. Generally, the relationships were high, positive and significant (P>0.01) this implies

that improvement targeted at keel length will lead to improvement in thigh weight. However, keel length, back length and shank length had positive but insignificant relationships with carcass traits. This is in exception of the positive and significant relation of shank length (0.550) with carcass weight. This means that selection geared at improving these correlated linear body measurements will invariably lead to corresponding improvement in these highly, positive and significantly correlated carcass traits. The results of this study agree with the work of (3) who observed high and significant correlation between cut up parts of meat-type chickens in Nigeria.

Table 4 presents the results of correlation coefficient between some carcass traits and linear body measurements for Noiler strain of chickens. All the relationships were positive though ranged low (0.075) to high (0.702) in line with the range of other strains. The

correlation between shank length and carcass weight was highest while the co-efficient observed between thigh length and wing weight was the least. Unlike with the other chicken strains, shank length in Noiler had high, positive and significant relationships with all the carcass traits. On the other hand, shank circumference, keel length, thigh length and drumstick length expressed though positive but low and insignificant relationships with the carcass traits.

Similar findings have been observed by (3). The insignificant relationship observed between carcass traits and shank circumference, keel length, thigh length and drumstick length in this study contradicts the report of (9). The authors reported that carcass traits were highly correlated with all cut up parts in meat-type chickens. This could be connected with genetic constitution of chicken strains in use and variation in method of data analyses adopted.

**Table 1: Correlation coefficients between some carcass traits and linear body measurements of Cobb 500 strain of meat-type chickens**

Traits	SL	SC	KL	TL	BL	CC	DSL
Carcass weight (g)	0.729**	-0.059	0.553*	0.718**	0.741**	0.806**	0.722**
Wing weight (g)	0.684**	-0.070	0.391	0.676**	0.733**	0.744**	0.661**
Thigh weight (g)	0.870**	0.073	0.575*	0.776**	0.786**	0.834**	0.661**
Drumstick weight(g)	0.758**	-0.110	0.577*	0.799**	0.762**	0.831**	0.743**
Breast weight (g)	0.483	-0.086	0.426	0.463	0.469	0.507	0.398

SL: shank length, SC: shank circumference, BL: back length, TL: thigh length, KL: keel length, CC: chest circumference, DSL: drumstick length, \*= $P < 0.05$ , \*\*= $P < 0.001$ .

**Table 2: Correlation coefficients between some carcass traits and linear body measurements for Marshall strain of meat type chickens**

Traits	SL	SC	KL	TL	BL	CC	DSL
Carcass weight (g)	0.387	0.658**	0.432	0.771**	0.862**	0.736**	0.794**
Wing weight (g)	0.179	0.398	0.700**	0.705**	0.844**	0.717**	0.668**
Thigh weight (g)	0.412	0.641*	0.296	0.605*	0.770**	0.731**	0.773**
Drumstick weight(g)	0.080	0.548*	0.169	0.417	0.689**	0.430	0.552*
Breast weight (g)	0.283	0.510	0.245	0.684**	0.471	0.456	0.559*

SL: shank length, SC: shank circumference, BL: back length, TL: thigh length, KL: keel length, CC: chest circumference, DSL: drumstick length, \*= $p < 0.05$ , \*\*= $p < 0.001$ .

**Table 3: Correlation coefficients between some carcass traits and linear body measurements for Arbor acre strain of meat type chickens**

Traits	SL	SC	KL	TL	BL	CC	DSL
Carcass weight (g)	0.550*	0.625*	0.247	0.680**	0.425	0.659**	0.708**
Wings weight (g)	0.428	0.373	0.116	0.508	0.395	0.669**	0.584*
Thighs weight (g)	0.262	0.452	0.005	0.464	0.406	0.525*	0.434
Drumsticks weight(g)	0.213	0.336	0.207	0.378	0.209	0.370	0.335
Breasts weight (g)	0.424	0.613*	0.455	0.724**	0.283	0.623*	0.668**

SL: shank length, SC: shank circumference, BL: back length, TL: thigh length, KL: keel length, CC: chest circumference, DSL: drumstick length, \*= $p < 0.05$ , \*\*= $p < 0.001$ .

