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PREDICTION OF BODY WEIGHT FROM BODY MEASUREMENTS IN CANERAT: *Thryonomys swinderianus* (Temminck, 1827)

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Abstract

Study on prediction of body weight from linear measurements of other body parts of feral Canerats killed in Abeokuta, Ogun State was conducted. Seventy eight (78) canerats from hunters return were collected and weighed. Other body parts of the animals such as body length (BL), head length (HL), ear length (EL), tail length (TL), hindlimb (HLL) and forelimb length (FLL) were measured. Data collected was subjected to regression and correlation analysis using Statistical Package for Social Sciences (SPSS 10.00 Version, 2001). The study shows that head length appeared as the highest single predictor variable (R^2 = 1.00) for body weight in canerats. This was followed by body length which was also highly ($P<0.01$) significant in body weight prediction of canerats (R^2 = 0.678). Notwithstanding the unit of calculation, the equation of the head length has shown that the numerical value of the body weight is approximately equal to a quarter of the numerical value of the head length. Each of the parameter measured shows varied degree of association from, positively weak (0.322) to positively strong (0.824) correlation. There is significant different ($P < 0.01$) in the degree of association between body weight and other linear body measurements; hence, body weight can be predicted from linear body measurements but with different degree of reliability for each parameter.

Keywords: Canerat, Body weight, Prediction, measurement, linear, feral.

Introduction

Traditionally, visual assessments of animal sizes being used as a method of judgment (Abanikanda *et al.,* 2002) are subjective. Therefore, the development of the objective means (i.e. body linear measurements) for describing and evaluating body size and conformity characteristics would overcome many problems associated with visual evaluation (Shrestha *et al.,* 1984). The use of body conformation measurement to determine the body weight of both domestic livestock and wild animals is efficient, however, it has been shown that it is of more general application for wild animals than for domestic stocks, perhaps because wild animals tend to maintain more constant condition despite marked changes in environment and in availability of food (McCulloch and Talbot, 1965). In the opinion of De Brito Ferreira *et al*. (2000) body weight is mostly

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used to evaluate body development in animals but it is not easily measured in the field. This is due to the time and energy expended during the determination and the non-availability of weighing balance (Yakubu *et al*., 2007). However, linear body measurements are useful in live weight determination especially in villages where weighing machines are not available (Ige *et al*., 2007). The live weight in mammals is a useful tool in health and feed management. It also provides basis for reproduction, performance monitoring and marketing of its products (James *et al*., 2007). However, this trait is rarely measured in rural areas where majority of these animals are kept, killed and hunted (Mayaka *et al*., 1995).

Regression models have been established to estimate body weight from body dimensions (Hassan and Ciroma., 1992; Singh and Mishra, 1994; Gul *et al*., 2005). The main method of weight determination is by regression of body weight on linear measurements. These regression models allow fast evaluation of the body weight of an animal and are also used for optimization of feeding, determination of optimum slaughtering age and selection criteria (Blasko and Gomez, 1993). Live weight prediction equations for various species are presented as linear regressions, as power relationships and in terms of an index of body volume (McCulloch and Talbot, 1985). However, there are conflicting reports cutting across breeds and climatic zones on the choice of model that gives the best fit (Ayoade, 1981; Islam *et al.*, 1991; Benyi, 1997). Notwithstanding, several research findings have shown that linear body measurements are closely related to live weight of animals (Brody and Davies, 1937; Bhachila *et al.*, 1979; Antobam, 1983 and Benyi, 1997).

A host of equations applicable to diverse ages, sizes, sexes, classes and breeds has been published (McCulloch and Talbot, 1965). Linear body measurements of Yankasa ewes, kept under the semi-sensitive system of management, were studied by Fasae *et al.* (2005), using morphometric variables. Linear and geometric regression equations were also used by James *et al*, (2007), to estimate weight of semi-intensively managed West African Dwarf (WAD) goats from Chest girth and Wither height measurements.

