EFFECT OF BREED, PARITY AND MATING FREQUENCY ON LITTER TRAITS OF THREE RABBIT BREEDS IN NORTHERN GUINEA SAVANNAH ZONE OF NIGERIA

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ABSTRACT

A total of 36 does mated to 12 bucks were evaluated for various litter traits in three rabbit breeds namely; New Zealand White (NZW), Californian White (CAW) and Chinchilla (CHC). Three parities were considered and two mating frequency was adopted (once a day at 800 hours only and twice a day at 800 hours and 1700 hours local time). The study was carried out in Zaria (Northern Guinea Savannah zone of Nigeria) and the results obtained revealed that mating frequency had significant effect on all the reproductive traits tested except gestation length (GL). Twice mating frequency improved the performances of the kits. Similarly, breed significantly affected litter size at birth (LSB) and weaning (LSW), litter weight at birth (LBW) and weaning (LWW), individual kit weight at birth (IKBW) and weaning (IKWW). The CAW produced the largest LSB (7.33±0.19) while CHC had the smallest (6.05±0.29). The CHC had the highest LBW (163.68±5.76g) while NZW had the lowest (149.25±3.92g). The IKBW was higher (27.05±2.14g) in CHC than in the other two breeds. Weaning mortality (WM) and GL were unaffected by breed. All the traits investigated were significantly higher during the third parity than in the first and second, except for GL and WM, which remain unaffected by parity. It was concluded that the CAW and NZW breeds produced the largest LSB and LBW while CHC produced the heaviest kits (IKBW and IKWW). Therefore, for larger litter size the CAW and/or NZW could be exploited while CHC proved the best breed for IKBW and IKWW. Furthermore, twice mating frequency is recommended because it improved LSB, LSW, LBW and reduced mortality as observed in the present study.

Keywords: Parity, New Zealand white, Chinchilla, California white, Breed

INTRODUCTION

Rabbit breeding and farming is becoming more attractive due to high reproductive potentials (Kabir et al., 2012a), high mothering ability (Lukefahr and Cheeke 1990), adaptability in wide range of climatic conditions (Aduku and Olukosi, 1990), high genetic variability (Kabir et al., 2011a and 2011c), high roughage utilization potentials (Iyeghe-Erapotobor et al., 2009) and low cost of production (Aduku and Olukosi, 1990). Moreover, detailed information about the effects of breed, parity and mating frequency on the litter performance of rabbit in the Northern Guinea Savannah zone of Nigeria is not available for commercial rabbit farming. The aim of this study is therefore, to determine the effect of breed, parity and mating frequency on the litter performance of three breeds of rabbits.

MATERIALS AND METHODS

Experimental site

The study was conducted at the Rabbitry Unit of the Teaching and Research Farm of the Department of Animal Science, Ahmadu Bello University, Zaria. Zaria is located between latitude 11o 30'N and longitude 12o 33'E and on altitude of 686 meters above sea level. Detailed description of Zaria had been given by Kabir et al., 2012a).

Experimental animals and mating design

Three breeds of rabbit were used namely Chinchilla (CHC), New Zealand White (NZW) and California White (CAW), each having 12 adult females (does) and 4 adult males (bucks). The 36 does were in the age group of 7–8 months and weighed 2.25 to 2.45kg; while the 12 bucks belong to the age category of 8–9 months and weighed 2.3 to 2.6kg. The 48 experimental rabbits were divided randomly into two mating frequency groups so that each group had 6 does and 2 bucks of same breed. In Group I, does were mated to bucks of the same breed once in the morning (800 hours), whereas in Group II, does were mated to bucks twice on the same day ie in the morning (800 hours) and in the evening (1700 hours). Mating pairs were kept in concrete floor hutch until
mating is assured then pregnant does were isolated and monitored individually to term. There were three parities.

