

REPEATABILITY AND HERITABILITY ESTIMATES OF FIVE RABBIT GENOTYPES AT VARIOUS AGES

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ABSTRACT

This breeding experiment was carried out at the Rabbit Unit, Teaching and Research Farm, Federal University of Technology, Akure (FUTA) between 2009 and 2010. Data on litter traits such as individual kit weight (IKW), average litter weight (ALW), litter weight (LTW), litter size (LTZ) of the animals were collected. Data on the litter traits were taken at birth, 21, 35 and 56 days of age from 13 progenies and 5 parental genotypes. Heritability estimates due to dam ranged from very low value of 0.00014 (IKTW) at 21 days to a very high value of 0.774 (LTW) at 35 days. Repeatability followed similar trend but ranged from extremely low value of 0.00004 (IKW) at 21 days to medium value of 0.194 (LTW) at 35 days. The study show that selection could be better made for the traits at 35 days of age as that would bring improvement for the traits in question. The results also indicated the superiority of the dam over the sire in selection for improvement of the traits.

Keywords: dam, sire, litter, estimates

INTRODUCTION

The proportion of total observed variation of a trait within a herd that is due to genetics is called heritability (h^2). It is the fraction of the observed phenotypic variance resulting from differences in heredity (Chineke, 2003) and is the singular parameter needed to make effective use of a genetic variation (Ndjon and Nwakalor, 1998). Repeatability shows how individual animal repeats record for a particular trait. It is the frequency of occurrence of a particular trait in the breeding sequence. In addition, being the upper limit of heritability, repeatability indicates the extent to which selection will influence future animal performance (Ibe, 1995 and Chineke *et al.*, 2001). In researches done on rabbit, moderate to high estimates were obtained for body weight at 6 and 9 weeks, for body length at 6, 9 and 12 weeks and head to shoulder length at 9 weeks (Chineke and Adeyemi, 2001; Akanno and Ibe, 2005; Akpa and Alphonsus, 2008). This indicated the potentials for genetic improvement of rabbits through individual selection. Negative variance components are regarded as an indication of negligible contribution of additive genes to variation of the traits concerned. Akpa and Alphonsus (2008) reported moderate to high repeatability estimates of litter size and gestation length. The observed correlation relationship among the traits in the study also suggested that the rabbit could be selected for increased litter size and short gestation length using the first or second records. Repeatability is useful for comparing the producing abilities of animals, which have different number of records, and for culling

purpose (Chineke, 2003). Therefore, the objective of this study is to evaluate the performance characteristics of rabbit genotypes at various ages and to determine the heritability and repeatability estimates of their body weight and litter traits.

MATERIALS AND METHODS

This study was carried out in the Rabbitry Unit of Teaching and Research Farm, Federal University of Technology, Akure (FUTA), Ondo State, Nigeria. Five parent rabbit genotypes were used for the breeding experiment. The animals obtained as weaner rabbits from reputable farm were fed on growers' mash of 18% crude protein and 2300Kcal/Kg metabolisable energy. This was supplemented with forages like *Aspilia Africana*, *Tridax procubens*, *Ipomea batatas* and elephant grass. The experiment was carried out in a completely randomized design by assigning the doe randomly to the buck for mating. The rabbits, 20 bucks and 40 does comprising Chinchilla (CHA), New Zealand White (NZW), New Zealand Red (NZR), Florida White (FLW) and Locally adapted breed (LAB) were mated. The does were checked for conception early in the morning after 10 days of mating by abdominal palpation. The does' gestation length fell within the range of 29-33 days. Records as litter size, litter weight, individual kit weight and average litter weight were taken at birth within 24 hours of kindling. The kits were maintained on does' milk from birth till weaning age of 35 days. The does produced 152 offspring which were distributed into 13 genotypes. The genotypes were Chinchilla x Chinchilla

(CHACHA) = 11, Chinchilla x Florida White (CHAFLW) = 10, Chinchilla x Locally Adapted Breed (CHALAB) = 7, Chinchilla x New Zealand White (CHANZW) = 15, Florida White x Florida White (FLWFLW) = 11 and New Zealand Red x Chinchilla (NZRCHA) = 20. The remaining were New Zealand Red x Florida White (NZRFLW) = 4, New Zealand Red x Locally Adapted Breed (NZRLAB) = 8, New Zealand Red x New Zealand Red (NZRNZR) = 11, New Zealand Red x New Zealand White (NZRNZW) = 12, New Zealand White x Florida White (NZWFLW) = 12, New Zealand White x Locally Adapted Breed (NZWLAB) = 21, New Zealand White x New Zealand White (NZWNZW) = 10. Data were collected from the 152 young rabbits comprising of 72 females and 80 males. Data collected were on the litter traits, linear body measurements and the blood indices. Litter traits studied include gestation length (GSL), individual kit weight (IKW), litter weight (LTW), average litter weight (ALW) and litter size (LTZ). The effects of genotype, parity and sex on the linear body measurements and litter traits were estimated from least-squares procedures of unequal subclass numbers. The data were analyzed using the mixed model least-squares and maximum likelihood computer software (SAS 2009 and SPSS Vs 16) to estimate the observable variance components due to sire (σ_s^2), dam (σ_d^2) and error (σ_e^2) by equating computed mean squares to their expectations and solving for the components. Heritability (h^2) and Repeatability (r) estimates were obtained as:

$$h^2 = \frac{4\sigma_d^2}{\sigma_s^2 + \sigma_d^2 + \sigma_e^2}$$

$$r = \frac{\sigma_d^2}{\sigma_s^2 + \sigma_d^2 + \sigma_e^2}$$

RESULTS AND DISCUSSION

Heritability and repeatability estimates of litter traits at birth, 21, 35 and 56 days are presented in Tables 1 to 4. Heritability estimates at birth due to dam line had a very low range from 0.0016 (GSL) to a value of 0.012 (IKW). Estimates due to sire line tend towards negative and could not be documented for all the ages. Repeatability estimates followed range as it had low values as well (Table 1). A very low range value of 0.00014 for IKW to 0.0062 for ALW was recorded based on the dam line for heritability estimates at 21 days. Range of values recorded

for repeatability were 0.0004 (IKW) to 0.0016 (ALW) (Table 2). A low value range of 0.0073 was recorded for IKW to a high value of 0.774 for LTW based on the dam line, 0.345 was recorded for ALW and a high value of 0.63 was recorded for IKW. The repeatability estimates at 35 days ranged from low value of 0.002 (IKW) to a moderate value of 0.194 (LTW) based on the dam line. The estimate of heritability for litter traits at 56 days ranged from a very low value of 0.0016 for LTW to a low value of 0.105 for IKW based on the dam line (Table 4). The repeatability estimate revealed a low value range of 0.001 for LTZ to 0.026 for IKW based on the dam line. At 21 days, the heritability estimates of 0.00014, 0.0062, 0.0025 and 0.0054 were recorded for IKW, ALW, LTW and LTZ. At 56 days post-weaning the estimates were 0.105, 0.006, 0.0016 and 0.004 for IKW, ALW, LTW and LTZ. These values were extremely low and seemed to agree with the results of Lukefahr and Hamilton (1997), Sorensen *et al.* (2001) and Iraqi *et al.* (2006). These authors recorded very low estimates of 0.04 litter size and litter weight at birth and weaning. Our observations were contrary with the results of Chineke and Adeyemi (2001), Alkano and Ibe (2005), and Iraqi *et al.* (2008). Repeatability at same age followed similar trends as heritability. These could be due to low population size and environmental differences. At 35 days, heritability estimates due to dam were ranged from 0.0073 (IKW) to 0.774 (LTW). The present results did not compare with the high linear heritability ranges given by Chineke and Adeyemi (2001) and Chineke (2003) but agreed with the report of Ndjon and Nwakalor (1998), Adeoye *et al.* (2003) and Akanno and Ibe (2005). Repeatability at 35 days followed the same trend as heritability because LTW had the best value of 0.194 while IKW had the least value. Heritability estimates due to sire could not be recorded for all the parameters at all the ages because of negative sire variance components in the analysis of variance.

Conclusion

The present result suggested that selection could be better made for all the traits at 35 days of age as that would bring improvement for the traits in question. The results also indicated the superiority of the dam over the sire in selection for improvement of the desired traits.

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Table 1: Heritability and repeatability estimates of litter traits at birth

Parameters	Heritability (Dam)	Repeatability (Dam)
IKW	0.012	0.003
ALW	0.0041	0.00103
LTW	0.0039	0.001
LTZ	0.00423	0.0011
GSL	0.0016	0.0004

IKW=Individual kit weight; ALW=Average litter weight; LTW=Litter weight; LTZ=Litter size; GSL=Gestation length.

Table 2: Heritability and repeatability estimates of litter traits at 21 days

Parameters	Heritability (Dam)	Repeatability (Dam)
IKW	0.00014	0.00004
ALW	0.0062	0.0016
LTW	0.0025	0.00063
LTZ	0.0054	0.0014

IKW=Individual kit weight; ALW=Average litter weight; LTW=Litter weight; LTZ=Litter size.

Table 3: Heritability and repeatability estimates of litter traits at 35 days

Parameters	Heritability (Dam)	Repeatability (Dam)
IKW	0.0073	0.002
ALW	0.024	0.006
LTW	0.774	0.194
LTZ	0.037	0.0093

IKW = Individual kit weight, ALW = Average litter weight, LTW = Litter weight, LTZ = Litter size.

Table 4: Heritability and repeatability estimates of litter traits at 56 day

Parameters	Heritability (Dam)	Repeatability (Dam)
IKW	0.105	0.026
ALW	0.006	0.0015
LTW	0.0016	0.004
LTZ	0.004	0.001

IKW = Individual kit weight, ALW = Average litter weight, LTW = Litter weight, LTZ = Litter size.