**Table 4: Correlation coefficients between some carcass traits and linear body measurements for Noiler strain of meat type chickens**

Traits	SL	SC	KL	TL	BL	CC	DSL
Carcass weight (g)	0.702**	0.226	0.254	0.146	0.662*	0.688**	0.463
Wing weight (g)	0.587*	0.191	0.156	0.075	0.608*	0.565*	0.320
Thigh weight (g)	0.603*	0.211	0.236	0.117	0.636*	0.594*	0.387
Drumstick weight(g)	0.567*	0.298	0.324	0.314	0.693**	0.594*	0.374
Breast weight (g)	0.588*	0.219	0.208	0.226	0.509	0.564*	0.381

SL: shank length, SC: shank circumference, BL: back length, TL: thigh length, KL: keel length, CC: chest circumference, DSL: drumstick length, \*= $P < 0.05$ , \*\*= $p < 0.001$ .

### Regression output including fitted function, F value and R coefficients for some carcass components of Cobb 500 strain of meat type chickens.

Table 5 presents the regression output including fitted function, F value and R coefficients for some carcass components of Cobb strain of meat type chickens. The

results showed that the best single predictors of carcass and drumstick weight for the Cobb 500 strain is chest circumference with  $R^2$  values of 0.65 and 0.69, respectively. The  $R^2$  values for the prediction of carcass and drumstick weight both improved to 0.71 when chest circumference was combined in equations with back and shank length,

respectively. Only a marginal improvement in  $R^2$  (0.72) was observed when three predictors (Shank, Chest Circumference and Back length or Drumstick, Back and Shank length) were included in an equation to predict drumstick weight. No improvement was observed in  $R^2$  with carcass weight. The adjusted  $R^2$  was higher for equation with two predictors compared to three (0.66 vs 0.64). This agrees with the report of (10).

Thus, the best equations for predicting carcass and drumstick weight for Cobb 500 strain of chickens from body measurements are those with two predictors. The work of (11) who reported  $R^2$  range from 0.66 to 0.80 for indigenous chickens of Nigeria confirms the result of this study.

#### **Regression output including fitted function, F value and R coefficients for some carcass components of Marshall Strain of meat-type chickens.**

Table 6 presents the regression output including fitted functions, F values and R coefficients for some carcass components of Marshall Strain of meat type chickens. The results showed that the best single predictors of carcass and thigh weight are back and drumstick weight had the higher  $R^2$  values (0.74) and (0.60) respectively. The  $R^2$  values for the prediction of carcass and thigh weight both improved to (0.80) when thigh was combined with back length in the equation and (0.69) when drumstick was combined with back length. However, only marginal improvement in  $R^2$  (0.81) was observed when three predictors (chest circumference, Drumstick and Back length) were included in an equations to predict carcass weight. Similarly, thigh weight improved significantly with  $R^2$  values (0.71) when (Chest Circumference, Back and Drumstick

length) were included in the equations to predict thigh weight. The adjusted  $R^2$  values were the same for both equations (0.76) in predicting carcass weight. However, adjusted  $R^2$  was higher for the equation with two predictors (0.77 vs 0.63) in predicting thigh weight. Thus, the best equation for predicting thigh weight in Marshall Strain of chickens from body measurements are those with two predictors, while two, three and four predictor equations had similar values in predicting carcass weight in this strain. Similar findings have been reported by (11). These authors observed  $R^2$  in the range of 0.66 and 0.80 for indigenous chickens of Nigeria.

#### **Regression output including fitted function, F value and R coefficients for some carcass components of Arbor acre strain of meat type chickens**

The Regression output including fitted function, F value and R coefficients for some carcass components of Arbor acre strain of meat type chickens are presented in Table 7. The resultant predictive equation showed drumstick length with the higher  $R^2$  (0.50) in predicting carcass weight. The least was recorded when keel length was used (0.06). However, the resultant predicting equation showed  $R^2=0.52$  when thigh length was used to predict breast weight. Similarly, the accuracy of the model further improved  $R^2$  (0.57) when thigh length and chest circumference were added to the model to predict carcass weight., This was further improved with addition of drumstick length, keel length, back length, shank length, and chest circumference to the model ( $R^2=0.76$ ). This implies that carcass weight and breast weight could be predicted with fair degree of accuracy using these linear body parameters

in meat-type chickens. This report iscorrelates with the report of(12) on Nigerianindigenous chickens.

