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BREED AND PARITY EFFECTS ON REPRODUCTIVE PERFORMANCE TRAITS OF RABBITS RAISED IN THE SAVANNA ENVIRONMENT OF SOUTHERN GUINEA, NIGERIA

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ABSTRACT: This study determined the effect of breed and parity on the reproductive performance of rabbits. A total of 96 adults (24 bucks and 72 does) of three breeds, namely Chinchilla (CHC), New Zealand White (NZW), and California White (CAW), were used for the study. The parameters included considered includes; litter size at birth (LSB) and weaning (LSW), litter weight at birth (LWB) and weaning (LWW), individual kit weight at birth (IKWB) and weaning (IKWW), and gestation length (GL). Only three parities (first, second, and third) were considered. The results indicated that breed significantly (P<0.05) affected all the parameters studied, except GL. The CAW breed produced the largest LSB (7.50), LSW (5.90), LWW (1850.77 g), and lowest WM (15.00 %) whereas the CHC breed displayed the highest LWB (169.48 g), IKWB (27.65 g), and IKWW (350.98 g) than the other two breeds. Parity significantly (P<0.05) affected all reproductive performance parameters measured, except GL. The results revealed higher values for the measured variables in the third parity than in the first and second parities. It was concluded that the CHC breed produced kits that were heavier at birth (IKWB) and at weaning (IKWW) whereas the CAW and NZW breeds produced more kits per litter (LSB) than the CHC breed, and third parity enhanced the reproductive performance traits.

Keywords: Breed, Parity, Rabbit, Reproductive traits, Southern guinea savanna

INTRODUCTION

According to the World Health Organization (WHO, 2017) malnutrition is a significant issue facing the global population, especially in developing countries. The severe inability to supply the high dietary protein requirements and the resulting intense competition between humans and livestock are indicators of this (Suman et al., 2015). 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., 2013).

According to Oloruntola et al. (2015), rabbits have several characteristics, such as small size, growth, high potential for reproduction, short generation interval, ability to use non-competitive feeds, ability to produce high-quality meat, and good potential for genetic improvement. These various characteristics make it a viable option for addressing the issue of poor protein consumption in developing countries and encourage its cultivation at both the commercial and subsistence levels. There has been increased awareness of the advantages of rabbit meat production in developing countries as a means of alleviating world food shortages (Ajala & Balogun, 2004). An immediate response to the decrease in food production that could cause human nutritional inadequacies in human is needed (Amaduruonye et al., 2018). As an alternative, the focus has been on the production of micro-livestock. Rabbits are extremely prolific and have a brief gestation period (Mafimidiwo et al., 2022). Rabbits meat has been linked to vascular illnesses such as arteriosclerosis because of its low cholesterol content (Fortes et al., 2020), and this could be linked to the rabbits' high genetic selection potential, efficient feed and land space utilization, limited competition with humans for foods and high quality nutritious meat (Ayo-Ajasa et al., 2015). Rabbit farming is becoming increasingly attractive due to its high reproductive potential (Kabir et al., 2012a), high mothering ability (Kabir et al., 2012b), adaptability to a wide range of climatic conditions, high genetic variability (Kabir et al., 2011a), high roughage utilization potential (Iyeghe-Erakpotobor et al., 2009), and low cost of production (Aduku & Olukosi, 1990).

Genetic improvement of rabbits is important to increase their contribution to the animal protein that Nigeria needs. Knowledge of breeds and parity, litter growth, and weaning characteristics in many generations is a prerequisite for this improvement (Fayeye & Ayorinde, 2010). Genetic improvement of rabbit, is a vital scope on the way to increasing their contribution to the much needed animal protein in developing countries (Okoro et al., 2010). However, the importance and efficacy of rabbit production in Nigeria has not been fully harnessed with respect to the profitability and their impact in meeting the animal protein demand in Nigeria. To reduce the production cost and increase the profitability of rabbit production, genetic improvement of the adapted breed must be undertaken. Knowledge of genetic parameters for important economic traits is a pre-requisites for genetic improvement (Akanno & Ibe, 2006). Several types of farm animals, including those from Nigeria, including rabbits, are used to produce meat. Rabbits are an abundant source of meat with a high protein nutritional value. Fast development and the capacity to effectively use of forages are two exceptional qualities that encourage rabbit production. Rabbits can rebreed multiple times in a year, have a short gestation period, and reach early sexual maturity (Sharp et al., 2007). 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).

