Effect of Sex on Linear Body Measurements of Guinea Pig (*Cavia porcellus*)

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Abstract

Twenty four weaned guinea pigs were used to study the effect of sex on the interrelationship between body weight and linear body measurements. The guinea pigs were randomly alloted to two treatments representing different protein and energy levels. Twelve guinea pigs make up a treatment group each with three replicates consisting of four animals. The animals were grouped by sex. The experiment spanned 12 weeks. At 12 weeks, data were collected on male and female body weight, body length, heart girth, trunk length, fore leg length, hind leg length and length of ear respectively. Results showed that significant differences ($p < 0.05$) exist between male and female body weight, body length, heart girth, trunk length, hind leg length and length of ear. Correlation analysis revealed that all the parameters studied were positively and significantly ($p < 0.05$) correlated in males. In females, negative correlation was observed between body weight and body length, fore leg length and body weight as well as between fore leg length and trunk length. It was concluded that sex had an effect on the interrelationship between body weight and linear body measurements in guinea pigs.

Keywords: *Guinea pig, sex, body weight, linear body measurements, interrelationship.*

Introduction

There's been a move toward encouraging the production and exploitation of lesser known animals otherwise known as *microlivestock* as likely sources of animal protein. This is because the well known conventional livestock has not been able to meet up with the demand for animal protein in most developing countries. The utilization of *microlivestock* it is envisaged will address this protein deficit particularly in the rural areas where the deficit is most apparent. Most animals in this class rely on feed material not competed for by man and the industry hence they can easily be produced. They have short generation interval and are very prolific.

The guinea pig (*Cavia porcellus*) is a rodent considered a very promising *microlivestock* species for rural development because it requires little capital, equipment, space and labour (NR International 2006). It originated in the mountains and grasslands of the Altiplano region in South America and was domesticated around 5,000BC (Morales 1995). In South America, guinea pigs are considered a special delicacy (Hilary 2008). They are also a source of meat in Nigeria and other parts of Africa, as well as in the Philippines (NRC 1991). Its meat is of high value due to its low cholesterol and high protein level compared to the chicken, beef and lamb (Numbela and Valencia 2003).

Previous reports (Vaccaro *et al.* 1968; Dillard *et al.* 1972; Quijandria *et al.* 1983) suggest that a genetic basis exists for vital production characters of guinea pig, such as body weight and litter size. The implication is that a general improvement in these traits would occur when selection is practiced. Wright (1960) and Dillard *et al.* (1972)

reported phenotypic and genetic correlations among weights of guinea pigs at different ages, weight gains and litter size.

Linear body measurements provide good information on performance, productivity and carcass characteristics of animals (Ige *et al.* 2006). Linear measurements have been used to predict performance characteristics in poultry (Oni *et al.* 2001; Adenowo and Omoniyi 2004), goats (Ozoje and Mbere 2002), sheep (Salako and Ngere 2002; Salako 2004) and cattle (Mbap and Bawa 2001; Olutogun *et al.* 2003). There is a paucity of reported work on linear body measurements of guinea pigs in Nigeria (Egena 2010). It is against this background that the study was undertaken with the aim of determining the effect of sex on the interrelationship between body weight and linear body measurements. An attempt will be made to also find out the degree of association between body weight and linear body measurements.

Materials and Methods

Location of study

The data for this study was collected from 24 guinea pigs raised intensively to 12 weeks post-weaning at the Teaching and Research Farm of the Department of Animal Production, Federal University of Technology, Minna, Niger State, Nigeria. Minna lies within the Southern guinea savannah agro-ecological zone of Nigeria. It has two distinct climate; a dry harmattan season (November-April) and a wet rainy season (May-October). It experiences an annual rainfall of between 1,100-1300 mm and a mean temperature range of 38-42 ºC. It is situated at latitude 9˚ 45′ North and longitude 6˚ 33′ East of the equator.

Source of Experimental Animals and Their Management

The animals used for the experiment were sourced from three localities within the state (Kagara, Kotangora and Gwada). The animals were all weaned and non-pedigreed. 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. 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 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* two compounded diets (T_1= 16%CP, 3187.18Kcal/Kg of energy; T_2= 22%CP, 2864.81Kcal/Kg of energy) supplemented with *Tridax procumbens* and Mango leaves over the course of the experiment since the animal is largely herbivorous. The ingredients used in making the feed included maize, soyabean, maize bran, methionine, lysine, palm oil, bone meal, premix and salt.

Data Collection

At twelve weeks, data was collected using a 5kg weighing scale and a measuring tape. Information on body weight and linear body measurements were collected on each animal. Males and females were taken from each treatment in order to minimize the effect of the diet. Linear body measurements included body length (BL), heart girth (HG), trunk length (TL), fore leg length (FLL), Hind leg length (HLL) and length of ear (LE). Measurements were taken using measuring tape.

Linear body measurements studied were carried out 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;

FLL = length from the point of attachment of the fore leg to the tip of the fore leg;
HLL = length from the point of attachment of the hind leg to the tip of the hind leg;
LE = length from the point of attachment of the ear to the tip of the ear.

Data Analysis

Data obtained were subjected to analysis using t-test. Pearson's correlation coefficients were estimated between body weight and linear body measurements. Regression equations of linear body measurements with body weight were also generated. All the analysis were done using Minitab statistical package (Minitab 2003). The following statistical model was used:
$Y_{ij} = U + S_i + e_{ij}$,
where:
Y_{ij} = body weight or body measurement;
U = population mean;
S_i = fixed effect of sex;
e_{ij} = residual error.

