

BODY WEIGHT AND REPRODUCTIVE PERFORMANCE OF FOUR GENOTYPES OF RABBITS RAISED IN HUMID TROPICS

*Sam, I. M., Essien, C. A., & Edet, B. M.

Department of Animal Science, Faculty of Agriculture, Akwa Ibom State University, Akwa Ibom State.

**Corresponding author. Email: sidorenyin@yahoo.com*

ABSTRACT

A study was conducted to evaluate the influence of genotype on reproductive performance of two breeds of rabbit and their reciprocal crosses as well as body weight performance of their first filial generation. A total of 126 kittens were generated from cross of Newzealand white (NZWXNZW), Chinchilla (CHXCH) and their reciprocal crosses Newzealand male and Chinchilla female (NZWXCH) and Chinchilla male and Newzealand female (CHXNZW). The parameter measured were Gestation length (GL), Litter size at birth (LSB), Litter size at weaning (LSW), Birth weight (ABWT), Body weight at weaning (AWWT) and weekly body weight. The data obtained were subjected to analysis of variance and significance means were separated using Duncan multiple range test. The results indicated that genotype significantly ($p < 0.05$) influenced weekly body weight during the preweaning stages. The NZWXCH had significantly higher body weight than the other three genotypes. It was also observed that NZWXCH had significantly ($p < 0.05$) better LSW (4.95 ± 0.03), ABWT (37.00 ± 0.03), GL (28.33 ± 0.67), AWWT (594.55 ± 12.18), and percentage mortality (5.71 ± 8.69) than other genotypes. It was concluded that NZW X CH be used for breeding purposes to increase rabbit production, as this genotype indicated better suitability in the tropics, thus increasing and improving protein intake in the study area.

Key words: Rabbit, Body weight, Reproductive, Performance, Genotype

INTRODUCTION

The population growth in developing countries like Nigeria is rapidly increasing, thus the need for alternative source of protein to meet up the protein requirement of the population. Rabbit production is a veritable way of alleviating animal protein deficiency in Nigeria (Ajala and Balogun, 2004), because rabbit has immense potentials and good attributes which include high growth rate, high efficiency in converting forage to meat, short gestation period, and high prolificacy, relatively low cost of production, high nutritional quality of rabbit meat which includes low fat, sodium and cholesterol levels. It also has a high protein level of about 20.8% and its consumption is bereft of cultural and religious biases (Biobaku and Oguntona, 1997).

The production of rabbit meat is based on pure breed selected for meat traits and on their crosses (Maj *et al.*, 2009). As production of livestock directly depends on reproduction, reproductive performance of rabbits becomes an important aspect in determining profitability and economic success of commercial rabbits breeding. Litter size (the number of kits born) is the most important economic character in rabbit production (Nofal *et al.*, 2005). Litter size is mainly controlled by heredity and can be improved by crossbreeding between breeds (Nofal *et al.*, 2005). Pre-weaning survival percentage of kit rabbits is of vital importance in commercial rabbit farming, where it plays a major role in determining the net financial income of the farms (Rashwan and Marai 2000).

Factors such as breed, season, age and weight of females influence the reproductive performance of animals (Lazzaroni *et al.*, 2012). Cross breeding is one of the fast tools offered to a breeder to improve many traits in farm animals including rabbits (Nofal *et al.*, 2005). The major essence of deliberate selection for breeding is to improve the quantitative traits.

Genetic improvements of animal require a good understanding of basic concepts of animal breeding (Ibe, 1998). Previous works by Fayeye (2013) revealed significant heterosis for growth rate and body weight though at variable values of parental means. Chineke, (2006) reported superiority of the crossbreds over pure breeds for mean body weight and linear body parameters. Rochambeau (1988) in a study conducted to compare pure breed rabbits and the terminal crosses involving these breeds, observed heterotic effect on litter growth rate. In similar experiment, (Oseni *et al.*, 1999) reported that crossbred rabbits showed superior performance over pure breeds in all pre-wearing litter traits studies. These findings suggested that cross breeding under tropical condition hold some promises in improving performance traits in

rabbits. Therefore, this study was conducted to evaluate reproductive and pre-weaning characteristics of two strains of rabbits and their reciprocal crosses in Obio Akpa, in Nigeria.

Experimental Site

This experiment was carried out at the Rabbitary Unit, Teaching and Research Farm, Akwa Ibom State University Obio Akpa Campus. Obio Akpa is located between latitudes 5°17'N and 5°27'N and between longitudes 7°27'E and 7°58'E with an annual rainfall ranging from 3500mm – 5000mm and average monthly temperature of 25°C, and relative humidity between 60-90%. (Wikipedia, 2016).