In Nigeria, many breeds of rabbits, such as Giant Flemish, Chinchilla and the Rex are available in most farms. Other breed abounds in some well-organized farms in Nigeria, including the New Zealand White, Californian White, and recently Hyla. Lukefahr and Hamilton (1997) studied the productive performance of New Zealand White and Californian White in particular. Moreover, detailed information about the effect of breed, parity and mating frequency on the reproductive performance of rabbit in the Southern Guinea Savanna zone of Nigeria is not available for commercial rabbit farming, which prompted the study.

MATERIALS AND METHODS

Experimental site

The study was conducted at the Rabbitary Unit of the Teaching and Research Farm of Agricultural Education Department of Emmanuel Alayande University of Education, Oyo, Oyo State. Oyo lies on the longitude $3^{o}\,7^{'}$ east of the Greenwich Meridian and latitude 7° 5' north of the equator. It is about 5 km northeast Ibadan, the capital of Oyo state. The altitude is between 300 and 600 m above sea level. The mean annual temperature is about 27°C (GoogleMap, 2025), while that of rainfall is 1165 mm.

Experimental Animals and their Management

A total of 96 rabbits of three breeds of rabbit were used and sourced from pre-existing rabbits on the Rabbitry Unit of the farm, namely Chinchilla (CHC), New Zealand White (NZW) and, California White (CAW), each having 24 adult females (does) and 8 adult males (bucks). The 72 does were in the age group of 7-8 months and weighed 2.20 - 2.50 kg, while the 20 bucks belonged to the age category of 8-9 months and weighed 2.30 - 2.60 kg. The mating plan was as described by Kabir et al. (2011b).

Feeding of rabbits

There were three parity and mashed concentrate diet (100g) was given in the morning, and green roughage was supplied ad libitum in the afternoon. The composition of feed was similar for all experimental rabbits and in accordance with the 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 Dry Matter - 93.14, Crude Protein - 14.48, Ash - 7.15, Ether Extract - 10.25, Crude Fibre - 10.64, Non-Fibre Extract - 57.83 and Moisture context - 92.88%. The other routine management was the same. Feed was analyzed regularly once a month as per the standard method described in A.O.A.C. (2005).

Data Collection

A total of 785 data on different reproductive parameters recorded over 18 months (June-December 2019) on 92 rabbits were considered. The parameters included litter size at birth (LSB), litter size at weaning (LSW), litter weight at birth (LWB), litter weight at weaning (LWW), individual kit weight at birth (IKWB), individual kit weight at weaning (IKWW), gestation length (GL) and weaning mortality (WM). The weight measurements were obtained using a digital scale calibrated in grams (g). The variables were obtained by the procedure described by the Food and Agricultural Organization (FAO, (2012).

Statistical Analysis

The experiment followed a completely randomized design (CRD), and the data obtained were subjected to one-way analysis of variance using SAS's general linear model (GLM of SAS, 2009) means were compared for significant differences using Duncan's multiple range test of the same software. The following model was adopted:

$Y_{ijk} = \mu + B_i + P_j + (BP)_{ij} + e_{ijk}$

Where,

Y_{ij} = j^{th} Individual observation within the i^{th} genotype

μ = Overall mean

B_i = Fixed effect of the i^{th} breed (i = 1, 2, 3)

P_j = Fixed effect of the j^{th} parity (i = 1, 2, 3)

$(BP)_{ij}$ = interaction effect of i^{th} breed and j^{th} parity

e_{ijk} = evenly distributed experimental errors

Results

Table 1 shows the least square means and standard errors of reproductive performance traits as affected by different breed of rabbits. There were significant (P<0.05) differences between the rabbit breeds and the reproductive performance traits measured. The California White (CAW) displayed superiority in terms of the largest LSB (7.50), LSW (5.90 g) and LWW (1850.77 g) coupled with the least WM (15.00 %) than its other counterpart breeds. The breed of New White (NZW) was closely followed for all these parameters. The Chinchilla (CHC) breed had the highest LWB, IKWB, IKWW, and WM of 169.48 g, 27.65 g, 350.98 g, and 20.30 %, respectively over other of rabbit breeds. However, no significant (P >0 .05) variation existed between the rabbit and GL breeds.

