rabbit genetics

Heritability estimates of body weight traits at various ages in a crossbred rabbit population using Restricted Maximum Likelihood

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Abstract. Data on 96 progeny obtained from a random bred population of American Chinchilla, New Zealand White and Dutch breeds of rabbits were used to estimate heritability for body weight traits at day 14 through to week 14. The variance of components of heritability was estimated employing AIREMLF90 of BLUPF90 programme based on restricted maximum likelihood software and R-Software was used to calculate standard error of heritability. Heritability estimates for body weight were high and of similar range with values of 0.59±0.25, 0.73±0.21, 0.67±0.17, 0.53±0.29, 0.55±0.26, 0.64±0.20, 0.60±0.24 for 2, 4, 6, 8, 10, 12 and 14 weeks respectively. Heritability estimates for body weight recorded in this study imply that additive genetic effect was of importance at different stages of growth. Therefore, genetic improvement can be done through pedigree or individual selection. The results also indicate that rabbit breeders can predict breeding value from the heritability values estimated.

Key words: genetic parameters, litter traits, *Oryctolagus cunniculus*, variance components.

Introduction. Rabbit production in recent times has gained renewed attention as an alternative to poultry production because of its white meat. Litter size, growth of individual rabbit, survival rate is among the important economic traits in rabbits (Lukefahr et al 1992; Akanno & Ibe 2005). Rabbits grow rapidly and their growth rate is similar to that of broiler fowls (Rao et al 1997). Rabbits are recognized for their fecundity and prolificacy and ability to utilize forage (Cheeke 1986). Moreover, rabbit producers and breeders are interested in breeding potentials of body weight traits, because this information would tell something about rabbit feed efficiency and production performance (Okoro et al 2010).

One of the pre-requisite for genetic improvements is the knowledge of genetic parameters for important economic traits (Akanno & Ibe 2005). Genetic parameters have been used to characterize breeds, evaluate breed performance and to predict hereditary in animals. The growth of individual rabbits varies and depend on many factors such major genes, extra nuclear genes, mothering ability of doe, and environmental effect on litter traits (Ferraz & Eler 2000). Estimation of genetic parameters for productive and reproductive traits is very vital to selection, since it could lead to maximum genetic improvement when suitable breeding program are used (Elamin et al 2012). Odubote & Somade (1992) proved that rabbits breeding programmes in Nigeria are conducted for specific selection programmes, while Sorhue (2014) posited that estimates of genetic parameters are functions of the variances in that population. However, heritability estimates are useful for predicting responses and progress from selection and reports of genetic parameters have been reported by numerous researchers including, but not limited to Ahmed et al (2004), Oni et al (2007), Archambault et al (2009), Maniee et al (2009), Sorhue et al (2013), Sorhue (2014), and Sorhue et al (2014). More so, as environmental conditions change with emerging climate change, there is need for more recent report on genetics parameter estimates on quantitative traits since they are influenced by variations in environment. This study was therefore designed to estimate heritability in this rabbit population.

Material and Method

Experimental site. This experiment was carried out at the Rabbitry Unit of the Teaching and Research farm of Delta State University, Asaba, Nigeria. The experiment lasted for 7 months (March-September 2021).

Experimental animals and management. A total of 24 dams were mated to 8 sires in a ratio of 1:3 in a nested experimental design and offspring produced were identified along the Sire line. A total of 96 kits produced were used for the study. The rabbits were fed with pelletized concentrate feed containing crude protein 15%, fat 7%, crude fibre 10%, calcium 1.0%, phosphorus 0.35% and energy 2550 kcal kg^{-1} and alongside with *Tridax procumbens*. Prior to commencement of the experiment, the animals were given recommended doses of glucose, oxytetracycline (long acting 20%) and sulphaquinoxaline as anti-stress, antibiotics, and coccidiostat respectively. Each rabbit was kept in individual hutches made of wood with wire netting (dimensions of hutch will be 40 cm x 40 cm x 50 cm) and equipped with feeders and drinkers.

Experimental design and data collection. A total of 8 sires were mated to 24 dams in a mating ratio of 1 sire: 3 dams. Offspring from does were recorded according to the sire they were mated to; the animals were monitored and body weight data were collected every two weeks from 14^{th} day to 14^{th} week with the aid of a weighing scale.

Data analysis. Heritability was estimated using restricted maximum likelihood program (REML) of R-Statistical package.

Results and Discussion. Heritability estimates of body weight traits obtained from domestic rabbits at different ages are shown in Table 1.

Table 1

Variance components and heritability of bodyweight of rabbit at different weeks

Traits	σ^2_a	σ^2_r	σ^2_p	$h^2 \pm SE$
BWT (2 weeks)	260.49	183.71	444.20	0.59±0.25
BWT (4 weeks)	1136.70	414.23	1550.93	0.73±0.21
BWT (6 weeks)	1842.50	914.34	2756.84	0.67±0.17
BWT (8 weeks)	1736.80	1564.70	3301.50	0.53±0.29
BWT (10 weeks)	3026.30	2490.00	5516.30	0.55±0.26
BWT (12 weeks)	4656.40	2609.50	7265.90	0.64±0.20
BWT (14 weeks)	5324.60	3573.40	8898.00	0.60±0.24

σ^2_a = additive genetic variance; σ^2_r = residual variance; σ^2_p = phenotypic variance; h^2±SE = heritability and standard error; BWT = body weight.

Estimates were high and of similar range (0.53, 0.55, 0.59), (0.60, 0.64, 0.67 and 0.73). h^2 of BWT at 4 weeks was highest (0.73±0.21). These heritability values obtained for body weight at various ages are similar to 0.42 obtained for body weight at 90 days (Lukefahr et al 1992). The estimates obtained in this study for body weight are also similar to those obtained for rabbit breeds in temperate environment according to earlier reports (Szendro et al 1988; Lukefahr et al 1996) but are of higher values. These results show strong contribution of addictive genes in the expression of characters, and suggest possible improvement of body weight in rabbits by either pedigree or individual selection method (Akanno & Ibe 2005). High heritability estimates obtained for the population studied might indicate that improvement of body weight could be achieved through selection (El-Deighadi & Ibrahim 2017).

Result obtained at 4 weeks was of highest value, therefore, phenotypic selection at that age would be effective for high body weight response in these rabbits strains (Gharib et al 2020). Higher estimate were obtained by Youssef (2004) involving New Zealand White and Red Baladi rabbits. Although, reports from Sorhue et al (2013) for litter size traits indicated higher values of heritability, the heritability estimates for body weight in this finding tend to be higher than findings from other authors, which imply that additive effect were of importance at different stages of growth.

Conclusions. Though heritability estimates outcomes of the variances in that population, the results of this study shows that rabbit breeders can predict breeding value from the heritability values estimated in this population due to the high heritability reported for the traits studied.

Conflict of interest. The authors declare that there is no conflict of interest.

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Received: 11 October 2022. Accepted: 11 November 2022. Published online: 30 December 2022.
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How to cite this article:
Akporhuarho P. O., Sorhue U. G., Akpudi M. E., Onotasamideri T. A., 2022 Heritability estimates of body weight traits at various ages in a crossbred rabbit population using Restricted Maximum Likelihood. Rabbit Gen 12(1):14-17.