Body Length, Heart Girth and Trunk Length as Predictors of Live Body Weight of Guinea pig (*Cavia porcellus*) in The Southern Guinea Savannah Zone of Nigeria

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Abstract: Body weight (BL), heart girth (HG) and trunk length (TL) were used to predict live body weight of guinea pig using simple linear regression model. 440 records of 24 guinea pigs taken at forthnightly interval were used. The three parameters measured were also correlated with body weight. The predictive equations generated were: Y=-169+ 16.4BL+8.9HG –10.5TL, Y=-207+8.28BL+5.90HG +52.3TL, Y=-372+24.9BL+4.75HG+16.6TL, Y=-401+ 18.3BL+20.8HG+7.2TL and Y=-259–2.9BL+38.2HG+24.5TL for 4, 6, 8, 10 and 12 weeks of age post-weaning respectively. The coefficient of determination (R^2) values obtained ranged from 0.29 to 0.84 with the highest (R^2 =0.84) observed at week 10. The equations were all significant ($p<0.05$). Positive and significant ($p<0.05$; $p<0.01$) phenotypic correlations were observed between body weight and all the parameters measured except for body weight and trunk length at week 4 where no significant ($P>0.05$) difference was observed. It was concluded that, early prediction of live body weight could be achieved in guinea pig from measurements taken from BL, HG and TL using simple linear regression equation. [New York Science Journal. 2010;3(2):9-14]. (ISSN: 1554-0200)

Key words: Guinea pig, live body weight, body length, heart girth, trunk length.

Introduction

The guinea pig (*Cavia porcellus*) is an animal indigenous to the South American Andes whose breeding, offers a nutritional alternative and also income for the farmer (Numbela and Valencia, 2003). Its meat is used as an important source of animal protein given that it is a product of high quality, high biological value, high protein and low fat compared to other meats (Numbela and Valencia, 2003). Its meat has a protein content of about 21%, which is higher than that of pork, poultry, mutton or beef, and a lower fat content of about 8% (Nr International Managers of Livestock Production Programme, 2006). The animal has a body weight of between 700-1200g and can measure up to 20-25cm in length (Vanderlip, 2003). The guinea pig requires less room than traditional livestock and reproduces extremely quickly making them a more profitable source of food and income than many traditional stock animals such as pigs and cows (Nuwanyakpa *et al.,* 1997). If its rearing is encouraged therefore, it will go a long way in reducing dependence on the conventional livestock as well as becoming a ready source of protein and income for resource poor people in the rural areas of most developing countries. Beside, its management is so easy that even children can rear them.

Linear body measurements of traits has been used to describe body conformation and carcass composition, evaluate breed performance, predict live weight gain, examine relationships among economic characteristics, reproductive performance and to study the interactions between heredity and the environment in several animals (Monsi, 1992; Okon *et al.,* 1997; Chineke, 1996, Akpa, 2000, ozoje and Mbere, 2002). Ozoje and Mbere (2002) reported on the use of skeletal dimensions such as shoulder width, heart girth and height at withers as good indicators of live weight and condition score. Heart girth that reflects the physiological status of animals has also been considered as the best indicator of live weight and condition (Tegbe and Olorunju, 1986). Chineke (2005) is of the opinion that simple linear measurements that can reliably predict body weight without necessitating animal slaughter are desirable. References in available literature relating linear measurements to production traits in animals, involves mostly cattle, sheep, poultry and goat. Information on association among live body measurements in the guinea pig is limited. This study therefore was designed to attempt a prediction of live body weight of guinea pig from three linear measurements namely body length (BL), heart girth (HG) and trunk length (TL) as well as find out the degree of correlation between the traits and live body weight.

Materials and Methods

Location of study

The study was conducted at the Teaching and Research Farm of the Federal University of Technology, Minna, Niger State, Nigeria. Minna is situated at latitude 9˚ 45′ North and longitude 6˚ 33′ East of the equator. It lies within the southern guinea savannah agro-ecological zone of Nigeria. It is characterized by two distinct climate; harmattan (November-April) and rainy (May-October). The annual rainfall and mean temperature range are: 1,100-1300mm and 38-42^{0}C respectively.

Experimental animals and their management

The 24 guinea pigs used for the experiment were sourced locally from Kagara, Kotangora and Gwada all within Niger State. The weaned non-pedigreed animals were purchased from peasant farmers who keep them primary for meat. They were housed in hutches made of wood and wire mesh. The wire mesh was placed at the bottom and sides of the hutch. This is to ensure proper ventilation and easy disposal of droppings. The dimension of each hutch was 65cm x 46.5cm x 58.8cm. The hutches were raised 30inches above the floor level for sanitation purpose. The hutches were large enough to allow for easy movement. Feeders and drinkers were provided. The house and the surroundings were kept clean. The house was swept daily and drinkers were also washed regularly. The animals were treated against both internal and external parasites by the use of Ivomec®. Anti-stress was provided in the form of Vitalyte®.

Feeding and watering

The guinea pigs were fed *ad libitum* a compounded diet supplemented with *Tridax procumbens* and Mango leaves over the course of the experiment. Clean water was given *ad libitum*.

Data collection

Collection of data started 4 weeks after the commencement of the experiment and thereafter at two weekly intervals until the 12th week. The linear body traits studied was body length (BL), heart girth (HG) and trunk length. Linear measurements were taken using measuring tape while body weight was measured using a 10kg measuring scale. The linear measurements are as follows:

BL = length between the tip of the nose and the rump.
HG = body circumference taken just behind the fore legs.
TL = length between the neck and the rump.