Results and Discussion

Table 1 summarizes the mean values of body weight and linear body measurements in relation to sex of the guinea pigs for all traits studied. Males were higher in body weight and body measurements ($p < 0.05$) than females except for length of ear. Gueye *et al.* (1998) and Misshohou *et al.* (1997) had reported similar observation in the chicken. Such sex dimorphism as observed in this study according to Gatford *et al.* (1998), improves competitive ability and greater opportunity for breeding. Hence the bigger male is most opportuned to mate with females in the colony due to its size.

Table 1. Mean values for body weight and linear body measurements.

Traits	Males Mean ± SEM	Females Mean ± SEM	Significance
Body weight (g)	454.00 ± 14.69^a	436.67 ± 6.52^b	*
Body measurements (cm)			
Body length (BL)	25.73 ± 0.30^a	24.67 ± 0.17^b	*
Heart girth (HG)	17.20 ± 0.19^a	16.53 ± 0.19^b	*
Trunk length (TL)	5.44 ± 0.14^a	5.27 ± 0.07^b	*
Fore leg length (FLL)	2.53 ± 0.03	2.53 ± 0.02	ns
Hind leg length (HLL)	4.70 ± 0.06^a	4.41 ± 0.06^b	*
Length of ear (LE)	2.60 ± 0.05^a	2.36 ± 0.05^b	*

Legend: *Significant difference ($p < 0.05$); ns: Not significant ($p > 0.05$);
ab: Means denoted by different alphabets across row differ ($p < 0.05$) significantly;
SEM: Standard error of mean.

Table 2. Correlation coefficients between body weight and linear body measurements.

	BW	BL	HG	TL	FLL	HLL	LE
BW	-	0.735**	0.799**	0.582**	0.491*	0.575**	0.661**
BL	-0.091*	-	0.671**	0.700**	0.415*	0.414*	0.630**
HG	0.368*	0.738**	-	0.598**	0.304*	0.715**	0.688**
TL	0.748**	0.446*	0.695**	-	0.578**	0.737**	0.584**
FLL	-0.268	0.201	0.255	-0.419*	-	0.427*	0.535**
HLL	0.674**	0.155	0.396*	0.443*	0.350*	-	0.685**
LE	0.703**	0.473*	0.776**	0.776**	0.267	0.878**	-

Legend: *Significant difference ($p < 0.05$); **Significant difference ($p < 0.01$); BW: Body weight.
Values for males are above the diagonal while those for females are below the diagonal.

The correlation coefficients obtained between body weight and linear traits are presented in Table 2 with respect to sex. Body weight correlated positively with all the linear body measurements and significantly ($p < 0.05$) in male guinea pigs. Similar result was observed in females except for body weight and fore leg length which negatively correlated with body weight. Equally, the correlation between fore leg length and trunk length was observed to be negative in females. The high and significant correlation between body weight and body length, heart girth, trunk length and length of ear suggests that they could be very useful in predicting live body weight in male guinea pigs. Ige *et al.* (2006) reported similar findings in broiler chickens. Trunk length, hind leg length and length of ear could be used for the same purpose in females.

Predictive regression equations (Table 3) showed that there were significant ($p < 0.05$) of linear body measurements with body weight except for body length in the female. The R^2 value ranged from 0.24 to 0.64 in males and 0.01 to 0.56 in females. Considering individual traits, HG had the best fit in males (0.64) followed by BL (0.53) and LE (0.44). In females, the best fit was TL (0.56), followed by LE (0.49) and HLL (0.46). The implication of the high R^2 value observed in males for HG and BL is that these traits could be used to predict live body weight for the animal since they could explain 64% and 53% of the variation in live body weight. Similarly, TL and LE could be used to predict live body weight in females since they equally account for 56% and 49% respectively of the variation.

Table 3. Predictive equations relating body weight to linear body measurements.

Sex	Regression equation	R^2	SEM
Male	BW= -448+35.0BL	0.53*	10.50
	BW= -622+62.6HG	0.64*	9.17
	BW= 129+59.7TL	0.34*	12.40
	BW= -230+271FLL	0.24*	13.29
	BW= -225+144HLL	0.33*	12.47
	BW= -18+182LE	0.44*	11.49
Female	BW= 521-3.4BL	0.01ns	6.74
	BW= 230+12.5HG	0.14*	6.29
	BW= 51+73.2TL	0.56*	4.49
	BW= 680-96.2FLL	0.07*	6.52
	BW= 90+78.6HLL	0.46*	4.99
	BW= 240+83.3LE	0.49*	4.81

Legend: *Significant difference ($p < 0.05$); ns: Not significant ($p > 0.05$); R^2= Coefficient of determination; SEM: Standard error of mean.

The trend of the values of R^2 for individual body weight traits followed the trend in phenotypic relationships with body weight as the same traits correlated most with body weight in both sexes. It is logical to expect therefore that selection of one or more of these characters would mean increase in body weight of guinea pigs.

Conclusion

High and significant correlation was observed between body weight and linear body measurements as influenced by sex. This indicates that any one of the linear body measurements could be used for selection except BL and FLL in females. Equally, the inclusion of traits related to body weight as selection criteria may go a long way in improving the accuracy of predicting body weight in guinea pigs thus allowing breeders to make more knowledgeable selection decisions.

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