Thus, methods and models of predicting body weight of conventional domestic animals also can be used to predict the body weight of Canerat (*Thryonomys swinderianus* Temminck), since it is a mammal and thus a vertebrate. However, body weight of wild mammals poses a more difficult problem than estimating that of domestic livestock. In the field, weighing facilities are rarely available to biologists, game wardens and other people who work with wild animals. Thus only a few persons have sufficient experience to make accurate visual estimation of any given wild species, but it is easier to make a near accurate estimation of other linear body measurement on animals visually.

However, since standard measurement can easily be taken on dead or captured animals, a model for estimating the weight of such animal from the body measurements if developed would be of great value to the workers. Hence, visual estimation of those body linear measurements can be used to predict the body weight of the animal having established the model for calculating it. The model if developed will also go a long way to solve the problem of handling that always brings about mortality in canerat farming. Availability of such model will prevent capturing the animal for weighing on a scale before the weight is known.

Materials and methods

Seventy eight (78) freshly killed canerats from hunters return to Olomore bushmeat depot in Abeokuta Ogun state were collected within a period of three month during the dry season. The animals were brought to the depot from villages and farms in Abeokuta, Yewa, Ewekoro, Wasimi and Odeda areas in Ogun state. The area lies within latitude 6^o 30′ – 7^o30′N and longitude 3^o00′ – 4^o30′E (Fig. 1). The animals were weighed with a Salter top pan scale to get its Body Weight (BW). Other body linear measurement such as body length (BL), Chest Girth (CG), Ear Length (EL), Forelimb Length (FLL), Hind Limb Length (HLL), Tail Length (TL) and Head Length (HL) were measured with girthing tape and ruler according to Fasae *et al.* (2005) and Tegbe and Olorunju, (1986). The data obtained were subjected to simple linear regression and Pearson Product moment correlation analysis using Statistical Package for Social Sciences (SPSS, Version 10.00).

Total body weight was regressed against all other seven (7) linear body measurement differently using the model Y = a + bX; where Y is the Body weight, 'a' is the model intercept, 'b' is the regression coefficient associated with the independent variable (other linear body measurement) denoted by 'X'. The regression coefficient of determination (R^2) was calculated in order to know the degree of association between the body weight and individual linear body measurements; hence it is easier to pick the variable that best predict the dependent variable (Y). Pearson Correlation analysis was done in order to depict the level of relationship between each and every other parameter measured. Getting the cooperation of the bushmeat sellers in order to take the measurement was one of the limiting factors of the experiment since live animal was not readily available.