Data analysis

Data obtained of each of the linear body measurements; BL, HG and TL were regressed against live body weight at 4, 6, 8, 10 and 12 weeks using simple linear regression analysis. The linear measurements were also correlated with body weight. The analysis was carried out using MINITAB statistical package (MINITAB, 2003). The relationship between live weight and each of the linear body measurements was accessed. The coefficient of determination (R^2) was used to compare the accuracy of prediction.

Results

Table 1 represents the predictive equations generated from data on BL, HG and TL taken at 4, 6, 8, 10 and 12 weeks post-weaning. The equations were all significant ($p<0.05$). The coefficient of determination (R^2) values showed an increase in magnitude as the experiment progressed up to week 10 before showing a decline. The best fit in the linear regression equation (R^2=0.84) was obtained at week 10 followed by the equation obtained at week 8 (R^2=0.79), week 6 (R^2=0.62), week 12 (R^2=0.49) and week 4 (R^2=0.29). The best fit equation is as follows:

$$Y=-401+ 18.3BL+20.8HG+7.2TL$$

Where Y= live body weight, BL= body length, HG= heart girth and TL= trunk length respectively.

Tables 2 to 6 shows the degree of correlation between live body weight and linear body dimensions. The phenotypic correlation values were generally positive and significant ($p<0.05$) except for correlation between live body weight and trunk length at week 4 which was not significant ($p>0.05$). The degree of association between body weight and linear body dimensions followed the same trend as the predictive equations. The highest values were observed in weeks 8 and 10 respectively.

Discussion

Equations were generated for predicting live body weight from linear traits (Table 1). It was observed that the equations were all significant ($p<0.05$). As clearly indicated, 84% of the variation in live weight was explained by BL, HG and TL at the 10th week of the experiment. From the magnitude of the coefficient of determination (R^2) value, it is evident that live body weight increases with age. The results also showed that a decline in live body weight occurred between weeks 10 and 12 as reflected by the lower value of R^2. The result also implied that simple

Table 1. Predictive Equations for Weekly Live Body Weight in Guinea Pig

Week	Equation	SEM	R2	Significance
4	Y=-169+ 16.4BL+8.9HG –10.5TL	11.86	0.29	*
6	Y=-207+8.28BL+5.90HG +52.3TL	8.88	0.62	*
8	Y=-372+24.9BL+4.75HG+16.6TL	6.22	0.79	*
10	Y=-401+ 18.3BL+20.8HG+7.2TL	4.89	0.84	*
12	Y=-259–2.9BL+38.2HG+24.5TL	8.26	0.49	*

Y=live body weight
BL=body length
HG=heart girth
TL=trunk length
*Significant ($p<0.05$)

Table 2. Correlation Between BW, BL, HG and TL at 4 weeks

	BW	BL	HG	TL
BW	-			
BL	0.519**	-		
HG	0.422*	0.638**	-	
TL	0.218	0.409*	0.689**	-

BW=body weight
BL= body length
HG=heart girth
TL=trunk length
*Significant ($p<0.05$)
**Significant ($p<0.01$)

Table 3. Correlation Between BW, BL, HG and TL at 6 weeks

	BW	BL	HG	TL
BW	-			
BL	0.615**	-		
HG	0.643**	0.749**	-	
TL	0.740**	0.538**	0.624**	-

BW=body weight
BL= body length
HG=heart girth
TL=trunk length
**Significant ($p<0.01$)

Table 4. Correlation Between BW, BL, HG and TL at 8 weeks

	BW	BL	HG	TL
BW	-			
BL	0.880**	-		
HG	0.732**	0.778**	-	
TL	0.773**	0.802**	0.648**	-

BW=body weight
BL= body length
HG=heart girth
TL=trunk length
**Significant ($p<0.01$)

Table 5. Correlation Between BW, BL, HG and TL at 10 weeks

	BW	BL	HG	TL
BW	-			
BL	0.877**	-		
HG	0.849**	0.773**	-	
TL	0.706**	0.795**	0.565**	-

BW=body weight
BL= body length
HG=heart girth
TL=trunk length
**Significant ($p<0.01$)

Table 6. Correlation Between BW, BL, HG and TL at 12 weeks

	BW	BL	HG	TL
BW	-			
BL	0.482*	-		
HG	0.675**	0.620**	-	
TL	0.448*	0.690**	0.417*	-

BW=body weight
BL= body length
HG=heart girth
TL=trunk length
*Significant ($p<0.05$)
**Significant ($p<0.01$)

linear regression could be used to explain the relationship between live weight and body measurements such as BL, Hg and TL. This is in agreement with the observation of Mullick (1950).

The correlation coefficients obtained between the traits are presented in Tables 2 to 6. Generally, live body weight correlated ($p<0.05$) well with all the linear body measurements except for TL at week 4 (Table 2) where the relationship was not significant and also very low. The high and significant correlation coefficients between body weight and BL, body weight and HG and, between body weight and TL suggests that BL, HG and TL could be very useful for predicting live body weights in guinea pigs. Hassan and Adamu (1997) reported similar findings in the pigeon. The high positive correlation values indicative that as live body weight increases, the linear body measurements will also increase. The implication is that, the traits could be selected for at the same time (Adewumi *et al.,* 2006). The high correlations also indicate that the total size of the animal is a function of both the length and body circumference as reported by Raymond *et al.* (1987).

Both the regression equations and phenotypic relationships followed the same trend; increasing with age up to the 10th week, followed by a decline in the magnitude from the 10th week to the 12th week. Bemji and Osinowo (2009) observed similar trend of regression and correlation in their study of milk yield from some udder traits in goats.

Conclusion

Early prediction of live body weight of guinea pigs could be achieved from measurements of body length, heart girth and trunk length using a predictive linear regression equation. Results from the study also showed that live body weight, body length, heart girth and trunk length were mostly positively and significantly correlated and the degree of association increases with age up to the 10th week post-weaning.

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