**Regression output including fitted function, F value and R coefficients for some carcass components of Noiler strain of meat type chickens.**

Table 8 presents the regression output including fitted function, F value and R coefficients for some carcass components of Noiler strain of meat-type chickens. The results showed that the best single predictors of carcass and thigh weight are shank (0.49) and back length (0.40). The R<sup>2</sup> values improved (0.55) when shank length was combined with chest circumference to predict carcass weight while the thigh weight

got better (0.47) when back length was combined with shank length. Only a marginal improvement in R<sup>2</sup> (0.59) was observed when three predictors (chest circumference, back and shank length) were combined in an equation to predict carcass weight. No improvement in R<sup>2</sup> was observed with thigh weight (0.47).The adjusted R<sup>2</sup> was the same for both the equations with carcass weight (0.48).While the value was lower for equations with three predictors compared with two (0.33 vs 0.39). Thus, the best equations for predicting thigh weight for Noiler strain of meat type chickens were those with two predictors. However, the accuracy was same with carcass weight for this strain of meat-type chickens. This is in accordance with the report of(10).

**Table 5: Regression output including fitted functions, F value and R coefficients for some carcass components of Cobb Strain of meat type chickens**

Parameter	Predictive equation	F value	R	R <sup>2</sup>	Adj. R <sup>2</sup>	SE
SL	CW= 4326.611+806.334SL	14.78	0.73	0.53	0.50	191.04
SC	CW= -74.555+2820.653SC	0.05	0.06	0.03	-0.07	278.76
KL	CW= 3079.753+3.32.731KL	5.72	0.55	0.31	0.05	232.70
TL	CW= 480.904+ 5490.702TL	15.82	0.74	0.55	0.51	187.53
BL	CW= 158.833+ 1737.221BL	15.82	0.74	0.55	0.51	189.53
CC	CW= 107.049+ 1849.527CC	24.18	0.81	0.65	0.62	165.11
DSL	CW= 767.768+ 5497.545DSL	14.14	0.72	0.52	0.48	193.25
SL	DW=99.727+518.712SL	17.51**	0.76	0.57	0.54	21.70
SC	DW=-16.695+424.847SC	0.16	0.11	0.01	-0.06	33.04
KL	DW=41.36+367.76KL	6.49	0.58	0.33	0.28	27.16
TL	DW=63.79+731.82TL	23.01**	0.80	0.64	0.61	19.98
BL	DW=19.44+193.38BL	17.95**	0.76	0.58	0.55	21.55
CC	DW=13.13+208.13CC	28.92**	0.83	0.69	0.67	18.52
DSL	DW=94.13+655.21DSL	16.04**	0.74	0.55	0.52	22.25
BL,SL	CW=-3763.27+443.86SL+95.47BL	9.91**	0.79	0.62	0.56	178.50
BL,CC	DW=-239.69+5.87BL+10.10CC	14.43**	0.84	0.71	0.66	18.75
DSL,CC	DW=-259.89+8.77DSL+12.17CC	13.42**	0.83	0.69	0.640	19.24
BL,CC	CW=-2112.43+81.83BL+911.19CC	11.99**	0.82	0.67	0.61	167.83
BL,DSL	CW=-4739.47+100.85BL+442.27DSL	11.08**	0.81	0.65	0.59	172.27
DSL,CC	CW=-2278.11+72.63DSL+99.12CC	11.22**	0.81	0.65	0.59	171.58
DSL,BL	DW=-562.7+54.40DSL+12.4BL	13.14**	0.83	0.69	0.63	19.38
SL,CC	DW=-344.38+31.06SL+10.09CC	14.57**	0.84	0.71	0.66	18.69
SL,DSL	DW=-750.76+61.75SL+53.74DSL	12.22**	0.82	0.67	0.62	19.86
SL,BL,CC	CW=-2933.6+195.63SL+42.11BL+66.17CC	7.67**	0.82	0.68	0.59	172.63
DSL,CC,BL	CW=-3136.54+165.99DSL+59.42CC+57.32BL	7.51**	0.82	0.67	0.58	173.90
DSL,CC,BL	DW=-363.01+19.98DSL+7.40CC+6.89BL	9.05**	0.84	0.71	0.63	19.42
DSL, BL,SL	DW=-648.60+41.84DSL+8.60BL+37.51SL	9.33**	0.85	0.72	0.64	19.20
SL,DSL,CC	DW=-431.63+32.61SL+13.68DSL+8.44CC	9.02**	0.84	0.71	0.63	19.43
SL,CC,BL	DW=-351.83+26.71SL+7.96CC+4.94BL	9.41**	0.85	0.72	0.64	19.14
SL,BL,CC,DSL	CW=-4142.72+209.11SL+50.98BL+39.87CC+186.82DSL	5.39**	0.83	0.68	0.56	179.21

SL: shank length, SC: shank circumference, BL: back length, TL: thigh length, KL: keel length, CC: chest circumference, DSL: drumstick length, CW: carcass weight, DW: drumstick we\*\*=p<0.001.