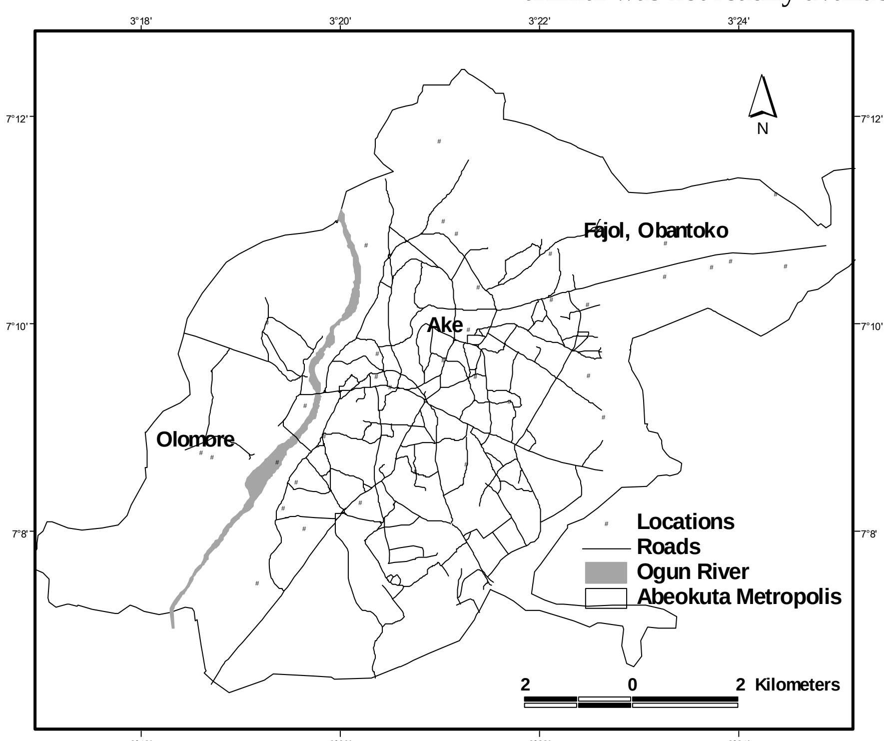

Fig. 1. Map of Abeokuta Metropolis showing Bush Meat Depot and Locations

Results

The mean body weight of the 78 Cane-rats sampled was 3.73kg ± 1.00 (Table 1). Their weight ranged from 2.73kg to 4.73kg, while the body length with mean 64.35cm ± 8.11 ranged from 53.53cm to 75.16cm. Mean value of other body linear measurements and the range are shown in Table 1. Linear regression equations predicting body weight from other linear body measurements with their R^2 values are shown in Table 2. It was revealed that head length (HL) gave the highest coefficient of determination ($R^2 =$ 1.00), followed by body length (BL) (R^2= 0.678), while the least R^2 (0.258) was observed for ear length (EL) as a means of determining the level of relationship between the measured parameters and the body weight of the animals.

Correlation between body weight and other individual linear body measurements ranged between 0.322 – 0.824, which can be interpreted to mean that the degree of associations between these measured parameters ranged from positively weak to positively strong. Some of the associations when compared were significantly ($p<0.01$) different as a parameter to be considered for prediction of body weight of canerats (Table 3).

Table 1. Means of all the Linear Body Measurements of Canerats used in the Study

PARAMETERS	MEANS (± SD)	RANGE
Body Weight (kg)	3.73 ± 1.00	2.73 – 4.73
Body Length (cm)	64.35 ± 8.11	53.53 – 75.16
Head Length (cm)	15.08 ± 2.44	12.64 – 17.52
Ear Length (cm)	3.80 ± 0.46	3.35 – 4.26
Forelimb Length (cm	13.13 ± 2.68	10.45 – 15.81
Hindlimb Length (cm)	16.26 ± 3.42	12.84 – 19.68
Tail Length (cm)	17.39 ± 3.94	13.45 – 21.33
Chest Girth (cm)	35.34 ± 5.81	29.53 – 41.16

Table 2. Regression Equations (models) for predicting Body weight of Canerats from measurements of other body parts

Body Parts	Regression Models	R^2
Body Length	BW = 0.076BL – 1.190	0.678
Chest Girth	BW = 0.094CG + 0.372	0.302
Ear Length	BW = 1.112EL – 0.506	0.258
Forelimb Length	BW = 0.254FLL + 0.387	0.459
Head Length	BW = 0.239HL + 0.117	1.000
Hindlimb Length	BW = 0.209HLL + 0.338	0.462
Tail Length	BW = 0.159TL + 0.953	0.391

Table 3. Correlation of different body parts of Canerats measured in the study area.

	Body weight	Body Length	Chest Girth	Ear Length	Forelimb Length	Head Length	Hindlimb Length	Tail Length
Body Weight								
Body Length	0.824[c]							
Chest Girth	0.550[a]	0.602[b]						
Ear Length	0.513[a]	0.614[b]	0.516[a]					
Forelimb Length	0.679[b]	0.634[b]	0.371[d]	0.407[d]				
Head Length	0.583[a]	0.706[b]	0.618[b]	0.585[a]	0.408[d]			
Hindlimb Length	0.667[b]	0.688[b]	0.371[d]	0.450[d]	0.668[b]	0.322[d]		
Tail Length	0.626[b]	0.718[b]	0.740[b]	0.365[d]	0.582[a]	0.420[d]	0.579[a]	

Figures in the same row and column with same superscripts are not significantly ($p<0.01$) different.

