RABBIT GENETICS

Rabbit Genetics
International Journal of the Bioflux Society

Repeatability estimates of pre-weaning and weaning litter body weight traits in domestic rabbits at birth, 7, 14, 21 and 42 day of age in a tropical environment

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Abstract. Data from 195 domestic rabbit (*Oryctolagus cuniculus*) individuals obtained from three consecutive mating, each from fifteen does, were used to estimate repeatability for litter body weight at birth, 7, 14, 21 and 42 days respectively. The analysis of variance was obtained in a balanced design with equal number of records per doe was used to obtain variance component. Repeatability was estimated from standard expression. Mean values ranged from 0.05 ± 0.04 for LBWT (litter birth weight) to 0.59 ± 0.02 for 42 BWT (body weight at 42nd day). Repeatability estimates were mostly low with values of 0.14, 0.02, 0.32, 0.14, 0.29, 0.45, 0.23 and 0.37 respectively. In conclusion litter body weight trait tend to be lowly repeatable except for 14 BWT (body weight at 14th day) were estimate was high. These low estimates of repeatability suggest low genetic influence of the traits and higher environmental contributions.
Key Words: *Oryctolagus cuniculus*, domestic rabbit, doe, tropical environment, rabbit genetics.

Introduction. The domestic rabbit *Oryctolagus cuniculus* present favorable biological characteristics as most avian species; the rabbit is characterized by a short generation interval and a high fecundity and prolificacy (Beaumont et al 2003). Genetic parameter estimates (heritability, repeatability and correlations) are especially needed for selection and improvement of tropical rabbit populations in order to provide quality breeding stock to farmers. Rabbit, as a source of animal protein, in efficient production systems, can turn 20 % of the proteins they eat into edible meat, comparable figures for other species are 22 to 23 % for broiler chickens, 16 to 18 % for pigs and 8 to 12 % for beef so that with its fast production cycle it may provide solution for animal protein crisis, especially in the less developed countries (Lebas et al 1986). Milk yield of the doe is the major pronounced postnatal maternal component influencing pre-weaning litter traits in terms of litter size and litter weight (Santacreu et al 2005). Litter weight at birth and number of suckling kits both strongly influence milk production of rabbit doe (Pascual et al 2008). Although numerous attempts have been made to evaluate performance characteristics and genetic parameter estimates of rabbits in Nigeria, most results and estimates available have been obtained from experimental populations established for various types of selection study (Odubote & Somade 1992). Since the performance of any population is a function of the genotype and the environment, estimates of these genetic parameters are functions of the variances in that particular population. The objective of this study is to estimate the repeatability of litter body weight at birth, 7, 14, 21 and 42 days of age.

Material and Method. The study was conducted at the rabbitry unit of the Department of Animal Science, Delta State University, Asaba Campus, Nigeria. Asaba Campus is located at latitude of 06^0 14'N and longitude of 06^0 49'E. It lies in the tropical rainforest zone. The record of 195 young's obtained from 15 does was used for the study. The rabbits were raised in wooden hutches measuring 100 x 60 x 65 with wire mesh. The animals were fed concentrate and forages, the water was provided *ad libitum*. Litter

parameters studied were litter birth weight (LBWT), 7, 14, 21 and 42 day body weight (BWT). Each doe produced three parities. There was equal number of measurements per doe (balanced design). The data were subjected to analysis of variance using SAS (2001) and the repeatability calculated manually according to Becker's (1984) formula.

Statistical Model: $Y_{KM} = \mu + \infty k + ekm$

Where: μ - the common mean,
∞k - the effect of kth individual,
ekm - the environmental deviation of mth measurement within an individual (error term)

Estimating repeatability and variance components:

$$\sigma^2_E = \mathrm{Ms_E}$$

$$\sigma^2_W = \frac{\mathrm{Ms_W} - \mathrm{Ms_E}}{\mathrm{K_1}}$$

$$R = \frac{\sigma^2_W}{\sigma^2_W + \sigma^2_E}$$

Standard error of repeatability was estimated according to Becker (1984).

