

EVALUATION OF LITTER TRAITS AND DEVELOPMENT OF SOME BODY ORGANS IN TWO BREEDS OF RABBIT

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ABSTRACT

This experiment was carried out using 65 purebred kits born in 3 parities. The purebred kits comprised of 31 Chinchilla (CHC) kits and 34 New Zealand White (NZW) kits. The mating plan followed the procedure outlined by Becker, where pure CHC males were mated to pure CHC females and pure NZW males mated to pure NZW females. The study was conducted at the Animal Science Departmental Research Farm, Ahmadu Bello University, Zaria, Nigeria. Data collected are; Litter traits at birth and at weaning which includes: Gestation Length (GL), Litter Size at Birth (LSB), Litter weight at Birth (LBW), Litter Size at Weaning (LSW), Litter Weight at Weaning (LWW) and Preweaning Mortality (PWM). Development of some body organs monitored include; ear unfolding, first fur, eruption of upper and lower incisor, eye opening, full fur, nipple or areola and the number of nipples counted in both male and female kits. Data collected was subjected to analysis of variance using the General Linear Model (GLM) procedure of SAS. The significantly different means were compared using Duncan's Multiple Range Test. Result showed a significant difference ($P < 0.05$) in LSB, LWB, LWW and PWM between the two breeds in parity 1, 2 and 3. NZW was superior in terms of LSB (11-12) as well as LWB (411-458g). However, CHC was superior to NZW in terms of LWW (2240-3204g) and PWM (11-27%). Result for the development of body organs revealed number of days for ear unfolding (8-9:9-10), eye opening (10-12), upper and lower incisor eruption (19-21), nipple appearance (16-17:13-16), first fur appearance (5-7) and number of nipples (7-13) in Chinchilla and New Zealand breeds. It was concluded that breed affects preweaning litter traits while development of body organs was affected by sex and breed but not by parity. CHC was recommended for higher litter weight at weaning because their good mothering ability.

Keywords: Body organs, litter traits, rabbit, analysis.

INTRODUCTION

Because of the enormous benefits associated with rabbit production and the belief that it will certainly bridge the animal protein gap been experienced in developing countries (Nigeria inclusive), it is imperative to give the needed attention to rabbit breeds just like other animal genetic resources. The production efficiency of commercial rabbit farms is largely dependent on the litter size at kindling and the survivability of the kittens up to weaning (Kabir *et al.*, 2011). In addition, the pre-weaning growth is very critical in meat rabbits due to its impact on the meat produced at the finisher stage of production (Kabir *et al.*, 2012). Kabir *et al.* (2014) reported that litter size in rabbits is regarded as one of the most important economic traits in any breed development and improvement programs for intensive meat production. This work was carried out to evaluate reproductive trait (from birth to weaning) and monitor the development

of some body organs in two breeds of rabbits. Such baseline information would assist rabbit breeders to decide the selection methods that will be applicable at early age for the genetic improvement of the heterogeneous rabbit populations in Nigeria.

MATERIALS AND METHODS

Experimental site

The study was conducted at the Research Farm of the Department of Animal Science, Ahmadu Bello University Zaria, Nigeria. Zaria is located between latitude 11° and 12° N and on altitude of 640m above sea level. The area falls within the Northern-Guinea Savannah zone having an average annual rainfall of 1100mm which starts from late April and early May to mid October. The peak of rainy season is between June and September, followed by the harmattan period of cool and dry weather which lasts from October to January. This is then followed by hot-dry

weather from February to April as described by Kabir *et al.*, (2014).

Experimental animals

The parent stock of the rabbits used in this study originated from the National Veterinary Research Institute (NVRI), Vom near Jos, Plateau State. The animals were utilized for previous Diallel experiment (Kabir *et al.*, 2012). Part of the data generated from the pure-cross research was used in this study, which involved 65 purebred kits born in 3 parities. The purebred kits comprised of 31 Chinchilla (CHC) kits and 34 New Zealand White (NZW) kits. The mating plan followed the procedure outlined by Becker (1992), where pure CHC males were mated to pure CHC females and pure NZW males mated to pure NZW females. The scheduled mating plan and the offspring generated from three parities was shown in Table 1.

Data collection

Litter traits measured at birth and at weaning

1. Gestation Length (GL): was measured in days as the difference between the date of kindling and the date at which successful mating occurred.
2. Litter Size at Birth (LSB): was obtained by actually counting the number of kits born per given litter. It is commonly termed as measure of prolificacy.
3. Litter weight at Birth (LBW): this was obtained by subtracting the weight of the nest box from the combined weight of nest box and the kits, using a digital scale.
4. Litter Size at Weaning (LSW): was the number of kits alive at weaning.
5. Litter Weight at Weaning (LWW): weight of litter taken in kg at weaning.
6. Prewaning Mortality (PWM): was the number of dead kits recorded at the time of weaning expressed as a ratio of the total pups in the litter.