**Feeding and management**

Concentrate mash feed was given at 100g in the morning and green roughage was supplied ad libitum in the afternoon. Composition of feed was similar for all experimental rabbits and in accordance with specifications of Aduku and Olukosi (1990): maize = 40%, maize offal = 22%, groundnut cake = 12%, soya bean meal = 18%, trace ingredients = 5%, vitamin and mineral mixture = 2.5%, common salt = 0.5%. The proximate composition of the diet was DM = 93.04, CP = 14.08, Ash = 7.12, EE = 10.64, NFE = 57.83 and OM = 92.88%, respectively. Other routine management was the same. Feed was analyzed regularly once a month as per standard method described in AOAC (1984).

**Experimental design, data collection and analysis**

The experimental design was a completely randomized design (CRD). A total of 185 records on the various litter traits collected within a study period of eighteen months (June 2007–December 2008) obtained from the 48 rabbits were considered. The parameters included litter size at birth (LSB), litter size at weaning (LSW), litter birth weight (LBW), litter weight at weaning (LWW), individual kit weight at birth (IKBW), individual kit weight at weaning (IKWW), gestation length (GL) and weaning mortality (WM). Weight measurements were obtained using Mettler® top loading digital scale in grams (g). The general linear model (GLM) procedure of SAS (SAS, 2002) computer programme was used for computing the analysis of variance (ANOVA). Means were compared for significant difference using the Duncan’s Multiple Range Test (DMRT) (Duncan, 1955). The statistical model adopted was as shown:

\[ Y_{ijkl} = \mu + B_i + P_j + M_k + \epsilon_{ijkl} \]

Where:
- \( Y_{ijkl} \) = Individual observation
- \( \mu \) = overall mean
- \( B_i \) = fixed effect of the ith breed of rabbit (i = 1,2,3)
- \( P_j \) = fixed effect of the jth parity (j= 1st, 2nd, 3rd)
- \( M_k \) = fixed effect of kth mating frequency (k = once and twice)
- \( \epsilon_{ijkl} \) = random error.

**RESULTS AND DISCUSSION**

**Effect of Breed**

Breed significantly (P<0.05) affected the reproductive performance of all the breeds studied (Table 1). The CAW breed produced the largest LSB (7.33±0.19) with a corresponding LBW of 155.94±4.34g, which was higher than the litter size produced by CHC and NZW does. The NZW breed gave a LSB of 6.89±0.25 weighing 149.25±3.92g, while CHC breed gave a LSB of 6.05±0.29 which had the heaviest LBW of 163.68±5.76g. The result obtained in this study agreed with the reports of Irekhore (2007) who stated that California breed produced higher litter size at birth than New Zealand White, New Zealand Black and Flemish Giant breeds. The findings also concur with the earlier submissions of Kabir et al. (2011b). Liang (1996) reported much higher LSB (7.50) and LWW (3.32 kg) in NZW rabbit in China than the result obtained in this study. But Rastogi (1996) reported lower LSB (5.20) and LSW (4.30) in NZW breed of rabbit in Trinidad. Similar to the present findings Das et al. (2006) reported significantly (P<0.05) higher litter size at weaning and litter weight at weaning in New Zealand White breed of rabbit than Soviet Chinchilla breed; while Das and Bujarbarua (2005) found no effect of breed on litter weight at birth.

Iraqi et al. (2006) corroborated with this finding in respect of litter size at birth (6.60) and litter size at weaning (4.80) but contradicted with the findings in this study with respect to litter weight at birth (429 g) and litter weight at weaning (2.97 kg) in New Zealand White breed of rabbit in Egypt. Though the LSB obtained in this study compares with that reported by Patial et al. (1991), it was higher than that (5.6) reported by Odubote and Akinokun (1991). The range of 6.05–7.33 for LSB obtained herein was higher than the LSB values of 4.4 (Iyeghe et al., 1996), 4.77 (Fayeye and Ayorinde, 2003), 5.8–6.61 (Irekhore, 2007), 4.27–5.33 (Zalla et al., 2007) and 5.69 (Akpa and Alphonsus, 2008). It was also higher than other reported values in literature (Ayorinde, 1997; Oseni et al., 1999; Akanno et al., 2004). The differences in literature values with those obtained from this study could be attributed to the combined effects of breed and/or environment (study location, nutrition, management and diseases) as reported by Kabir et al. (2012b). The CAW breed recorded the least WM (20%) while CHC breed had the highest WM (24%).
Table 1: Effect of breed on reproductive performance of rabbits

