JOURNAL OF SCIENCE, TECHNOLOGY AND EDUCATION (JSTE) VOL. 4. NO. 10
JSTE PUBLICATIONS, 2020 www.nsukjste.com
ISSN: 2651-5539

EFFECTS OF BREED AND PARITY ON REPRODUCTIVE PERFORMANCE OF RABBITS REARED IN SOUTHERN SAVANNA ZONE OF NIGERIA

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Citation: Amao, S. R. (2020). Effects of breed and parity on reproductive performance of rabbits reared in southern savanna zone of Nigeria. *Journal of Science, Technology and Education (JSTE)*; http://nsukjste.com. 4:10;pp 114-123

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) comprises of three breeds were used namely Chinchilla (CHC), New Zealand White (NZW) and California White (CAW) for the study and the parameters 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) and only three parities (first, second and third) were considered. The results obtained 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 %) while CHC breed displayed the highest LWB (169.48 g), IKWB (27.65 g) and IKWW (350.98 g) than in the other two breeds. Parity significantly (P<0.05) affected all the reproductive performance parameters measured except GL. The results revealed higher values in the third parity than in the first and second parities for the variables measured. It was concluded that CHC breed produced kits that were heavier at birth (IKWB) and at weaning (IKWW) while CAW and NZW breeds produced more number of kits per litter (LSB) than the CHC breed and third parity enhanced the reproductive performance traits.

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

Introduction

There has been increased awareness of the advantages of rabbit meat production on the developing countries as a means of alleviating world food shortages (Ajala & Balogun, 2004), This could be linked to the rabbits' high genetic selection potential, efficient feed and land space utilization, limited competition with human for foods and high quality nutritious meat (Ayo-Ajasa, Aina, Sowande, Egbeyale, Ozoje, Oso, Oso, Abiona, & Abel, 2015). Rabbit farming is becoming more and more attractive due to high reproductive potentials (Kabir Akpa, Nwagu & Adeyinka, 2012a), high mothering ability (Kabir, Akpa, Nwagu & Adeyinka, 2012b), adaptability in wide range of climatic conditions, high genetic variability (Kabir, Akpa, Nwagu, Adeyinka, & Bello, 2011a), high roughage utilization potentials (Iyeghe-Erakpotobor, Sekoni & Esievo, 2009) and low cost of production (Aduku & Olukosi, 1990).

Genetic improvement of rabbits is important in order to increase their contribution to the much needed animal protein in Nigeria. A prerequisite for this improvement is the knowledge of their breeds and parity, litter growth and weaning characteristics in many generations (Fayeye & Ayorinde, 2010). Improvement of rabbit genetically, is a vital scope on the way to increasing their contribution to the much needed animal protein in developing countries (Okoro, Ezeokeke & Chukwudum, 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 much needed animal protein in Nigeria. In other to reduce the production cost and increase the profitability of rabbit production, genetic improvement of the adapted breed has to be undertaken. One of the pre-requisites for genetic improvement is the knowledge of genetic parameters for important economic traits (Akanno & Ibe, 2006). In Nigeria, many breeds of rabbits are available in most farms such as Giant Flemish, Chinchilla and the Rex. Other breeds abounds in some well-organized farms in Nigeria include the New Zealand White and Californian White. The productive performance of New Zealand White and Californian White in particular has been studied by Lukefahr and Hamilton (1997). Moreover, detailed information about the effect of breed, effect of parity and effect of mating frequency on the reproductive performance of rabbit in the Southern Guinea Savanna zone of Nigeria is not available for commercial rabbit farming and this prompted the study.

Materials and Methods

Experimental site

The study was carried out at the Rabbitary Unit of the Teaching and Research Farm of Agricultural Education Department of Emmanuel Alayande College of Education, Oyo. Oyo State. Oyo lies on the longitude 3^{o} $7^{'}$ East of Greenwich meridian and Latitude 7^{o} $5^{'}$ North of the equator. It is about 5 kilometers north-eastward from Ibadan, the capital of Oyo state. The altitude is between 300 and 600 meters above sea level. The mean annual temperature is about 27^{o}C (Amao, 2020) while that of rainfall is 1165mm.

Experimental Animals and Management

A total of 96 of three breeds of rabbit were used and soured from pre-existed 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 to 2.50 kg, while the 20 bucks belong to the age category of 8-9 months and weighed 2.30 to 2.60 kg. The mating plan adopted was as described by Kabir, Akpa, Nwagu, Adeyinka, & El-Inguini, (2011b).

Feeds and Feeding of the rabbits

There were three parities. Mashed concentrate diet was given at 100 g 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 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%, respectively. Other routine management was the same. Feed was analyzed regularly once a month as per standard method described in A.O.A.C. (2000).

Data Collection

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). There variables were obtained by the procedure described by Food and Agricultural Organization -FAO, (2012).