Table 1: Least square means and standard errors of reproductive performance traits as affected by rabbit breed

Traits	**Breed**		
	CHC	**NZW**	**CAW**
Litter size at birth	6.15 ± 0.88^{c}	6.90 ± 0.95^{b}	7.50 ± 0.55^{a}
Litter size at weaning	4.96 ± 0.04^{c}	5.89 ± 0.23^{b}	5.90 ± 0.22^{a}
Litter birth weight (g)	169.48 ± 8.92^{a}	139.45 ± 3.92^{c}	150.04 ± 7.29^{b}
Litter weaning weight (g)	1611.45 ± 56.67^{c}	1732.42 ± 81.22^{b}	1850.77 ± 60.55^{a}
Individual Kit birth weight (g)	27.65 ± 2.11^{a}	22.96 ± 2.31^{b}	21.12 ± 1.34^{b}
Individual Kit weaning weight (g)	350.98 ± 9.45^{a}	330.89 ± 8.34^{b}	318.45 ± 7.22^{c}
Gestation length (days)	31.00±0.04	30.02±0.02	31.00±0.04
Weaning mortality (%)	20.30 ± 0.11^{a}	17.20 ± 0.03^{b}	15.00 ± 0.01^{c}

[abc] Means along the same row with different superscripts were significantly (P<0.05) different

CHC = Chinchilla, NZW = New Zealand White, CAW = California White

Table 2 shows the least square means and standard errors of reproductive performance traits as affected by rabbit parity. Significant (P<0.05) effect existed between the parity and the reproductive performance parameters measured. Generally, the parity increases from each parity to each other as in order Frist < Second < Third. The LSB, LSW, LWB, LWW, IKWB, and IKWW were superior for the third parity with values of 7.54, 6.39, 249.33, 2196.39, 35.98 and 325.98 g respectively, which were better than other parities. The second parity was followed closely while the lowest values were observed for these variables in the first parity. The third parity also had the lowest weaning mortality of 10.34 %. However, the GL had non-significant (P > 0.05) variations across the first, second, and third parity.

Table 2: Least square means and standard errors of reproductive performance traits as affected by parity of rabbits

Traits	Parity		
	First	**Second**	**Third**
Litter size at birth	5.90±0.25^{c}	6.74±0.12^{b}	7.54±0.26^{a}
Litter size at weaning	4.72±0.11^{c}	5.45±0.05^{b}	6.39±0.23^{a}
Litter birth weight (g)	165.45±7.99^{c}	194.67±9.45^{b}	249.33±9.78^{a}
Litter weaning weight (g)	1570.78±45.77^{c}	1706.21±91.45^{b}	2196.39±56.34^{a}
Individual Kit birth weight (g)	22.58±1.19^{c}	28.93±1.07^{b}	35.98±0.28^{a}
Individual Kit weaning weight (g)	319.89±5.87^{b}	307.23±9.89^{c}	325.98±12.65^{a}
Gestation length (days)	30.23±0.33	30.25±0.40	30.15±0.90
Weaning mortality (%)	15.99±0.11^{b}	20.30c ±0.78^{a}	10.34±0.16^{c}

^{abc} Means along the same row with different superscripts were significantly (P<0.05) different

