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

[1]IKPEZE, Obiora Osegboka and [2]EBENEBE, Cordelia Ifeyinwa
[1]Department of Parasitology and Entomology, Nnamdi Azikiwe University, Awka.
[2]Department of Agricultural Education, Nwafor Orizu College of Education, Nsugbe.

Corresponding author: Dr. IKPEZE, O. O. Department of Parasitology and Entomology, Nnamdi Azikiwe University, Awka. Or POBox 36, Afor-igwe, Ogidi, Anambra State.

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,* $r = (\sum yx_1)_{/\surd}(\sum y^2 \sum x_1^2)$ etc., was applied to the paired-variables Body weight versus Body length ($Y:X_1$), Body weight versus Heart girth ($Y:X_2$), Body weight versus Height-at-withers ($Y:X_3$), 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_1	HG (cm) X_2	H (cm) X_3
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
Means		**1.59**	**35.10**	**28.48**	**17.05**

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^2	x_1^2	x_2^2	x_3^2	$y x_1$	$y x_2$	yx_3	$x_1 x_2$	$x_1 x_3$	$x_2 x_3$
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	-.001	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
Σ		**3.28**	**516.5**	**531.6**	**143.6**	**40.98**	**40.98**	**21.59**	**514.7**	**269.7**	**270.5**

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

Variables	*BW (Y)*	*BL(X_1)*	*HG (X_2)*	*H (X_3)*
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= (Mean Y) – b (mean X)*	*Regression equation* $\tilde{Y} = a + b X$
BW: BL (Y:X_1)	0.0793	- 1.1934	BW = - 1.1934 + 0.0793BL
BW: HG (Y:X_2)	0.0796	- 0.6684	BW = - 0.6684 + 0.0796HG
BW: H (Y:X_3)	0.1503	- 0.9726	BW = - 0.9726 + 0.1503H
BL : HG (X_1:X_2)	1.0000	- 3.3800	BL = 6 + HG
BL : H (X_1:X_3)	1.8786	3.0690	BL = 3.069 + 1.8786H
HG : H (X_2:X_3)	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_1 (BL)**	**X_2 (HG)**	**X_3 (H)**
Y	3.28	-	-	-
X_1	40.98	516.5	514.7	269.7
X_2	40.98	514.7	531.6	270.5
X_3	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-efficents 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_{cal}**
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_1:X_2), Body length versus Height-at-withers (X_1:X_3), Heart girth versus Height-at-withers (X_2:X_3).

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^2 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.

ACKNOWLEDGEMENT

The authors acknowledge the assistance of the staff of Akpaka forest reserve who effectively restrained the grasscutters during weighing and linear body measurements.

REFERENCES

AKPA, G. N. (2000). Factors affecting growth and body measurements of Traditionally-managed Red Sokoto goats. Pages 252 – 253. *In:* S. N. Ukachukwu, J. A. Ibeawuchi, S. N. Ibe, A. G. Ezekwe, S. E. Abasiekong (Eds). *Book of Proceedings of the 25th Annual Conference of the Nigerian Society for Animal Production*. 19 – 23 March 2000, Michael Okpara University of Agriculture, Umudike, Abia State.

ALADE, N. K., OLUTOGUN, O. and IGWEBUIKE, J. U. (1999). Genetic characterization of linear measurement of N'Dama cattle at various ages in the humid tropics of Nigeria. Pages 315 – 318. *In:* S. N. Ukachukwu, J. A. Ibeawuchi, S. N. Ibe, A. G. Ezekwe, S. E. Abasiekong (Eds). *Book of Proceedings of the 24th Annual Conference of the Nigerian Society for Animal Production.* 21 – 25 March 1999, University of Ilorin, Ilorin, Kwara State.

CHINEKE, C. A. (1996). Relationship between body measurement and live body weight of Yakasa ewes at various ages. *Applied Tropical Agriculture*, *1:* 34 – 37.

CHINEKE, C. A. (2000). Characterization of physical body traits of domestic rabbit in humid tropics. Pages 237 – 239. *In:* S. N. Ukachukwu, J. A. Ibeawuchi, S. N. Ibe, A. G. Ezekwe, S. E. Abasiekong (Eds). *Book of Proceedings of the 25th Annual Conference of the Nigerian Society for Animal Production*. 19 – 23 March 2000, Michael Okpara University of Agriculture, Umudike, Abia State.

CHINEKE, C. A., IKEOBI, C. O. N. and OLOGUN, A. G. (2000). Live body measurement in domestic rabbits. Pages 271 – 273. *In:* S. N. Ukachukwu, J. A. Ibeawuchi, S. N. Ibe, A. G. Ezekwe, S. E. Abasiekong (Eds). *Book of Proceedings of the 25th Annual Conference of the Nigerian Society for Animal Production*. 19 – 23 March 2000, Michael Okpara University of Agriculture, Umudike, Abia State.

IBE, S. N. (1989). Measurement of size and conformation in commercial broilers. *Journal of Animal Breeding and Genetics, 106*: 461 – 469.

IBE, S. N. and EZEKWE, A. G. (1994). Quantifying size and shape differences between Muturu and N'Dama breeds of cattle. *Nigerian Journal of Anim*al *Production, 21:* 51 – 58.

LITTLE, T. M and HILLS, F. J. (1977). Linear correlation and regression. Pages 167 – 194. *In: Agricultural Experimentation: Design and Analysis.* John Willy and Sons Publishers, New York.

ORHERUATA, A. M. and OLUTOGUN, O. (1994). Pre and post-weaning phenotypic relationship between some N'Dama cattle linear measurements in the tropics. *Nigerian Journal of Anim*al *Production*, *22*: 76 – 81.

OZOJE, M. O. and HERBERT, U. (1997). Linear measurement in West African Dwarf (WAD) and WAD x Red Sokoto goats. *Nigerian Journal of Animal Production, 24(1):* 13 – 19.