Experimental Animals and Management

A total of forty (40) adult rabbits (New Zealand White and Chinchilla) comprising 18 New Zealand White does and 18 Chinchilla does, 2 New Zealand White bucks and 2 Chinchilla bucks were used. One New Zealand White buck was selected to mate with 9 New Zealand White does and the second new Zealand buck was selected to mate with 9 Chinchilla does. While one Chinchilla buck was selected to mate with 9 Chinchilla does and the second chinchilla buck selected to mate with 9 New Zealand White does. At the end of breeding period one hundred and twenty six (126) kittens produced from crosses comprising of NZW x NZW, CHA x CHA, NZW x CHA and CHA x NZW (Table 1) were used for this study. The rabbits were kept in 4 hutches each measuring 170cm by 32cm and consisting of 10 cells, each of which was measuring 34cm x 30cm x 28cm such that one rabbit was accommodated in one cell. Identification marks such as tags were placed on the cell in which each rabbit was accommodated.

All the rabbits in their respective cells were fed with forages such as *Ipomea batata*, *Centrosema spp*, *Peuraria phaseoloides* and commercial concentrates feed was also given with drinking water ad-libitum. The diet fed to the animals consisted of 18% CP, 2600 Kcal/kgME, and 8% CF as analyzed. Routine management operations were carried out on a daily basis. Pregnancy was detected by careful abdominal palpation on 14th and 21st days after mating, if confirmed pregnant, nest boxes were provided on 28th day of pregnancy.

Table 1: Mating scheme and number of progeny produced

Genotype	Number of sire	Number of Dam	Number of Progeny
CH X CH	1	9	35
NZW X NZW	1	9	27
CH X NZW	1	9	31
NZW X CH	1	9	33

Note: CH = Chinchilla; NZW = New Zealand White

DATA COLLECTION

Measurement/Data Collection

The following parameters were measured

Gestation Length: This was measured by finding the interval between the date of last mating and date of kindling.

Litter Size at Birth: This was measured by direct counting of the kittens immediately after kindling with still birth inclusive.

Litter Size at Weaning: This was the number of weaner's (young rabbits) in each litter at weaning time (6 weeks).

Birth Weight: This was measured by transferring all the kittens in a litter with gloved hands well rubbed on the body of the doe in question to the weighing scale and the weight of the litter read off and divided by the total number of kittens in the litter.

Body Weight at Weaning: This was measured by taking the weight of each kitten in a litter at weaning time (6 weeks).

Weekly Body Weight: This was measured by weighing each kitten in a litter on weekly basis.

Statistical Analysis / Experimental Design

The effect of sire breed and dam breed on performance traits (gestation length, litter size at birth, birth weight, litter size at weaning, body weight at weaning and weekly body weight) were subjected to analysis of variance (ANOVA) using the General Linear Model (GLM) procedure of SPSS. Significant means were separated using New Duncan Multiple Range Test. The Model incorporated Genetic Groups as fixed factors while performance traits (gestation length, litter size at birth, birth weight, litter size at weaning, body weight at weaning and weekly body weight) were dependent variables.

The linear model was as follows;

$$Y_{ij} = \mu + B_i + E_{ij}$$

Where:

Y_{ij} = measurement on traits

μ = Population mean

B_i = Effect of i th genetic groups (CH x CH, NZW x NZW, NZW x CH, and CH x NZW)

E_{ij} = Random error effect

RESULTS AND DISCUSSION

The means of weekly body weight of kittens from the four genetic groups are presented in Table 2, the result showed that NZW X CH genotype had significantly ($P < 0.05$) highest weight (145.23g) followed by NZW X CH (133.30g) and CH X NZW (111.75g) which were statistically similar; while CH X CH had the least weight (84.62g) at end of week one. At week two NZW X CH still showed significant ($P < 0.05$) higher body weight (201.08 ± 3.85) than other genetic groups which were statistically similar, 127.83 ± 7.09 , 182.61 ± 4.18 and 146.160 ± 2.96 for CH X CH, NZW X NZW and CH X NZW respectively. This trend was observed throughout the pre weaning period of 6 weeks. The result obtained from this studies are similar to those reported by Ajayi *et al.*, (2018), Oke *et al.*, (2010) who all observed significant differences on body weight of different breeds of rabbits. But this study is contrary to the reports of Ozimba and Lukefahr (1991) who observed no significant differences for growth traits of different breeds of rabbit in a comparative study. The animals increased in body size and other body dimensions as they grow in age indicating that, the animals were in normal good physiological and health conditions, Ajayi *et al.*, 2018 had earlier indicated that the genotype and environmental factors such as nutrition, disease, hormone and general management could lead to variation in growth rate or weight gain of rabbit within the same breed or among different breed. However variation in body weight in this study could be as a result of genetic variations in the various genotypes used. Body weight is said (Ajayi *et al.*, 2018) to be highly heritable and hence the selection of heavier individuals in a population should result in genetic improvement of the trait.

