

## RELATIONSHIPS BETWEEN PHYSICAL BODY TRAITS OF THE GRASSCUTTER (RODENTIA: THRYONOMYIDAE) IN AKPAKA FOREST RESERVE, ONITSHA

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### ABSTRACT

*Physical body traits of nine grasscutters (*Thryonomys swinderianus* Temminck) were characterized using body weights (BW), body length (BL), heart girth (HG), and height-at-withers (H). Simple linear correlation matrix showed high, positive and significant values among the parameters studied ( $P < 0.01$ ). The highest coefficient was obtained for body weight and body length ( $r = 0.9956$ ). The very high associations for body length and heart girth ( $r = 0.9821$ ) and between body length and height ( $r = 0.9905$ ) indicate that frame size and absolute height were complementary. Selection for increased measurement in any of the parameter would mean positive significant influence on the other and would lead to increased skeletal stature with concomitant increases in other absolute body measurements. Regression equations from this study could be used to estimate live body weights of grasscutters aged between 2 -10 months.*

**Keywords:** Grasscutter, Physical Body Traits, Estimation, Correlation and Regression Models

### INTRODUCTION

The relationships existing among physical body traits provide useful information on productive performance and carcass characteristics of animals. Different linear body measures would be required to quantify body shape and size in different breeds and under different conditions of feeding (Ibe, 1989; Ibe and Ezekwe, 1994). Quantitative measures for size and shape are necessary for estimating genetic parameters in animal breeding programmes (Chineke, 2000). Much work has been done in this area with ruminants (Akpa, 2000, Alade *et. al.*, 1999, Ozoje and Herbert, 1997, Chineke, 1996, Orheruata and Olutogun, 1994) and rabbits (Chineke, 2000, Chineke, *et. al.*, 2000).

There is however a dearth of information on the interrelationships among physical body traits in captive grasscutters. The aim of this paper is to establish the relationships that exist among body weight and linear body measurements (body length, heart girth, and height-at-withers) in grasscutters reared in Akpaka Forest Reserve, Onitsha, Nigeria. This will also provide formulae for the estimation of live weights of grasscutters aged between 2 – 10 months.

### MATERIALS AND METHODS

Body weights and linear measurements of nine 2-months-old grasscutters from our grasscutter research station at the Akpaka forest reserve, Onitsha were assessed for 2 - 10 months. Body weight (BW) in kilograms of each animal was taken every month, by means of a Way Master precision scale. Body length (BL), heart girth (HG), and height-at-withers (H) were similarly taken in centimeters. Body length was taken as the distance from the point of the nose to the base of the tail. Heart girth was taken as the circumference of the chest while height-at-withers was measured as the distance from the surface of a platform to the withers.

Data were collated and the method of least square means was used for simple linear correlation and multiple linear regression analyses (Little and Hills, 1977). *Simple linear correlation*,  $r = (\sum yx_1) / \sqrt{(\sum y^2 \sum x_1^2)}$  *etc.*, was applied to the paired-variables Body weight versus Body length (Y:X<sub>1</sub>), Body weight versus Heart girth (Y:X<sub>2</sub>), Body weight versus Height-at-withers (Y:X<sub>3</sub>), Body length versus Heart girth

**Table 1: Body weight and linear body measurements of grasscutters**

Observation (n)	Age (months)	BW (kg) Y	BL (cm) X <sub>1</sub>	HG (cm) X <sub>2</sub>	H (cm) X <sub>3</sub>
1	2	0.66	23.25	18.64	11.00
2	3	0.88	26.33	20.95	12.55
3	4	1.10	29.29	22.04	14.05
4	5	1.39	31.41	24.41	15.45
5	6	1.63	35.03	26.63	17.02
6	7	1.86	39.50	32.25	18.08
7	8	2.08	40.68	35.33	19.95
8	9	2.22	43.57	37.90	21.62
9	10	2.51	46.61	40.14	23.75
<b>Means</b>		<b>1.59</b>	<b>35.10</b>	<b>28.48</b>	<b>17.05</b>

Deviations  $y, x_1, x_2,$  and  $x_3$  from the means of variables  $Y, X_1, X_2,$  and  $X_3$  were used to compute products of all possible pair-combinations of the corrected sums of squares.