**Table 6: Regression output including fitted functions, F value and R coefficients for some carcass components of Marshall Strain of meat type chickens.**

Parameter	Predictive equation	F value	R	R <sup>2</sup>	Adj. R <sup>2</sup>	SE
SL	CW=332.37+427.90SL	2.30	0.39	0.15	0.09	220.91
SC	CW=1223.33+7404.67SC	9.93	0.66	0.43	0.39	180.41
KL	CW=292.67+2453.95KL	3.00	0.43	0.19	0.12	216.054
TL	CW=189.30+857.70TL	19.08*	0.77	0.60	0.56	152.63
BL	CW=237.54+3633.12BL	37.72**	0.86	0.74	0.72	121.31
CC	CW=114.13+2142.43CC	15.32*	0.74	0.54	0.51	162.34
DSL	CW=424.25+1993.30DSL	22.22**	0.79	0.63	0.60	145.58
SL	TW=84.74+338.60SL	2.66	0.41	0.17	0.11	52.35
SC	TW=285.46+1907.51SC	9.05	0.64	0.41	0.37	44.11
KL	TW=48.07+423.24KL	1.25	0.30	0.09	0.02	54.87
TL	TW=35.62+236.69TL	7.52	0.61	0.37	0.32	45.73
BL	TW=50.84+912.50BL	18.91*	0.77	0.59	0.56	36.67
CC	TW=27.21+702.11CC	14.96*	0.73	0.54	0.50	39.17
DSL	TW=98.99+644.70DSL	19.30**	0.77	0.60	0.56	36.44
TL,BL	CW=-3385.91+79.28TL+174.64BL	23.40**	0.89	0.80	0.76	112.67
CC,BL	CW=-3963.51+40.76CC+187.20BL	21.19**	0.88	0.78	0.74	117.16
DSL,BL	CW=-3786.36+190.78DSL+166.33BL	24.68**	0.90	0.80	0.77	110.29
SC,DSL	TW=-1480.61+132.92SC+77.35DSL	11.54**	0.81	0.66	0.60	34.97
CC,DSL	TW=-822.52+13.25CC+65.56DSL	11.46**	0.81	0.66	0.60	36.05
BL,DSL	TW=-959.13+29.17BL+58.05DSL	13.38**	0.83	0.69	0.64	33.27
CC,DSL,BL	CW=-3925.38+20.52CC+156.76DSL+153.38BL	15.79**	0.90	0.81	0.76	113.09
TL,CC,DSL	CW=-2458.09+93.20TL+20.07CC+239.09DSL	10.63**	0.86	0.74	0.67	131.90

**Table 7: Regression output including fitted functions, F value and R coefficients for some carcass components of Arbor Acre Strain of meat type chickens.**

Parameter	Predictive equation	F value	R	R <sup>2</sup>	Adj. R <sup>2</sup>	SE
SL	CW=822.78+4614.53SL	5.65	0.55	0.30	0.25	225.36
SC	CW=1060.79+6320.84SC	8.36	0.63	0.39	0.34	210.61
KL	CW=25.50+1645.14KL	0.84	0.25	0.06	-0.01	261.58
TL	CW=357.42+3568.82TL	11.21*	0.68	0.46	0.42	197.80
BL	CW=97.38+298.53BL	2.87	0.43	0.18	0.12	244.32
CC	CW=95.32+1500.33CC	9.97	0.66	0.43	0.39	203.09
DSL	CW=582.82+3870.52DSL	13.06*	0.70	0.50	0.46	190.66
SL	BRW=265.80+1454.31SL	2.85	0.42	0.18	0.12	102.59
SC	BRW=436.34+2755.96SC	7.83*	0.61	0.38	0.33	89.49
KL	BRW=19.73+367.93KL	3.40	0.46	0.21	0.15	100.84
TL	BRW=159.61+1822.54TL	14.34*	0.72	0.52	0.49	78.11
BL	BRW=27.19+33.62BL	1.13	0.28	0.08	0.10	108.63
CC	BRW=37.83+721.62CC	8.25*	0.62	0.39	0.34	88.58
DSL	BRW=230.65+1655.59DSL	10.46*	0.67	0.45	0.40	84.32
TL,DSL	CW=4619.52+183.66TL+372.09DSL	7.57*	0.75	0.56	0.48	186.82
CC,DSL	CW=-3561.34+39.23CC+408.34DSL	6.76*	0.73	0.53	0.45	192.67
TL,DSL	BRW=-2111.58+102.36DSL+111.81TL	7.80*	0.75	0.57	0.49	77.73
CC,DSL	BRW=-1531.04+160.37DSL+15.80CC	5.37*	0.69	0.47	0.38	85.65
TL,CC	BRW=-1776.33+13.04CC+125.72TL	7.25*	0.74	0.55	0.47	79.34
CC,TL,DSL	BRW=2049.13+86.53DSL+108.18TL+5.01CC	4.81*	0.75	0.57	0.45	80.97
DSL,TL,CC	BRW=-2049.13+86.53DSL+106.18TL+5.01CC	4.8*	0.75	0.57	0.45	80.97
BL,CC,TL,DSL	BRW=-2015.82+169.7BL+102.45DSL+124.13TL+3.24CC	3.59	0.77	0.59	0.43	82.77
DSL,KL,BL,CC,	BRW=-1199.35+142.97DSL+2.82BL+21.19KL+373.90SC	3.14**	0.87	0.76	0.52	75.82