Table 2: Mean (\pm s.e) Body weight (g) performance of 2 breeds of rabbit and their crosses

Age (weeks)	CH \times CH (g)	NZW \times NZW (g)	CH \times NZW (g)	NZW \times CH (g)
1	84.62 \pm 5.33 ^c	133.30 \pm 3.39 ^b	111.75 \pm 1.285 ^b	145.23 \pm 4.39 ^a
2	127.83 \pm 7.09 ^b	182.61 \pm 4.18 ^b	146.160 \pm 2.96 ^c	201.08 \pm 3.85 ^a
3	190.12 \pm 10.77 ^c	267.77 \pm 11.16 ^b	188.20 \pm 2.94 ^c	315.48 \pm 15.11 ^a
4	326.59 \pm 14.91 ^b	397.53 \pm 9.09 ^b	266.60 \pm 6.08 ^c	468.09 \pm 13.87 ^a
5	364.57 \pm 16.77 ^c	474.88 \pm 8.57 ^b	335.76 \pm 6.06 ^c	522.26 \pm 12.82 ^a
6	418.78 \pm 16.57 ^c	532.88 \pm 7.554 ^b	394.04 \pm 8.07 ^c	594.55 \pm 12.18 ^a

a,b,c = Mean with different superscripts in the same row are significantly different ($P < 0.05$).

The means of the reproductive traits of the four genotypes are presented in Table 3. The result indicated that there were no significant differences among the genetic groups in litter size at birth (LSB). The result of this study is contrary to reports of Fadara and Fatoba (2018) who observed significant differences between genetic groups in litter size. But agrees with the work of MaryKitty and Nandakumar (2000) who reported non-significant effect of breed on litter size and litter weight at births.

However, significant ($P < 0.05$) differences were observed among genetic groups in litter size at weaning (LSW), NZW \times CH crosses had significantly ($p < 0.05$) higher litter size at weaning (4.95 ± 0.54) than other genotypes which were similar statistically. The average birth weight (ABWT) also followed the same trend as litter size at weaning. The NZW \times CH crosses had significantly ($P < 0.05$) heavier body weight at birth, while other genotypes were similar. Litter size at weaning is considered to be the best trait to us as selection criteria for improving reproductive performance (Moustafa *et al.*, 2014; Fadara and Fatoba (2018). This is because the productivity of rabbit depends primarily on the number of young kits surviving the pre-weaning stage. The ability of the doe to produce thrifty young at birth and to raise this young to weaning determines her productivity (Sorensen *et al.*, 2001). Thus, to maintain efficiency in rabbit production, high litter size at weaning is necessary. The report from this study is in line with the reports of Fadara and Fatoba (2018) who observed that litter size and litter weight at weaning were affected by breed.

The best gestation length (shortest) of 28.33 ± 0.67 days was recorded for NZW \times CH crosses which was significantly ($P < 0.05$) different from other genotypes which were statistically similar 31.67 ± 1.14 , 31.37 ± 0.67 and 30.50 ± 0.56 for CH \times CH, NZW \times NZW and CH \times NZW respectively. Variations in gestation length of rabbit due to differences in breed had earlier been reported by Apori *et al.*, 2015.

The result (Table 3) indicated that there were significant ($p < 0.05$) differences between the genetic groups in percentage mortality. It was observed that NZW \times NZW genetic group had the highest percentage of mortality (50.28 ± 5.78) followed by CH \times CH genetic group (25.10 ± 3.87) the crosses CH \times NZW and NZW \times CH genetic groups had similar percentage mortality, 8.87 ± 4.05 and 5.71 ± 8.69 respectively. The high percentage mortality observed in NZW \times NZW genetic group could be attributed to poor mothering ability, which may have resulted from inability of the does to produce sufficient fur in the nesting boxes for the naked kits at birth. It may also be attributed to tropical environmental condition which may not favour the genotype. Earlier report by Topzewka (2013) and Fadara and Fatoba (2019) indicated variation between rabbit breeds in percentage mortality.

Table 3: Mean (\pm s.e) of reproductive traits of 2 breeds of rabbit and their crosses

Age	CH \times CH	NZW \times NZW	CH \times NZW	NZW \times CH
LSB	5.83 \pm 0.98	5.50 \pm 0.34	4.50 \pm 0.67	5.17 \pm 0.67
LSW	4.30 \pm 0.89 ^b	2.67 \pm 0.21 ^b	4.00 \pm 0.52 ^b	4.95 \pm 0.54 ^a
ABWT	32.55 \pm 0.02 ^b	35.50 \pm 0.01 ^b	33.05 \pm 0.01 ^b	37.00 \pm 0.03 ^a
GL	31.67 \pm 1.14 ^a	31.37 \pm 0.67 ^a	30.50 \pm 0.56 ^b	28.33 \pm 0.67 ^a
AWWT	418.78 \pm 16.56 ^b	532.88 \pm 7.56 ^b	394.04 \pm 8.07 ^b	594.55 \pm 12.18 ^a
% MORT	25.10 \pm 3.87 ^b	50.28 \pm 5.78 ^a	8.87 \pm 4.05 ^c	5.71 \pm 8.69 ^c

Mean with different superscripts in the same row are significantly different ($P < 0.05$), LSB = Litter size at birth,

CONCLUSION

NZW X CH had a significant higher performance in body weight during the pre-weaning stage and other reproductive parameter measures (LSB, LSW, ABW, GL, AWWT and %mortality). Therefore, the NZW X CH genotype is suitable in the humid tropics in serving as protein source for the populace in Obio Akpa.

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