Statistical Analysis

The experiment followed a completely randomized design (CRD) and the data obtained were subject to one way analysis of Variance using the General Linear Model (GLM) of SAS (SAS, 2009) while means were compared for Significant difference using the 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} = jth Individual observation within the ith genotype

μ = Overall mean

B_i = Fixed effect of the ith 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} = Experimental errors which is evenly distributed

Results

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

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

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

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 (LSB)	5.90±0.25[c]	6.74±0.12[b]	7.54±0.26[a]
Litter size at weaning (LSW)	4.72±0.11[c]	5.45±0.05[b]	6.39±0.23[a]
Litter birth weight (LWB) (g)	165.45±7.99[c]	194.67±9.45[b]	249.33±9.78[a]
Litter weaning weight (LWW) (g)	1570.78±45.77[c]	1706.21±91.45[b]	2196.39±56.34[a]
Individual Kit birth weight (IKWB) (g)	22.58±1.19[c]	28.93±1.07[b]	35.98±0.28[a]
Individual Kit weaning weight (IKWW) (g)	319.89±5.87[b]	307.23±9.89[c]	325.98±12.65[a]
Gestation length (GL) (days)	30.23±0.33	30.25±0.40	30.15±0.90
Weaning mortality (WM) (%)	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

Table 2 revealed the least square means and standard errors of reproductive performance traits as affected by parity of rabbits. 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 third parity with values of 7.54, 6.39, 249.33 g, 2196.39 g, 35.98g and 325.98 g better than other parities and followed closely was the second parity while the least values were observed for these variables in the first parity. The third parity also had the least weaning mortality of 10.34 %. However, the gestation length (GL) had non-significant (P>0.05) variations across the first, second and third parity.

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 morality measured revealed that these variables were breed dependent. These observations were corroborated the earlier reports of Kabir *et al.* (2012b); Irekhere, (2007); Das, Das & Bujarbarua, (2006); Das and Bujarbarwa, (2005); Liang, (1996) and Rostogi, (1996). These authors in their different studies claimed that reproductive performance of rabbits depends on the type of breeds and this can be linked to the different genetic background of rabbits involved their studies. Kabir *et al.* (2012b) reported largest LSB for CAW in their study and this agreed with this current findings. This result of heaviest LSB also agrees 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. Liang (1996) reported much higher LSB (7.50) and LWW (3.32 kg) in NZW rabbits in China than the value obtained in this study. However, Rastogi (1996) reported lower LSB (5.20) and LSW (4.30) in NZW rabbits in Trinidad. Similar to the present findings Das *et al*. (2006) reported significantly better LSW and LWW in the NZW rabbit than the Soviet Chinchilla; while Das and Bujarbarwa (2005) found no effect of breed on LWB. Iraqi, Ibrahim, Hassan and Deghadi, (2006) report corroborated with this finding in terms of LSB and LSW. However, the report of contradicted studies with this finding in respect of LWB and LWW in the New Zealand White in Egypt was claimed by Patial, Manuja, Gupta and Sanjeet (1991). The range of value for LSB obtained in this current study was higher than the LSB values reported by Fayeye and Ayorinde, (2003); Irekhore, (2007); Zalla, Hassan, Maigandi and Daneji, (2007); Akpa and Alphonsus, (2008). It is also higher than other reported values in studies of Oseni, Odubote and Akinokun, (1999); Akanno, Ibe and Ogundu, (2004). The differences values in literature with those obtained from this study could be attributed to the combined effects of breed and environment; study location, nutrition, management and diseases.

The parity had 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 in this current study. This observation agrees with the earlier reports of Ayo-Ajasa *et al.* (2015); Kabir, Akpa, Nwagu and Adeyinka, (2011c); Das and Yadav, (2007). Das and Yadav (2007) claimed that in the third parity due to maturity of doe more ova were released from the ovary, hence more chance of increasing litter size at birth in third parity than first and second parities. Ayo-Ajasa *et al.* (2015) found similar pattern of parity documented in this study 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 has also been implicated (Paufler, 1985) whereby the NZW females 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, Honenboken, Cheeke, & Patton, 1981). Average milk yield of a medium heavy doe on *ad libitum* 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). All 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 setups. Fortun-Lamothe, Gidenne, Chalaye and Debray (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 third week of lactation following the reports that lactation increases until the end of the third week of lactation (Kustos, Szendro, Csapa, Biro, Raindai, Biro-Nemth & Balint, 1996). Generally, differences in the results obtained from this study with other researchers can be attributed to differences in breed, management and method of data analysis used.

Conclusion

The CAW and NZW rabbits produced higher LSB with a corresponding better LWB than the CHC rabbits. The CHC rabbits produced the heaviest kits in respect of IKWB and IKWW. Therefore, if the interest of the rabbit farmer is higher LSB and LSW, then CAW and/or NZW should be exploited. Otherwise, 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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