**Table 2: Sum of products of all possible pair-combinations of the corrected sums of squares**

n	Age (months)	y <sup>2</sup>	x <sub>1</sub> <sup>2</sup>	x <sub>2</sub> <sup>2</sup>	x <sub>3</sub> <sup>2</sup>	y x <sub>1</sub>	y x <sub>2</sub>	y x <sub>3</sub>	x <sub>1</sub> x <sub>2</sub>	x <sub>1</sub> x <sub>3</sub>	x <sub>2</sub> x <sub>3</sub>
1	2	0.879	134.7	96.86	36.62	0.88	9.23	5.67	114.2	70.24	59.56
2	3	0.515	77.03	56.73	20.26	6.30	5.40	3.23	66.10	39.51	33.90
3	4	0.248	34.14	71.261	9.01	2.89	4.20	1.48	49.10	17.46	25.34
4	5	0.043	13.66	16.58	2.56	0.76	0.84	0.35	15.05	5.92	6.52
5	6	0.001	0.0001	3.42	0.001	-0.001	-0.05	-0.01	0.01	0.0002	0.059
6	7	0.068	22.05	14.19	1.05	1.23	0.98	0.26	17.69	4.84	3.87
7	8	0.232	31.05	46.89	8.39	2.68	3.30	1.39	38.16	16.15	19.84
8	9	0.465	71.62	88.69	20.86	5.77	6.42	3.11	79.70	38.65	43.02
9	10	0.831	132.3	137.1	44.86	10.49	10.67	6.10	134.6	77.04	78.42
<b>Σ</b>		<b>3.28</b>	<b>516.5</b>	<b>531.6</b>	<b>143.6</b>	<b>40.98</b>	<b>40.98</b>	<b>21.59</b>	<b>514.7</b>	<b>269.7</b>	<b>270.5</b>

**Table 3: Simple linear correlation among body traits in the grasscutter**

Variables	BW (Y)	BL(X <sub>1</sub> )	HG (X <sub>2</sub> )	H (X <sub>3</sub> )
Body weight (BW)	-			
Body length (BL)	0.9956	-		
Heart girth (HG)	0.9813	0.9821	-	
Height-at-withers(H)	0.9949	0.9905	0.9790	-

Calculated r-values were greater than the tabular r-values at these levels of significant. (P<0.01).

**Table 4: Simple linear regression equations for body traits in the grasscutter**

Paired variables	Slope, b $b = (\sum yx) / \sum x^2$	Intercept, a $a = (\text{Mean } Y) - b(\text{mean } X)$	Regression equation $\hat{Y} = a + bX$
BW: BL (Y:X <sub>1</sub> )	0.0793	- 1.1934	BW = - 1.1934 + 0.0793BL
BW: HG (Y:X <sub>2</sub> )	0.0796	- 0.6684	BW = - 0.6684 + 0.0796HG
BW: H (Y:X <sub>3</sub> )	0.1503	- 0.9726	BW = - 0.9726 + 0.1503H
BL : HG (X <sub>1</sub> :X <sub>2</sub> )	1.0000	- 3.3800	BL = 6 + HG
BL : H (X <sub>1</sub> :X <sub>3</sub> )	1.8786	3.0690	BL = 3.069 + 1.8786H
HG : H (X <sub>2</sub> :X <sub>3</sub> )	1.8837	- 3.6370	HG = - 3.637 + 1.8837H

