ON-FARM PHENOTYPIC CHARACTERIZATION OF HETEROGENEOUS RABBITS FOR FERTILITY AND REPRODUCTIVE PERFORMANCE IN SOUTH-WESTERN NIGERIA

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ABSTRACT

This study assessed the effect of litter size at birth (LSB) class, doe body weight at conception (DWC), sire group (SG) and parity (P) on the fertility and litter performance in a heterogeneous population of rabbits in southwestern Nigeria. Data on 72 litters across 2 parities from 7 bucks and 42 does were analyzed. Fertility and pre-weaning growth performance and survival traits investigated included LSB, number of mating per conception (NMC), litter sizes and weights at 7, 14, 21 and 28 d post-kindling, pre-weaning survival rate (SR) and daily weight gain of kits from kindling to weaning. Data were analyzed using GLM procedure of SAS®. A linear model that included fixed effects of LSB classes (low, medium and large litters) DWC (light vs. heavy does), SG and P (one or two) was used. Results showed that higher performance for LSB and NMC were obtained in the second parity (P<0.05). Kits' weight at kindling and at 28 d, as well as daily weight gain were significantly higher in low-sized litters, when compared with medium- and large-sized litters (P<0.05). These traits also differed significantly across sire groups. Doe weight at conception did not influence any of the traits investigated while gestation length and survival rates (SR) were not significantly affected by all the fixed factors considered (P>0.05). It was concluded that kits born in low-sized litters were observed to have higher weight at kindling and higher daily weight gain at weaning and that does exhibited superior reproductive performance in the second parity.
Key Words: Heterogeneous rabbits, litter size, kit weight, kit survival.

INTRODUCTION

Stocks of rabbits used in Nigeria and in many parts of the developing countries are heterogeneous, because of their multiple breeds of origin (Lebas *et al.,* 1997; Lukefahr, 1998; Oseni *et al.*, 2008; Oseni and Lukefahr, 2014). These stocks are desirable because of their adaptation to low-input, backyard and sub-optimal management conditions, which are prevalent in the developing world (Colin and Lebas, 1996, Oseni, 2008). Heterogeneous stocks represent the product of crosses of pure breeds of commercial rabbits and/or local rabbit breeds (Lukefahr, 1998). Use of heterogeneous stocks may have merits especially in adverse environments, on account of the high degree of heterozygosity (Lukefahr, 1998). These unique characteristics could present enormous opportunities for genetic improvement (Oseni, 2008). However, further exploitation of these heterogeneous stocks could be based on detailed scientific information about factors affecting fertility, prolificacy and litter traits at kindling and at weaning, including average daily gain and kit survival rate. Therefore, the objective of this study was to characterize heterogeneous rabbit stocks for growth and reproductive performance in the humid tropics.

MATERIALS AND METHODS

Experimental Animals and Management

The study was conducted at the Rabbit Unit of Onileola Farms located at Ede, Osun State, Nigeria. Seven bucks and 42 does of 6 to 8 months of age and weighing between 2.2 and 2.8 kg were randomly selected from a colony of rabbits maintained at the Onileola Farms. All the rabbits were housed individually in cages of dimension 76 × 62 × 42 cm, placed 90 cm from the floor. The cages were made of wood with galvanized wire mesh at the sides and bottom. In each cage, there were two earthen pots for feed and water. Mating was routinely done in the morning before the weather gets hot. Pregnancy was detected 14 day post-mating. Does that were not gravid were re-mated immediately.

Data collection

Data included number of matings to conception, gestation length, and live litter size at kindling and subsequently at weekly intervals till weaning at 5 weeks. In addition, records of litter weights, weekly gains and survival rates across the same intervals were taken consistently across parities. Data collected also included doe body weight at conception (DWC; two classes: DWC≤2500 g and

DWC>2500 g), sire group, parity. Litter Size at Birth classes were defined as low for LSB≤3 kits, medium for LSB of 4 to 5 kits and large for LSB≥5 kits, while Survival Rate (SR) was defined as litter sizes at 7, 14, 21 and 28 d post-kindling, relative to the initial LSB.