Discussion

The pattern and variations displayed by the breed of rabbits and reproductive performance parameters, such as litter size at birth (LSB), litter size at weaning (LSW), litter birth weight (LWB), litter weaning weight (LWW), individual kit birth weight (IKWB), individual kit weaning weight (IKWW), and weaning mortality measured revealed that these variables were breed-dependent. These observations corroborated the earlier reports of Akilapa et al. (2025); Kabir et al. (2012b); Irekhere, (2007); Das and Bujarbarua, (2006); Das and Bujarbarwa, (2005); Liang, (1996), and Rostogi, (1996). In their different studies, these authors claimed that reproductive performance of rabbits depends on the breed type, and this can be linked to the different genetic background of rabbits involved their studies. Kabir et al. (2012b) reported the largest LSB for CAW in their study, which is consistent with this current finding. This result of the heaviest LSB also agrees with the reports of Irekhore (2007), who stated that the California breed produced a higher litter size at birth than the New Zealand White, New Zealand Black, and Flemish Giant breeds. Liang (1996) reported much higher LSB and LWW values in NZW rabbits in China than those obtained in this study. However, Rastogi (1996) reported lower LSB and LSW in Trinidadian NZW rabbits. Similar to the present findings, Das et al. (2006) reported significantly better LSW and LWW in the NZW rabbit than in the Soviet Chinchilla; whereas Das and Bujarbarwa (2005) found no effect of breed on LWB. Iraqi et al. (2006) corroborated this finding in terms of LSB and LSW. However, Patialet et al. (1991) reported contradicted studies with this finding in respect of LWB and LWW in the New Zealand White in Egypt. The range of LSB values obtained in this study was higher than those reported by Fayeye and Ayorinde, (2003); Irekhore, (2007); Zalla et al. (2007), and Akpa and Alphonsus, (2008). It is also higher than other values reported by Oseni et al. (1999) and Akanno et al. (2004). The differences between the values in the literature and those obtained in this study could be attributed to the combined effects of breed and environment; study location, nutrition, management, and diseases.

Parity had a significant effect on all the reproductive parameters measured except GL and litter size at birth (LSB), LSW, LWB, LWW, IKWB, and IKWW were significantly higher in the third parity than in the first and second parities. This observation agrees with earlier reports by Akilapa et al. (2025); Ayo-Ajasa et al. (2015); Kabir et al., (2011c); Das and Yadav, (2007). Das and Yadav (2007) claimed that more ova were released from the ovary in the third parity due to maturity of doe, hence more chance of increasing litter size at birth in third parity than first and second parities. Akilapa et al. (2025) affirmed a similar pattern of parity for the Hyla breed of rabbit in southwest Nigeria. Lawal et al. (2024) study aligned with the pattern of the results observed presently on the parity of rabbits. Ayo-Ajasa et al. (2015) found a similar pattern of parity that favoured the last parity than the previous parity. However, the present findings contradicted earlier submissions of Das and Bujarbarwa (2005), who reported significant effect of parity on LWB. Variations in milk production have also been implicated (Paufler, 1985) where NZW females produce less milk in their first lactation than in subsequent lactations. This has been proposed as another reason for the low weaning weights observed in the litter of first parity does (Lukefahr et al., 1981). The average milk yield of a medium-heavy doe on ad libitum concentrate feed was 250g over a four-week period lactation period (Paufler, 1985). The 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 the maximum yield (Paufler, 1985). All kits in this study were weaned at 35 days postpartum, which was regarded as early compared to other conventional and commercial setups. Fortun-Lamothe et al. (2001) observed that early weaning provides higher viability and faster growth in weaned rabbits. The peak of milk production in the rabbits is considered to be at the third week of lactation following the reports that lactation increases until the end of the third week of lactation (Kustos et al., 1996). Generally, differences in the results obtained from this study with other researchers can be attributed to differences in breed, management and data analysis method used.

Conclusion

The CAW and NZW rabbits produced higher LSB with a corresponding better LWB than CHC rabbits. The CHC rabbits produced the heaviest kits with respect to IKWB and IKWW. Therefore, if the rabbit farmer’s is interest is higher LSB and LSW, then CAW and NZW should be exploited. CHC was the best breed for individual kit weight at birth and weaning. Rabbit farmers in the southern Guinea Savanna region of Nigeria could take advantage of maturity in the third parity does in terms of improved LSB, LSW, LWB, and lowered mortality as revealed by the present study.

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