**Table 5: Sum of cross products of all possible pair-combinations of corrected sums of squares of the k+1 variables**

	Dependent variable		Independent variables	
	Y (BW)	X <sub>1</sub> (BL)	X <sub>2</sub> (HG)	X <sub>3</sub> (H)
<b>Y</b>	3.28	-	-	-
<b>X<sub>1</sub></b>	40.98	516.5	514.7	269.7
<b>X<sub>2</sub></b>	40.98	514.7	531.6	270.5
<b>X<sub>3</sub></b>	21.59	269.7	270.5	143.6

k equations:

$b_1 516.5 + b_2 514.7 + b_3 269.7 \pm 40.98$  .....(I),

$b_1 514.7 + b_2 531.6 + b_3 270.5 \pm 40.98$  .....(II),

$b_1 269.7 + b_2 270.5 + b_3 143.6 \pm 21.59$  .....(III),

Where  $b_1, b_2$  and  $b_3$  are partial regression co-efficients of BL, HG and H respectively

**Table 6: Multiple linear regression analysis of body traits in the grasscutter**

ANOVA				
Source of variation	df	SS	MS	F <sub>cal</sub>
Regression	3	3.25	1.0833	216.66
Error	6	0.03	0.005	
Total	9	3.28		

**Regression equation:**  $BW = -1.2179 + 0.0675BL + 0.0096HG + 0.0097H$   $R = 9953; R^2 = 0.9908$

(X<sub>1</sub>:X<sub>2</sub>), Body length versus Height-at-withers  
 (X<sub>1</sub>:X<sub>3</sub>), Heart girth versus Height-at-withers  
 (X<sub>2</sub>:X<sub>3</sub>).

## RESULTS AND DISCUSSION

Average body weights and linear body measurements obtained from the grasscutters are presented in Table 1. Table 2 shows products of all possible pair-combinations of the corrected sums of squares. Simple linear correlation among body traits are presented in Table 3. Regression equations computed for the estimation of body traits in grasscutters are presented in Table 4. Products of all possible pair-combinations of corrected sums of squares of the k+1 variable are arranged in Table 5 to bring out the so-called normal or k equations. The result of multiple linear regression analysis is presented in Table 6. R<sup>2</sup> was significant, indicating that some portion of the variability in body weight can be explained by body length, heart girth and height-at-withers of the grasscutter.

Table 1 showed that the body weights of grasscutters aged 2 – 10 months ranged from 0.66 – 2.51 kg. The coefficients of correlation among the body weight, body length, heart girth and height-at-withers were high, positive and significant and ranged between 0.9790 and 0.9956 (see Table 3). The highest correlation between BW and BL ( $r = 0.9956$ ) shows that body length was the best predictor for body weight. Very high association between BL and HG ( $r = 0.9821$ ), BL and H ( $r = 0.9905$ ) is an indication that heart girth and height may be complementary. High correlation between heart girth and body size has long been recognized in livestock (Chineke, 2000). The high co-relationship that existed among the linear body traits indicates that any one of them studied was sufficient for the estimation of body length. This is in line with the findings in rabbits (Chineke, 2000). Selection for increased measurement in any of the parameters would mean positive significant influence on the other and would lead to increased skeletal stature with concomitant increases in other body measurements.

Simple linear regression analysis confirmed the existence of linear relationships between physical body traits in the grasscutter. Grasscutter producer and researchers could estimate the live weight in 2-10 months old grasscutters by substituting the values of linear measurements in any of the equations shown in Table 4. Heart girth (cm) could be easily converted to body length (cm) by adding 6cm to the measured circumference of the chest (i.e.,  $HG + 6 = BL$ ). The choice of any linear body measurement depends on the ease in which that characteristic was measured.

Partial regression coefficients determined in this study have shown that the combined effects of body length, heart girth and height-at-withers in the manner prescribed by the regression equation contribute significantly to the variation in body weight of the grasscutter. The coefficient of determination ( $R^2 = 0.9908$ ), also significant, is a strong indication that more than 90% of the variability in body weight was explained by linear body measurements through the regression equation,  $BW = -1.2179 + 0.0675BL + 0.0096HG + 0.0097H$  from this study.

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