Discussion

In this study, it is evident that there is significant ($P < 0.01$) association between Body Weight and all other linear body measurements; hence, Body Weight can be predicted from linear body measurements. This is consistent with reports from different authors (James *et al.*, 2007; Yakubu *et al.*, 2007) in which it was reported that linear body measurements are closely related to live weight change of animal. Ranges of coefficients of determination (R^2) from 0.258 to 1.00 recorded in this study, is an indication that linear body measurements can describe Body Weight, but definitely not at the same degree. Head Length appeared as the highest single predictor variable (R^2 = 1.00) for Body Weight in Canerats. This observation does not support the claims of other authors (James *et al.*, 2007; Yakubu *et al.*, 2007) who reported that Chest Girth better estimated the live weight of West African Dwarf Goats. The variation may not be unconnected with the size of Canerats when compared to West African Dwarf goats. Taxonomically, the two animals belong to different groups and family; while Canerat is a rodent; West African Dwarf goat belongs to the Capridae and hence, may not readily conform to the same parameter as a predictor of their weight. Moreover the assertion above indicates that they are morphologically different and cannot conform to the same shape. In the case of canerats, when chest girth was regressed against body weight it gave a positively weak Coefficeint of determination (R^2 = 0.302) value, hence, it may not be as good or reliable predictor of body weight in Canerats. Ige *et al.* (2007) stated that heart (chest) girth is highly environmentally sensitive and that heart girth and body weight grow in response to environmental components such as food and management but since canerat is feral and does not undergo any tailored feeding management or growth, it may not be unexpected that its chest girth does not readily predict its body weight. The result of this study vis head length now bring to the fore the reason why size and shape of the head is being used to established sexual dimorphism in canerats.

Body length was also highly ($P<0.01$) significant in body weight prediction of canerats (R^2 = 0.678), which implies that body length is a good predictor of body weight. This is in line with the report of James *et al.* (2007), which recorded that the coefficient of determination R^2 ranged between 0.65– 0.71, which is highly significant ($P<0.01$) in predicting body weight of West African Dwarf goats from body length. This also agrees with the finding of Fasae *et al.* (2005) who also worked with West African Dwarf goats. This however shows that body weight can be reliably predicted from body length, hence, inferring that body weight is not only influenced by feeding pattern or feeding habit but on genetic inheritance, since canerat and West African Dwarf goat do not belong to the same group or family.

Hind limb length was significant ($p<0.01$) for body weight prediction of canerats (R^2 = 0.462), although not as strong as head length and body length. This implies that hind limb length can also be used to predict the body weight of canerats in the absence of any other linear body measurement. This assertion was drawn based on the fact that the correlation between body weight and hind limb length is strong. So also is the forelimb length which can also be used to predict body weight of canerats if their correlation value is being considered although it gave a lower value of R^2 (0.459); hence it will give a low degree of reliability in body weight prediction of canerat when compared with others like head length and body length.

The correlation (0.626) between body weight and tail length is strong but its coefficient of determination R^2 = 0.391 which is lower than that of all others that have been mentioned will definitely put it at a disadvantage when measurement of body part is been considered for body weight prediction in canerats. Lower level of the degree of reliability of the result of such prediction is a major setback because visual assessment of tail length and body length often are the easiest among other body parts in feral rodents. The least was observed for ear length (R^2 = 0.258), which implies that the coefficient though significant ($P<0.01$) with a correlation of 0.513 between itself and body weight, will give a very low degree of reliability in predicting body weight of canerats.

The results obtained in this study show that head length is the highest single predictor of body weight in canerats, and it best estimates the body weight of canerats than any other linear body measurement using linear regression equations: BW = 0.239HL + 0.117. It can also be inferred from this study that quick estimation of Canerat's body weight in the field is easier with the equation of the head length. From the equation it can be established that the numerical value of the body weight in kilogram is approximately equal to a quarter of the numerical value of the head length in centimeter. Writing it as a model it can be fixed as: BW (kg) = HL/4(cm), where BW is the body weight and HL is the head length of the animal. Hence, in the field and even in breeding programs, biologists and ecologists working with canerats can therefore estimate or predict the body weight of canerat using head length or body length measurement in the absence of appropriate weight measuring instruments. The study also shows that linear body measurements are very useful in predicting body weight of canerat but with different degree of reliability for each parameter.

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