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Original article

Genetic analysis of some economic traits in a composite breed of domestic rabbits reared in a tropical environment

U.G. Sorhue [a], F.U.C. Mmereole [b], E.P. Irikefe-Ekeke [c], S.U. Nwakwo [d,*]

[a] *Department of Agricultural Education, Delta State College of Physical Education, Mosogar, Delta State, Nigeria*
[b] *Department of Animal Science, Delta State University, Asaba Campus, Asaba, Delta State, Nigeria*
[c] *Department of Agricultural Education, Delta State College of Education, Warri, Delta State, Nigeria*
[d] *Department of Agricultural Education, Nwafor Orizu College of Education, Nsugbe, Anambra State, Nigeria*

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Abstract

Records of 224 kits produced by fifteen dams and five sires were used to estimate covariance and correlations of litter traits in composite breed rabbit using paternal and maternal half-sib method. The traits studied were total litter size at birth (TB), litter size born alive (BA), litter birth weight (LBWT), 7-day body weight (7BWT), 21 day body weight (21BWT) and weaning weight (42BWT). The analysis of variance was done in a nested design with equal number of subclass. The estimates of covariance were generally low 0.002 and 0.004,0.004 and 0.009,0.001 and 0.001 for LBWT and BA, TB and 7BWT, LBWT and 42BWT while positive and significant genetic correlations *(rG)* ($P > 0.05$) was obtained for LBWT and BA (0.94 and 0.67), BA and 42BWT (0.89 and 0.61), LBWTB and 21BWT (0.88 and 0.63) from sire and dam components respectively. Phenotypic *(rP)* and environmental *(rE)* correlations between the traits studied were mostly non-significant ($P < 0.05$). This report shows that there exists positive genetic correlation/relationship between litter size at birth and litter weight at weaning.

Keywords: Genetic; Correlation; Rabbit; Litter size; Litter weight

1. Introduction

The rabbit *Oryctolagus cunniculus* has been identified as one of the animals that can bridge the gap in dietary protein intake in developing countries. This has called for so many genetic and feeding experiments in developing and developed countries to improve the quality of stocks available in the developing countries [5–7, 9, 10, 13–16] are among the numerous researchers to have undertaken experiments on genetic parameters in domestic rabbit. Genetic parameters such as correlations is a requirement for genetic improvement for important economic characters in domestic animals, hence estimates of these genetic parameters are never too much since it is a tool for selection and livestock improvement. Genetic parameter is also a function of the environment, breed, season as well as the size of the breeding population [1, 2] postulated a standard expression which has been the method for estimating genetic parameters in most reports in Nigeria. This study was therefore designed to estimate the genetic, phenotypic and environmental correlations between some litter size and litter weight traits.

2. Materials and methods

The study was conducted at the rabbitry unit of the Department of Animal Science, Delta State University, Asaba Campus. Asaba is located at latitude 06° 14′N and longitude 06° 49′E. It lies in the tropical rainforest zone, characterized by seven months of rainy season between April and October punctuated by a short break in August with annual rainfall of 1500 mm–1849 mm [8]. Fifteen adult dams and five adult sires purchased from J.J Scot farms Sapele in Sapele Local

* Corresponding author. Tel.: +234 7036311884.
E-mail address: gtsorhue@yahoo.com (U.G. Sorhue).
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Government area of Delta State and a commercial rabbit breeder from Agbor in Ika South Local Government Area of Delta State, Nigeria were used for the study. The experimental stocks were composite breeds of domestic rabbits. The parental stock produced 224 kits which were weaned at 42 days of age. The design was a balanced design with equal numbers of sub-class, it was a three way nested classification, dams were nested between sires and litters were weaned at 6 weeks (42 days). Feed and water were provided *ad libitum* throughout the period of the experiment. The rabbits were raised in wooden cages with wire mesh. The feed used was commercial pellets with forages and grasses supplied to meet the nutrient required by the experimental animals Table 1.