Data analysis

Data collected was subjected to analysis of variance (ANOVA) using the General Linear Model (GLM) procedure of SAS (SAS 2002). The design of the experiment was the Nested type, in which a sire was mated to several dams with each mating producing several offspring. The model is given below:

$$Y_{ijkl} = \mu + B_i + S_{ij} + D_{ijk} + E_{ijkl}$$

Where; Y_{ijkl} = Observation on the l^{th} rabbit of the k^{th} doe mated to the j^{th} sire of the i^{th} breed; μ = overall mean, B_i = effect of the i^{th} breed; S_{ij} = effect of the j^{th} sire of the i^{th} breed; D_{ijk} = effect of the k^{th} doe mated to the j^{th} sire of the i^{th} breed; E_{ijkl} = random error, which is assumed to be identically, independent and normally distributed with zero mean and constant variance ($iind0\sigma^2$).

RESULTS AND DISCUSSION

Table 2 shows the least square means ($\pm$ SE) for gestation length, litter size at birth and weaning and preweaning mortality in pure bred CHC and NZW rabbit. The result revealed no significant difference ($P>0.05$) between gestation length (days) of pure bred CHC and pure bred NZW rabbit in parity 1, 2 and 3. There was however a significant difference ($P<0.05$) between the two breeds in terms of their litter size at birth in parity 1, 2 and 3 with NZW having larger litter size at birth in parity 1 and 2. This result agrees with the reports of Kabir *et al.* (2015), but contradicts the results obtained by Yahaya (1993) who reported higher litter size at birth for Chinchilla does than for New Zealand White. Rashwan *et al.* (1995) reported that differences in litter size at birth could be due to differences in ovulation rate and pre-implantation viability as well as maternal effects determined by the number of matured, fertilized and established ova. The effect of breed on litter size at weaning obtain in this study is in agreement with the report of Khalil *et al.* (1995). The effect of breed on preweaning mortality (%) was significant with CHC showing lower mortality than NZW in parity 1, 2 and 3, and may be attributed to good mothering ability of CHC over NZW as reported by Kabir *et al.* (2015), who attested to the fact that CHC breed is a good milker with better mothering ability than NZW.

Table 3 shows the least square means ($\pm$ SE) for physical development of body organs in pure bred CHC and NZW rabbit as affected by breed and parity. It shows that there was no significant ($P>0.05$) difference between number of days for ear unfolding in males and females of CHC and NZW in parity 1 and 2 but a significant difference was observed between the males and females of NZW in parity 2. These occurs within 8 to 9 days and 9 to 10 days after kindling for CHC and NZW respectively. Richardson (2000)

reported higher number of 12 days. The number of days (10 to 12) for eye opening and upper/lower teeth eruption (19 to 21) was not significantly ($P>0.05$) different between males and females of CHC and NZW in parity 1 and 2. The variation in the number of days could be due to breed and is similar to the value (10 days) reported by Richardson (2000) and the number (9-10 days) reported by Paul *et al.*, (1979) for eye opening. There was a significant ($P<0.05$) difference in the number of days for nipple or areola appearance between males and females of CHC and NZW. The males take longer time (15-17 days) than females (13-16 days) for both CHC and NZW in parity 1 and 2. It also showed that both males (17days) and females (16days) of NZW take longer number of days than males (15-16 days) and females (13days) of CHC; thus indicating effect of breed and sex on areola appearance. There was significantly ($P<0.05$) higher number of nipples on females (13) than on males (7-9) for both CHC and NZW in parity 1 and 2. Nipple number among neonate has been reported to be correlated significantly with litter traits (Lukefahr *et al.*, 1984). Hence number of nipples is important in selection of breeding rabbits at early age. There was no significant ($P>0.05$) difference between the number of days (5-7) for first fur appearance in males and females of CHC and NZW except in parity 1 for NZW and parity 1 for CHC respectively and it agrees with the number (7days) reported by Richardson (2000). These showed that fur appearance is neither affected by breed, parity nor sex. Parity showed no effect on the number of days for ear folding, first appearance of fur, upper/lower incisor eruption, nipples appearance and number of nipples.