Data analysis

Data were analysed using the GLM procedure of the Statistical Analysis System (SAS®, 2004). To evaluate factors affecting growth performance traits (e.g. kit weight at birth and kit weight at weaning and survival rate), the following fixed model was fitted: $Y_{ijklm}=\mu + DWC_i + SG_j + P_k + LSB_l + Є_{ijklm}$ where μ is the overall mean, DWC the doe body weight at conception, SG is the sire group, P is the parity group, LSB is the litter size at birth category and Єijklm the random error.
For number of mating per conception (NMC), gestation length (GL) and litter size at birth (LSB), the following fixed model was fitted: $Y_{ijkl}=\mu + DWC_i + SG_j + P_k + Є_{ijkl}$ where all the effects were defined as previously in the preceding model. Means comparison was done using the Duncan Multiple Range Test via the GLM of SAS®.

RESULTS AND DISCUSSION

Table 1 shows the effects of SG, DWC, P and LSB on litter weight at kindling, kits weight at kindling, weight at 28 d and daily gain from kindling to 28 d. There were significant effect of sire group on kits weight at kindling, weight at 28 d and daily gain in kit weight from kindling to 28 d which indicated differences in kits growth performance due to their respective sires. Simlarly, parity also had significant effect with higher values obtained in the first parity for all growth related traits evaluated. LSB category also had significant effect on growth performance traits. Kits belonging to low LSB category (≤ 3 kits) consistently had significantly higher growth performance while kits from large LSB category (> 5kits) had consistently lower growth performance. DWC had no significant effect on these growth performance. Further, kits born in low litter sizes had a higher daily weight gain at 28 days (12.339 g) than kits born in the medium (10.092 g) and large LSB (8.195 g). Intra-litter competition for resources and maternal care could be lower for rabbits born in low LSB when compared to rabbits born in large litters (Oseni and Ajayi, 2010). The mean daily weight gain recorded for the low LSB rabbits (12.339 g per day) is comparable to 12.5 g reported by Oseni and Ajayi (2010) under tropical conditions in southwestern Nigeria.

Table 2 shows the effect of SG, DWC, and P on LSB, NMC and GL. Doe weight at conception had no significant effect (P>0.05) on the reproductive traits investigated (LSB, NMC and GL). Similarly, SG, DWC, parity and their respective 2-way and 3-way interactions had no significant effect on GL. However, there were significant differences among sire groups and across parities for LSB and NMC. The average LSB of 5.55 kits obtained in this study was similar to 5.00 reported by Oseni and Ajayi (2010) and 5.70 kits reported by Oseni *et al.* (2016) for New Zealand rabbits but lower than 6.74 kits reported by Iraqi *et al.* (2008). The higher value of LSB obtained in the second parity was in consonance with the findings of Das and Yadav (2007) that reported that LSB was significantly higher in the later parities compared to the earlier ones. This indicated that prolificacy and litter traits improved with doe age and parity. The number of mating per conception was also significantly lower in the second parity indicating improved fertility of does with parity. Although previous studies on heterogeneous Nigerian rabbits by Oseni and Ajayi (2010) has established profound effects of DWC on LSB, this cannot be observed from our study as there were no significant effect of DWC on all the traits evaluated.

Figures 1(a) and (b) show the trend for the survival rate, highlighting the effect of parity and DWC on SR at 7, 14, 21 and 28 days. The SR of 100, 100 and 97.7% obtained for low, medium and large-sized litters at 28 d post-kindling is markedly higher than 90, 80 and 74% for low, medium and large-sized litters, respectively, reported by Oseni and Ajayi (2010). This could be as a result of improved management practices geared towards increasing kits' survival rate. Previous works by Rashwan and Marai (2000) and Oseni and Ajayi (2010) established the dependency of mortality on LSB which could not be verified in the present study. In this regard, cross-fostering could be employed as a key management practice whereby kits from large-sized litters are distributed among low-sized litters for improved maternal care in order to reduce kit losses.

Table 1: Effect of sire group, doe weight at conception, parity and litter sizes at birth on litter weight at kindling, kits weight at kindling, weight at 28 d and daily gain in kit weight from kindling to 28 d

