EFFECTS OF LITTER SIZE ON GROWTH TRAITS AND THEIR REPEATABILITY ESTIMATES IN CROSSBRED RABBITS

Ugwoke, S.C. [1,2*], Okoronkwo, D.J.[3] , Dahunsi, P.O. [2,4], Nnadozie C.O.[2], Mundi, I.[1], & Egahi, J.O.[1]

[1] Department of Animal Breeding and Physiology, Joseph Sarwuan Tarka University, Makurdi, Benue State, Nigeria

[2] Department of Animal Science, University of Nigeria, Nsukka, Enugu State, Nigeria

[3] Department of Agriculture and Environmental Sciences, Hungarian University of Agriculture and life sciences, Hungary

[4] International Livestock Research Institute, (ILRI), P.M.B. 5320, Ibadan 200001, Nigeria

***Corresponding author: simon.ugwoke.198749@unn.edu.ng| +2348105604303**

ABSTRACT

This study examined the effects of litter size on growth traits and repeatability estimates in the crossbred rabbits. A total of thirty six (36) parent stock rabbits consisting of six (6) pure breed bucks (2 each of Chinchilla, Dutch and New Zealand White) and thirty mixed local population of does were used as base population. A mating ratio of 1:5 buck to does was used. Data were collected on litter size, birth weight and body weights at 4, 8, 12, 16 and 20 weeks. Data on 100 progenies were subjected to analysis of variance and means were separated using Duncan Multiple Range Test (DMRT). Results obtained showed that litter size significantly affected (P<0/05) birth weight and body weights. Repeatability estimates for birth weights was lowest for CH x LC crossbreds (0.25) and highest for NZ x LC crossbreds (0.32). Also, repeatability for body weights at various ages from 4-20 weeks were highest in NZ x LC ranging from 1.45-.1.91. In conclusion, based on the present study, we can recommend the use of New Zealand White bucks in crosses with local does as a plausible way of upgrading their genetic make-up.

Keywords*: Litter size, crossbreds, repeatability, rabbits, growth traits*

INTRODUCTION

In recent times, researchers have shifted attention to development of micro livestock such as the rabbit. This interest is based on the numerous advantages associated with rabbit farming including high prolificacy, early sexual maturity, short gestation length, fast growth rate, high feed conversion efficiency, economic utilization of space and high genetic selection potential (Okoro *et al.*, 2012, Ebeid *et al.*, 2012). Consequently, the genetic improvement of rabbit is important in order to increase their contribution to the much needed animal protein in Nigeria.

Rabbit litter size and birth weight are traits of economic importance which should be given prominence in rabbit breeding programmes or enterprise (Egena et al., 2012). Heritability (h) estimates indicates the proportion of total phenotypic variation that is attributable to hereditary or a measure of the progress that can be made from generation to generation in a given trait (Cambel *et al.*, 2003). The current study was undertaken to evaluate the effect of litter size on growth performance of crosses between local females and three exotic buck breeds

MATERIALS AND METHODS

Thirty-six (36) parent stock rabbits with an average weight of 4.5kg consisting of six (6) pure breed {2 Chinchilla (CH), 2 Dutch (DU), and 2 New Zealand White (NZ)} bucks and thirty (30) mixed local population does were procured from the National Veterinary Research Institute (NVRI) Vom, Jos, Plateau State, Nigeria were used. The does and bucks were separately housed in thoroughly cleaned and disinfected hutches. The rabbits were allowed two (2) weeks of acclimatization on the experimental site before the commencement of mating. The does were randomly assigned to bucks using a 1:5 buck to doe mating ratio respectively. Matings were carried out in the early hours of the morning. Each doe was moved to the assigned buck to trigger successful mating. Matings were done once in a day with one (1) doe on a three (3) day interval. Pregnancy was detected through abdominal palpation 10 days succeeding mating. Mating was repeated in cases of failed initial mating. Nesting boxes were made available on the 21st day of gestation. Commercially pelleted available rabbit ration containing 16.23% crude protein, 10.27% crude fiber and 2280 Kcal/kg energy was fed to the rabbits in the morning, and fresh forages (*centrocema pubenscens* and cedar *acuta*) were served in the