CONCLUSION

It is concluded that breed and parity has no influence on gestation length, which ranged between 30-31days. Breed has an effect on preweaning traits with NZW having higher litter size at birth, litter weight at birth, preweaning mortality but lower individual kit weight at birth, litter weight at weaning individual kit weight at weaning. The period for development of body organs such as ears, nipples are affected by sex of the kits, while features such as fur, incisors eruption, ears and nipple are affected by breed of the kit.

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Table 1: Mating plan to generate purebred offspring

Mating breed	Parity 1	Parity 2	Parity 3	Total by breed
CHC x CHC	9	10	12	31
NZW x NZW	11	12	11	34
Total by Parity	20	22	23	65

Table 2: Least square means ($\pm$ SE) for gestation length, litter size at birth and at weaning and preweaning mortality in pure bred Chinchilla (CHC) and New Zealand (NZB) rabbit as affected by breed and parity

Breed	Parity	GL (days)	LSB (No)	LSW (No)	PWM (%)
CHC	1	30	9 $\pm$ 0.03 ^b	8 $\pm$ 0.03	11.11 ^a
NWZ	1	31	11 $\pm$ 0.04 ^a	8 $\pm$ 0.03	27.28 ^b
CHC	2	30	10 $\pm$ 0.04 ^b	8 $\pm$ 0.03	20.00 ^a
NZW	2	31	12 $\pm$ 0.04 ^a	8 $\pm$ 0.03	36.37 ^b
CHC	3	31	12 $\pm$ 0.05	9 $\pm$ 0.04 ^a	27.28 ^a
NZW	3	30	11 $\pm$ 0.04	7 $\pm$ 0.03 ^b	36.37 ^b

^{a,b} = Means having different superscript within the same column are significantly different ($P < 0.05$), GL=gestation length, LSB=litter size at birth, LSW=litter size at weaning, PWM=preweaning mortality

Table 3: least square means ($\pm$ SE) for physical development of body organs in pure bred Chinchilla (CHC) and New Zealand white (NZW) rabbit as affected by breed and parity

Breed	Chinchilla				New Zealand White			
	Parity 1		Parity 2		Parity 1		Parity 2	
Body organs	Male (4)	Female (4)	Male (4)	Female (4)	Male (4)	Female (4)	Male (4)	Female (4)
EU (days)	8 $\pm$ 3.22	8 $\pm$ 3.22	9 $\pm$ 3.41	8 $\pm$ 3.73	9 $\pm$ 4.28	10 $\pm$ 3.83	9 $\pm$ 3.16 ^b	10 $\pm$ 4.44 ^a
EO (days)	12 $\pm$ 6.45	12 $\pm$ 6.45	11 $\pm$ 6.39	11 $\pm$ 6.39	10 $\pm$ 7.17	12 $\pm$ 7.24	11 $\pm$ 6.33	11 $\pm$ 6.33
FFA (days)	5 $\pm$ 2.55	5 $\pm$ 2.55	6 $\pm$ 4.13	6 $\pm$ 4.13	6 $\pm$ 4.44 ^b	7 $\pm$ 3.89 ^a	7 $\pm$ 3.04	7 $\pm$ 3.04
ULIE (days)	19 $\pm$ 10.61	19 $\pm$ 10.61	21 $\pm$ 10.27	21 $\pm$ 10.27	20 $\pm$ 11.82	21 $\pm$ 12.33	21 $\pm$ 9.08	21 $\pm$ 9.08
FFC (days)	14 $\pm$ 9.31 ^a	13 $\pm$ 8.99 ^b	14 $\pm$ 8.09	14 $\pm$ 8.09	14 $\pm$ 7.01	13 $\pm$ 6.19	14 $\pm$ 7.36	14 $\pm$ 7.36
NAA (days)	16 $\pm$ 4.18 ^a	13 $\pm$ 2.55 ^b	15 $\pm$ 7.76 ^a	13 $\pm$ 5.22 ^b	17 $\pm$ 8.92 ^a	16 $\pm$ 8.24 ^b	17 $\pm$ 8.92 ^a	16 $\pm$ 8.24 ^b
NN	9 $\pm$ 0.37 ^b	13 $\pm$ 6.58 ^a	7 $\pm$ 0.18 ^b	13 $\pm$ 5.55 ^a	8 $\pm$ 5.52 ^b	13 $\pm$ 7.41 ^a	8 $\pm$ 5.52 ^b	13 $\pm$ 7.41 ^a

^{a,b}=means with different superscripts within the same row for a given parity and breed are significantly different ($P < 0.05$), figures in parenthesis indicates number of kits, EU=ear unfolding, EO=eye opening, FFA=first fur appearance, FFC=full fur coverage, ULIE=upper and lower incisor eruption, NAA=nipple or areola appearance, NN= number of nipples