	Litter weight at kindling	Average kit weight at kindling	Average kit weight at 28 days	Daily gain to 28 days	Average kit weight at 56 days	Daily gain to 56 days
Sire group						
F6	246.18	44.20^{a}	274.60^{a}	9.81^{a}	553.38^{ab}	9.88^{ab}
F23	244.18	40.69^{b}	227.98^{b}	8.14^{b}	447.80^{c}	7.99^{c}
F33	239.73	43.06^{ab}	248.78^{ab}	8.88^{ab}	537.03^{ab}	9.59^{ab}
F11	232.46	47.23^{a}	276.32^{a}	9.87^{a}	582.18^{a}	10.37^{a}
F12	226.13	41.07^{b}	262.07^{ab}	9.36^{ab}	535.03^{ab}	9.55^{ab}
F22	220.12	42.43^{ab}	253.44^{ab}	9.05^{ab}	528.95^{ab}	9.45^{ab}
F5	214.85	41.66^{ab}	258.63^{ab}	9.24^{ab}	522.57^{b}	9.33^{b}
Doe weight at conception (g)						
≤ 2500	233.50	43.56	264.18	9.44	542.43	9.69
> 2500	230.33	42.08	251.83	8.99	516.59	9.22
Parity						
1	237.90	45.07^{a}	281.814^{a}	10.06^{a}	583.13^{a}	10.41^{a}
2	222.53	39.90^{b}	226.293^{b}	8.08^{b}	457.64^{b}	8.17^{b}
LSB category						
Low (≤3)	262.25^{a}	50.96^{a}	345.50^{a}	12.34^{a}	671.16^{a}	11.99^{a}
Medium (4-5)	209.96^{b}	46.46^{b}	282.58^{b}	10.09^{b}	594.50^{b}	10.62^{b}
Large (>5)	136.83^{c}	39.57^{c}	229.47^{c}	8.195^{c}	472.21^{c}	8.43^{c}

Means along columns for each trait with different superscripts are significantly different (P<0.05)

Table 2: Effects of doe weight at conception and parity on litter sizes at birth, number of mating to conception and gestation length**.**

	LSB	NMC	GL
Sire group			
F6	5.67^{ab}	1.42^{bc}	31.25
F23	6.22^{a}	1.56^{bc}	31.22
F33	5.71^{ab}	2.43^{a}	31.42
F11	5.09^{b}	1.18^{c}	31.00
F12	5.58^{ab}	1.58^{bc}	31.41
F22	5.44^{b}	1.89^{ab}	31.11
F5	5.27^{b}	1.46^{b}	31.18
Doe weight at conception (g)			
≤ 2500	5.47	1.57	31.23
> 2500	5.65	1.62	31.20
Parity			
1	5.38^{a}	1.71^{a}	31.35
2	5.79^{b}	1.41^{b}	31.03

Means along columns for each trait with different superscripts are significantly different (P<0.05)

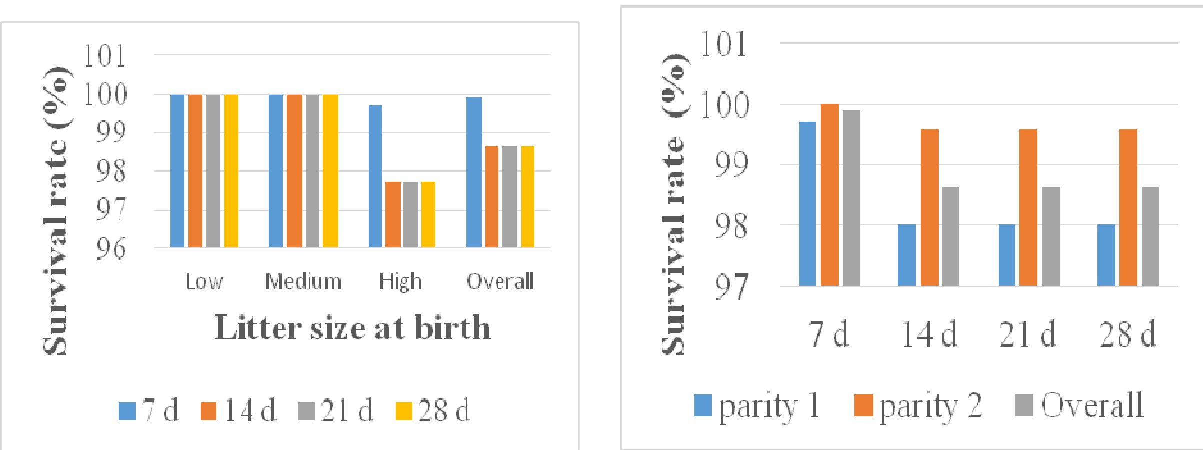

Figure 1: Effect of (a) litter size at birth category and (b) parity on survival rate at 7, 14, 21 and 28 days.

CONCLUSIONS

From this study, it can be concluded that does had superior reproductive performance in the second parity, kits born in low-sized litters were observed to have greater weight at kindling, and daily weight gain, and that doe weight at conception did not significantly affect all reproductive and growth perfomance-related traits investigated

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