**Table 8: Regression output including fitted functions, F value and R coefficients for some carcass components of Noiler Strain**

Parameter	Predictive equation	F value	R	R <sup>2</sup>	Adj. R <sup>2</sup>	SE
SL	CW=408.34+-221945SL	12.66*	0.70	0.49	0.45	169.96
SC	CW=101.54+192.66SC	0.70	0.22	0.05	-0.02	232.60
KL	CW=40.38+351.12KL	0.89	0.25	0.06	-0.01	230.98
TL	CW=29.71+458.78TL	0.28	0.15	0.02	-0.05	236.25
BL	CW=103.37+1047.29BL	10.14*	0.66	0.44	0.40	178.97
CC	CW=53.20+569.45CC	11.68*	0.69	0.47	0.43	173.30
DSL	CW=134.80+32 5.03DSL	3.54	0.46	0.21	0.15	211.69
SL	TW=66.55+361.88SL	7.42*	0.60	0.36	0.32	36.17
SC	TW=17.99+21.83SC	0.61	0.21	0.05	-0.03	44.32
KL	TW=7.14+49.97KL	0.77	0.24	0.06	-0.02	44.06
TL	TW=4.53+78.82TL	0.18	0.11	0.02	-0.06	45.03
BL	TW=18. 85+207.72BL	8.82*	0.64	0.40	0.36	34.10
CC	TW=8.72+94.31CC	7.08*	0.59	0.35	0.30	36.49
SL,CC	CW=-1779.72+248.11SL+28.63CC	7.47*	0.75	0.55	0.48	165.90
BL,SL	TW=-373.258+12.60BL+37.25SL	5.40*	0.69	0.47	0.39	34.24
CC,SL	TW=-288.48+4.78CC+39.80SL	4.18	0.64	0.41	0.31	36.23
BL,CC	TW=-205.23+12.85BL+4.03CC	4.69	0.66	0.44	0.35	35.36
CC,BL	CW=-1026.34+33.87CC+52.94BL	6.66*	0.73	0.53	0.45	171.16
SL,CC	CW=-1779.72+248.11SL+28.63CC	7.47*	0.75	0.55	0.48	165.90
CC,BL,SL	CW=-2019.22+15.57CC+43.13BL+220.90SL	5.24*	0.77	0.59	0.48	166.57
BL,SL,CC	TW=-351.81+11.40BL+1.33CC+32.61SL	3.33	0.69	0.47	0.33	35.67

SL: shank length, SC: shank circumference, BL: back length, TL: thigh length, KL: keel length, CC: chest circumference, DSL: drumstick length, CW: carcass weight, TW: thigh weight, \*=p<0.05, \*\*=p<0.001.

## Conclusions and Applications

1. The results revealed high positive relationships between carcass traits and linear body parameters which implied that when linear body parameters were improved in a breeding programme, the carcass traits would be increased.
2. Carcass weight could be best improved using back length, and shank length in Marshall and Noiler, respectively while thigh and breast weights could be best improved in Cobb 500 and Arbor acre, respectively.
3. The best equations for predicting some carcass parameters from body measurements are those with two or more predictors in all the four meat-type chickens.

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