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Mean (±SE) breed performance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CHC</td>
</tr>
<tr>
<td>Litter Size at birth (LSB)</td>
<td>6.05±0.29</td>
</tr>
<tr>
<td>Litter size at weaning (LSW)</td>
<td>4.58±0.24</td>
</tr>
<tr>
<td>Litter birth weight (LBW) (g)</td>
<td>163.68±5.76</td>
</tr>
<tr>
<td>Litter weaning weight (LWW) (g)</td>
<td>1596.9±66.31</td>
</tr>
<tr>
<td>Individual Kit birth weight (IKBW) (g)</td>
<td>27.05±2.14</td>
</tr>
<tr>
<td>Individual Kit weaning weight (IKWW) (g)</td>
<td>34.67±2.77</td>
</tr>
<tr>
<td>Gestation length (GL) (days)</td>
<td>30.00±0.04</td>
</tr>
<tr>
<td>Weaning mortality (WM) (%)</td>
<td>24.3±0.11</td>
</tr>
</tbody>
</table>

a,b,c Row means with different superscripts differ significantly at P<0.05; SE=standard error

Effect of mating frequency

Table 2 shows the effect of mating frequency on various parameters measured. The result indicated that LSB was significantly (P<0.05) higher in rabbits bred twice (13.47) than those bred once (9.62). Similar trend was observed for litter weaning weights, where does mated twice weaned significantly (P<0.05) heavier kits (1116.46g) than kits from does bred once (962.22g). The observations on mating frequency was in line with the report of Kabir et al. (2011b) but disagree with the findings of Das and Yadav (2007) who reported that litter size at birth was non-significantly (P>0.05) higher in the rabbits mated twice (6.31) (group 2) than those mated once (5.84) (group 1) on broiler rabbits under agro-climatic conditions in India. The authors further reported that individual litter weight at birth in Group 1 was significantly higher than that in Group 2. Szendro and Barna (1984) obtained a mean kit weight ranging from 53.0g to 67.6g.

Table 2: Effect of mating frequency on reproductive performance of rabbits

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Mating frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Once</td>
</tr>
<tr>
<td>Litter Size at birth (LSB)</td>
<td>9.62±0.29</td>
</tr>
<tr>
<td>Litter size at weaning (LSW)</td>
<td>7.54±0.24</td>
</tr>
<tr>
<td>Litter birth weight (LBW) (g)</td>
<td>317.28±2.77</td>
</tr>
<tr>
<td>Litter weaning weight (LWW) (g)</td>
<td>962.22±4.65</td>
</tr>
<tr>
<td>Individual Kit birth weight (IKBW) (g)</td>
<td>32.98±2.14</td>
</tr>
<tr>
<td>Individual Kit weaning weight (IKWW) (g)</td>
<td>127.61±2.77</td>
</tr>
<tr>
<td>Gestation length (GL) (days)</td>
<td>30</td>
</tr>
<tr>
<td>Weaning mortality (WM) (%)</td>
<td>21.62±0.11</td>
</tr>
</tbody>
</table>

a,b,c Row means with different superscripts differ significantly at P<0.05; SEM=standard error of means