The litter traits were measured from birth to weaning at 42 days of age. Data collected include: Total litter size at birth (TB), Born alive (BA),litter birth weight (LBWT),litter weight at 7, and 21 day and litter weight at weaning (42BWT). Litter weight was collected with the aid of a 20 kg sensitive scale (weighing pan) and the weight of the litter taken while litter size was collected counting the number of kits. All data collected were subjected to analysis of variance and covariance. Variance components were obtained using [12]; covariance components and correlations were estimated using standard expressions given by Ref. [1].

2.1. Statistical model

The statistical model used for the analysis of variance and covariance was

$$Yijk = \mu + Si + Dij + eijk$$

Where:

Yijk = Record of the k-th progeny of the Jth dam mated to the I-th Sire.
μ = the overall population mean
Si = the random effect of the i-th sire
Dij = the random effect of the jth dam mated to the i-th sire.
Eijk = the error term.

Covariance and correlations were estimated according to [1].

3. Results and discussion

Table 2 shows the Means and standard errors for litter size and body weight traits as well as the variance due to sire, dam and progeny. The mean values ranged from 0.05 ± 0.04 for litter birth weight (LBWT) to 0.59 ± 0.02 for 42 day body weight (42BWT). The Variance components were mostly higher from dam components than the reports from sire components.

Table 2
Number of observations, means and variance components for litter size and body weight traits.

Traits	σ^2_s	σ^2_d	σ^2_e	No of observation	Means ± se
TB	0.0086	0.0925	0.3111	224	4.98 ± 0.04
BA	0.0012	0.0407	0.2555	195	4.33 ± 0.02
LBWT	0.0020	0.0008	0.0068	195	0.05 ± 0.04
7BWT	0.0027	0.0089	0.0271	181	0.19 ± 0.12
21BWT	0.0003	0.0007	0.0032	179	0.28 ± 0.13
42BWT	0.0022	0.0020	0.0067	174	0.59 ± 0.02

TB-Total born, BA-Born alive, LBWT-litter-birth-weight, 7BWT-7 day body weight, 21BWT-21 day body weight, 42BWT-42 day body weight, σ^2s-Sire component of variance, σ^2d-Dam component of variance, σ^2e-variance due to progeny(litter size was collected by counting the number of kits while litter weight was measured in kg).

Table 3 above shows the estimates of covariance between litter size and body weight traits. All the covariance estimates were low but were generally positive.

Table 4 above shows the estimate of genetic correlations *(rG)* between litter size and body weight traits. Estimates of genetic correlations *(rG)* were generally positive and mostly significant ($p < 0.01$, <0.05). The values ranged from 0.29 for TB and BA to 0.94 for LBWT and BA when estimated from sire components while values ranging from 0.30 for TB and BA to 0.67 for LBWT and BA respectively.

Table 5 above shows the environmental correlations between litter size and body weight traits. Estimate of environmental correlations varied from negative to positive. Environmental correlations were mostly non-significant ($p > 0.05$).

Table 6 above shows the estimates of phenotypic correlation between litter size and body weight traits in domestic rabbits. The estimate of phenotypic correlation were positive but mostly non-significant ($p > 0.05$) for all the traits studied from sire component of covariance.

Strong positive genetic correlation of 0.59 was also reported by Ref. [3] for litter weight at birth and weaning weight in grass cutter. Genetic correlations observed between TB (total Born) and other litter traits were positive which compares favorably with the estimates of genetic correlations reported by Ref. [7] with value of 0.80 for total born and other

Table 1
Proximate composition of experimental diets.

	Pelletized commercial growers mash (%)	Guinea grass (%)	*Tridax procubens* stem (%)	*Tridax procubens* leaf (%)
Moisture	–	66.20	84.30	87.55
Crude protein	15.4	12.30	36.04	35.16
Ash	9.4	14.50	5.17	2.49
Ether extract	4.5	3.15	1.05	5.02
CHO	62.0	52.20	42.40	52.12
Crude fiber	8.7	18.04	16.91	5.88