Results and Discussion. Table 1 shows the mean and standard errors for litter body weight traits. The mean values increased from 0.05 kg (LBWT) to 0.59 kg (42 BWT). The mean values of litter birth weight (LBWT) and weaning weight were lower than the values reported for both traits by Ogah & Ehiobu (2004). However, the mean value obtained for litter weaning weight (0.59 ± 0.04) was higher than 0.52 ± 0.02 kg reported for the same trait by Ogah & Ehiobu (2004). The differences may be due to the fact that the animals were raised in different environments.

Table 1

Means and standard errors for body weight traits in domestic rabbits

Traits	*No of observation*	*Mean*	*S.E.*
LBWT	195	0.05	0.04
7 BWT	187	0.10	0.07
14 BWT	181	0.19	0.12
21 BWT	179	0.28	0.13
42 BWT	174	0.59	0.02

LBWT – litter birth weight, 7 BWT – 7 day body weight, 14 BWT – 14 day body weight, 21 BWT – 21 day body weight, 42 BWT - 42 day body weight.

Table 2 presents the mean square values for litter traits of rabbits obtained from analysis of variance while table 3 shows the variance components and repeatability estimates. Mean squares between individual were generally higher than the mean squares within individuals. Repeatability estimates for all the traits studied were mostly low in size and ranged from 0.14 to 0.45. The highest estimate was recorded for 14 BWT (R = 0.45). The repeatability of 0.14 for LBWT obtained in this study is in agreement with the 0.14 reported for the same trait by Ogah & Ehiobu (2004). However, the value was lower than the estimates reported by Iraqi & Youssef (2006) and Okoroh et al (2007) with values of 0.34 and 0.21 respectively while Iraqi & Youssef (2006) reported estimates of 0.097 which is lower than the estimates of 0.14 in this present study. Repeatability estimates

for 7 BWT and 14 BWT was scarce in literatures but 7 day body weight value of 0.29 is comparable to 0.26 for 28 day body weight reported by Rastogi et al (2000). The value of 0.29 for 7 day body weight is also similar to report by Sorhue et al (2013) for litter size at birth and litter size at weaning (0.29 and 0.32) while record of 0.45 for 14 day body weight is similar to 0.40 obtained for total number born (TB) by Gyovai et al (2009). Low estimate of 0.23 obtained for LBWT is higher than 0.18 and 0.07 reported by Rastogi et al (2000) and Iraqi (2008) respectively. Iraqi & Youssef (2006) and Ogah & Ehiobu (2004) reported repeatability estimates for 42 BWT of 0.28 and 0.01 respectively which is lower than the repeatability estimate of 0.37 obtained in this study. The low repeatability estimates obtained in the present findings indicates that many measurements are needed to correctly evaluate the consistency of the performance of doe rabbits in the experimental population.

Table 2

Mean square of analysis of variance for litter body weight traits

Source of variation	*DF*	*LBWT*	*7 BWT*	*14 BWT*	*21 BWT*	*42 BWT*
		MS				
Between individuals	14	0.0103	0.6091	0.0312	0.0061	0.0182
Within measurements	30	0.0068	0.0271	0.0094	0.0032	0.0067

MS - mean squares, DF - degree of freedom, BWT- body weight.

Table 3

Variance components, repeatability and standard error for litter size and body weight traits in domestic rabbits

Traits	σ_w^2	σ_e^2	*R*	*s.e.*
LBWT	0.0012	0.0068	0.14	0.34
7 BWT	0.0113	0.0271	0.29	0.65
14 BWT	0.0073	0.0094	0.45	0.32
21 BWT	0.0009	0.0032	0.23	0.35
42 BWT	0.0038	0.0067	0.37	0.34

σ_w^2 – variance within, σ_e^2 – variance error, R – repeatability, s.e. - standard error.

Conclusions. The doe 14 BWT is the only trait highly repeatable among the traits studied. This implies that multiple measurement or records will be needed to improve the other traits which are lowly repeatable.

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Received: 27 October 2014. Accepted: 05 December 2014. Published online: 13 December 2014.
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How to cite this article:
Sorhue G. U., 2014 Repeatability estimates of pre-weaning and weaning litter body weight traits in domestic rabbits at birth, 7, 14, 21 and 42 day of age in a tropical environment. Rabbit Gen 4(1):52-55.