Reporting on re-mated groups of does in Umudike, Abia State Nigeria, Oguike and Okocha (2008) corroborated with the findings of Szendro and Barna (1984) with respect to IKWB (65.59g). However, the birth weights observed in this work were lower than those reported by Szendro and Barna (1984) and Oguike and Okocha (2008), which could be due to differences in breeds of rabbit used and management. The IKWB and IKWW obtained in this study were generally lower than those reported by Das and Yadav (2007) where the weaning weights of individual kits was 444g and 449g in single and double mating systems, respectively. The difference in these results could be due to breeds differences as well as management factors. Mating frequency had no significant (P>0.05) effect on gestation length of the does. This observation is in line with the earlier submissions of Kabir et al. (2011b). However, twice mating frequency significantly (P<0.05) reduced the weaning mortality from 21.62% (once mating frequency) to 9.2%, which also concur with the findings of Kabir et al. (2012).
**Effect of parity**

The effect of parity on the parameters investigated is presented in Table 3. The result showed that parity had significant (P<0.05) effect on all the reproductive parameters measured except GL, which was similar. LSB, LSW, LWB, LWW, IKWB and IKWW were significantly (P<0.05) higher in the third parity than in the first and second parity. All the kits in this study were weaned at 35 days postpartum, which was regarded early as compared to the weaning practices in other conventional and commercial set-ups.

Table 3: Parity effect on reproductive performance of rabbit

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Mean (±SE) parity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First</td>
</tr>
<tr>
<td>Litter Size at birth (LSB)</td>
<td>5.82±0.13</td>
</tr>
<tr>
<td>Litter size at weaning (LSW)</td>
<td>4.69±0.03</td>
</tr>
<tr>
<td>Litter birth weight (LBW) (g)</td>
<td>154.26±1.36</td>
</tr>
<tr>
<td>Litter weaning weight (LWW) (g)</td>
<td>1460.56±52.52</td>
</tr>
<tr>
<td>Individual Kit birth weight (IKBW)</td>
<td>26.50±0.09</td>
</tr>
<tr>
<td>Individual Kit weaning weight (IKWW)</td>
<td>311.42±2.57</td>
</tr>
<tr>
<td>Gestation length (GL) (days)</td>
<td>31.02±0.03</td>
</tr>
<tr>
<td>Weaning mortality (WM) (%)</td>
<td>19.4±0.05</td>
</tr>
</tbody>
</table>

abc Row means with different superscripts differ significantly at P <0.05; SE=standard error.

The result in Table 3 agrees with the earlier reports in literature (Kabir et al., 2012b; Das and Yadav, 2007). Reporting further Das and Yadav (2007) argued that the reason might be the fact that in the third parity due to maturity of doe more ova were released from the ovary and therefore, there was more chance of increasing litter size at birth in third parity than first and second parity. The present findings however, contradicted earlier submissions of Das and Bujarbarua (2005) who reported significant (P <0.05) effect of parity on litter weight at birth. Variation in milk production has also been reported (Paufler, 1985) where the NZW females has been reported to produce less milk in their first lactation than subsequent lactations. This has been advanced as another reason for the low weaning weights observed in the litter of first parity does (Lukefahr et al., 1981). Average milk yield of a medium heavy doe on ad lib concentrate feed was 250g over a four week period of lactation (Paufler, 1985). Maximum daily milk yield is attained between the 18th and 23rd day after kindling and by the 42nd day it amounts to only 30–40% of maximum yield (Paufler, 1985). Fortun-Lamothe et al. (2001) observed that early weaning provides higher viability and faster growth in the weaned rabbits. The peak of milk production in the rabbits is considered to be at the 3rd week of lactation following the reports that lactation increases until the end of the 3rd week of lactation (Kustos et al., 1996; McNitt and Lukefahr 1996).

**CONCLUSION AND RECOMMENDATION**

It was concluded that, twice mating frequency improved most of the reproductive parameters measured (LSB=13.47, LSW=12.23, LBW=473.2g, WM=9.3%). Third parity was also found to significantly improve most of the parameters considered in this study (LSB=7.42, LSW=6.44, LBW=242g). It was therefore recommended that rabbit farmers in the northern guinea savannah zone of Nigeria should adopt twice mating frequency using the CHC breed of rabbit so as to have larger kits at birth (IKBW) and weaning (IKWW) with a general reduction in weaning mortality.

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