evening. Both ration and water were served *ad libitum*. Pregnant does were allowed to kindle with no human interference and the kindled Kitts were nursed by their respective dams. Data of litter size at birth, litter weight at birth, and progressive post-weaning litter weekly weights for up to twenty weeks after kindling were recorded. Generated data were subjected to analysis of variance procedure for a Completely Randomized Design and significant means were separated using Duncan Multiple Range Test (DMRT). The animal model fitted for the experiment was $Y_{ijk} = \mu + S_i + E_{ijk}$ where Y_{ijk} = Individual observation; μ= common mean; S_i= Effect of the i^{th} sire breed while E_{ijk}= experimental error. Repeatability (R) was estimated using the expression given by Kabir et al., (2010).
$R^2 = \delta^2B/\delta^2B + \delta^2E$ where δ^2B is the variance component due to sire and δ^2E is the variance component due to error.

RESULTS AND DISCUSSION

The effects of litter size on birth weight and weekly body weights are presented in Table 1. The result reveals that litter size varied from 1-6 kits per dam. Litter size had significant ($P<0.05$) effect on birth weight. Kits that are from single litter size had significant higher birth weight than their counterparts from 2 to 6 litter sizes. This is in line with the findings of Poornim *et al.*, 2002,Castellini et al., 2003 and Prakash and Gupta (2008) as they reported that post birth weight of rabbits is greatly influenced by litter size at birth due to the fact that the relative share of milk per kit decrease as the litter size increases. Kits from single litter size had superior body weights at 4,8,12, 16 and 20 weeks and were significantly different ($P<0.05$) from multiple kits from same litter. Repeatability estimates for birth and body weights at various ages for the three breeds (DU, NZ and CH) x LC are presented in table 2 and 3 respectively. Repeatability for birth weight ranged from low in DU x LC and CH x LC crosses to moderate in NZ x LC crosses. These traits show less correlation between the repeated measures of the same individuals and hence, selection decisions on such traits should be based on multiple litter measurements. The low repeatability estimates may be due to number of animals as Ojo *et al.*, (2018) suggested that estimates of these genetic parameters rest heavily on the sample size used for the estimation. Repeatability for body weights at various ages from 4-20 weeks were high in NZ x LC ranging from 1.45-1.91. Moderate to high repeatability was also reported by Adeolu and Ogunnupebi (2019), Chineke and Raheem (2009) and Ndjon and Nwakalor (1998). It implies that fewer records are required before selecting a doe for these traits in this cross.

Table 2: Repeatability estimates for body weights from sire variance components obtained at various ages in the genetic groups.

Weeks	**Breeds**	R^2
	DU x LC	0.22
	NZ x LC	1.89
	CH x LC	0.17
8	DU x LC	0.12
	NZ x LC	1.91
	CH x LC	0.22
12	DU x LC	0.58
	NZ x LC	1.52
	CH x LC	0.51
16	DU x LC	0.02
	NZ x LC	1.31
	CH x LC	0.40
20	DU x LC	0.46
	NZ x LC	1.45
	CH x LC	0.39

CH- Chinchilla, DU- Dutch, NZ- New Zealand White, LC- Locals, R^2- Repeatability.

Table1: Effects of litter size on birth weight and weekly body weights (g)

WEEK	LS1	LS2	LS3	LS4	LS5	LS6	LOS
BW	67.00±0.00^{a}	45.88±4.06^{bc}	50.50±2.91^{b}	42.08±1.22^{cd}	36.00±0.91^{d}	36.43±0.84^{d}	*
4	576.00±0.00^{a}	315.75±15.41^{c}	379.20±50.36^{b}	271.21±7.49^{c}	188.67±4.73^{d}	179.90±5.59^{d}	*
8	1118.00±0.00^{a}	668.63±51.15^{c}	820.90±558.89^{b}	558.89±14.11^{cd}	458.40±20.91^{c}	465.73±15.62^{c}	*
12	1577.00±0.00^{a}	1053.50±70.87^{b}	1125.60±77.54^{b}	834.75±19.87^{c}	732.83±34.96^{c}	764.18±30.82^{c}	*
16	1859.00±0.00^{a}	1302.43±84.26^{b}	1322.00±138.47^{b}	1165.68±32.23^{bc}	1012.00±38.17^{c}	1013.50±37.95^{c}	*
20	2056.00±0.00^{a}	1581.29±101.50^{b}	1631.75±136.21^{b}	1511.72±36.56^{b}	1352.80±64.93^{b}	1366.05±48.09^{b}	*

^{abcd} Mean values in a row not sharing the same superscript, are significantly different ($p<0.05$)BW- Birth Weight, LS1- Litter size 1, LS2- Litter size 2, LS3- Litter size 3, LS4- Litter size 4, LS5- litter size 5, LS6- Litter size 6.

Table 3: Repeatability estimates for birth weight (g) in the genetic groups

Breed	R^2
DU x LC	0.28
NZ x LC	0.32
CH x LC	0.25

CH- Chinchilla, DU- Dutch, NZ- New Zealand White, LC- Locals, R^2- Repeatability

CONCLUSION AND RECOMMENDATION

From the results, it is inferred that litter size is one of the biggest factor affecting growth of rabbit kits. Extra care should be provided to kits from high litter size to augment the reduced care received from the doe. Also, crossbreeding of New Zealand White sires with local females is recommended for enhanced growth rate due to the high repeatability estimates in birth weight and body weight as observed in this study.

REFERENCES

Adeolu, A.I and Ogunnupebi, J.T. (2019). Estimation of heritability and repeatability for pre-weaning body weights of domestic rabbits raised in the humid tropics *Nigerian Journal of Animal Production* 46(5):23-27

Cambell, J.R., Kenealy, D.M., Cambel, K.L. (2003). Animal Science: The biology, care and production of domestic animals. McGraw- Hill Higher Inc. NY. ISBN

Castellini, C., Dal Bosco, A. and Mugnai, C. (2003). Comparison of different reproduction protocol for rabbit does: effect of rabbit production in tropical and sub-tropical agricultural system *Journal of Animal Science* 63:1586

Chineke, C. A. and Raheem, M. A. (2009). Heritability estimates of rabbits litter and linear body traits at pre and post weaning in the humid th tropics. Proceeding of the 34 Annual Conference of Nigeria Society of Animal Production, Uyo, Nigeria

Ebeid TA, Zeweil HS, Basyony MM, Dosoky WM, and Badry H (2013). Fortification of rabbit diets with vitamin E or selenium affects growth performance, lipid peroxidation, oxidative status and immune response in growing rabbits. Livestock Science, 155: 323-331. DOI: https://www.doi.org/10.1016/j.livsci.2013.11.004.

Egena, S.S.A., Akpa, G.N., Alemede, I.C. and Aremu, A. (2012). Genetic and Non-Genetic factors affecting litter size and birth weight of Rabbit in Minna, Niger State, Nigeria. *Animal production* 14(3)160-166.

Kabir M, Akpa, G.N and Yakubu. H. (2010). Repeatability estimates for body weight and body linear measurements in broiler chickens. *Nigerian Journal of. Animal Science.* 12:7-14.

Ndjon, M. N. and Nwakalor, L. N. (1998). Estimates of genetic parameters in a mixed population of pure and crossbreed rabbits. Proceeding Silver Anniversary Conference of the Nigeria Society of Animal Production, Abeokuta, Nigeria, pp. 500-501

Okoro, V.M.O., Ogundu, U.E., Okoli., I.C., Anyanwu, G.A., CHikaire, J., Raji, A.O. and Maduka, C. G. (2012). Estimation of Heritability and Repeatability for Pre-Weaning and Post Weaning Litter Weights of Unselected Domestic Rabbits in South Eastern Nigeria International *Journal of Agriculture and Forestry* 2012, 2(1): 7-10

Ojo, O. A., Fayeye, T. R. and Ogunbiyi, R. (2018). Heritability And Repeatability Estimates Of Doe And Litter Traits In Nigeria; Domestic Rabbit *Wayamba Journal of Animal Science 2012-578X; P1636- P1640, 2018*

Poornim, K., Gupta, B.R., Rao, G.N. and Satyanarayana, A. (2002). Genetic study on re-weaning body weight and growth rates in Californian White rabbits. *Indian journal of Animal Science* 36:39-42

Prakash, G.M and Gupta, R.B. (2008). Pre-weaning performance of broiler rabbits. *Indian journal of Animal research* 42:276-278