BREED AND DOE'S BODY WEIGHT EFFECT ON LITTER WEIGHT AND NUMBER OF RABBITS RAISED IN SOUTH SOUTH NIGERIA

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ABSTRACT

A total of twenty four does of New Zealand White (NZW), Dutch (DUT) and their crosses i.e. NZW x DUT were used to determine the effects of breed and dam's body weight on litter weight and number of rabbits in South South Nigeria. The rabbits were kept in cages and were artificially inseminated and monitored for a period of one year. Data on body weight before mating (BWBM), body weight after mating (BWAM), body weight before kindling (BWBK), body weight after kindling (BWAK), litter size (LS) and litter weight (LW). Data generated were analyzed using Analysis of Variance (ANOVA). The results showed significant difference (p<0.05) in BWBM and BWAM in DUT and NZW x DUT breeds of rabbits, DUT recorded the highest values of BWBM and BWAM, while NZW x DUT had the least values of BWBM and BWAM. BWAK was significantly different between DUT and NZW x DUT. More so, NZW x DUT recorded the highest values for LS and LW. The results also showed that breed effect had negative correlation with BWBW, BWAM and BWAK with correlation values of -0.64, -0.64 and -0.207 respectively. The breed of rabbits also revealed a high correlation between BWBM and BWAM. BWAK showed a high correlation between BWAM and BWBK. The information provided by this study revealed that breed and the body weight of the dam influenced litter weight and litter number which can be harnessed in improvement programmes for rabbits.

Keywords: Rabbits, Breed, Body weight, Litter size, Litter number

INTRODUCTION

Rabbit breeding has played an indispensable role in meat and fur production in many countries of the world and more recently, there has been a rising awareness of rabbit breeding and consumption in the South-South region of Nigeria on the fact that rabbit production is an alternative means of alleviating food shortages and the problem of inadequate animal protein (Kalio *et al*., 2008). Factors such as breed, season, age and weight of females have been reported to have great impact on the reproductive performance of rabbits (Lazzaroni *et al*., 2012) and the production efficiency of commercial rabbit farms has been reported to largely depend on the litter size at kindling and the survivability of the bunnies up to weaning (Odeyinka *et al*., 2008). Some authors have done works on improving the performance of rabbits. Crossbreeding according to Nofal *et al*. (1997) is one of the fastest tools breeders use to improve many economic traits in farm animals. According to Fadare and Fatoba (2018), reproductive performance is an important trait of interest affecting productivity and economic success. In a study involving New Zealand White and California White rabbits, Maj *et al*. (2009) observed that crossbred rabbits performed better than purebred rabbits in terms

of growth rate. Oke *et al*. (2011) also observed significant differences in growth traits among breeds of rabbits. The documented breed differences in growth rate for exotic breeds could be exploited and used in breeding programme to develop a fast growing indigenous strain adaptable to hot environment. Das and Yadav (2007) reported no significant difference between NZW and SC for prolificacy and litter weights at birth and weaning. Also, Ponce de León *et al*. (2000) reported that the New Zealand had the highest performance in terms of reproductive ability compared to Semi-giant, Chinchilla and California breeds. Adeyinka *et al.* (2007) in their study on the factors affecting some traits of economic importance of rabbit in a tropical environment of Northern Nigeria stated that litter size at birth in rabbit was negatively correlated with individual rabbit weight at birth. Iraqi *et al.* (2007) in their study on estimation of genetic parameters for litter traits in Gabali rabbits raised in the north-western coast of Egypt using multi-trait animal model reported a strong positive correlation of 0.991 between litter size at birth and litter weight at birth. Despite these reports, there is scarcity on similar reports for rabbits raised in the South-South region of Nigeria. Hence, this study was embarked upon to determine the effects of breed and dam's body weight on litter weight and number of rabbits in South-South region of Nigeria.

MATERIALS AND METHODS

Ethical Approval: This study was conducted after approval of Animal Ethics Committee of the Department of Animal Science, Faculty of Agriculture, University of Port Harcourt, Port Harcourt, Nigeria.

Rabbits Management and Data Collection: The experiment was conducted at Rabbitry Unit of the Teaching and Research Farm of the Faculty of Agriculture, University of Port Harcourt, Port Harcourt, Rivers State. The rabbits were housed in hutches made of metals with a dimension of each hutch as 60 x 60 x 60 cm^3. Feeders and drinkers were also provided to allow *ad libitum* feeding of the rabbits. Hybrid growers mash containing 18 % crude protein and water was given to the rabbits in the morning while forages were administered in the evening. The research involved twenty four rabbits of three different genotypes i.e. four males and four females of New Zealand White (NZW), four males and four females of Dutch (DUT) and four males and four females of New Zealand White x Dutch (NZW x DUT) which were arranged in a 2 x 3 factorial experiment design. Mating was done through artificial insemination by collecting semen from the bucks with the aid of artificial vagina and artificially inserted into the vagina of the does. Data on body weight before mating (BWBM), body weight after mating (BWAM), body weight before kindling (BWBK), body weight after kindling (BWAK), and litter weight (LW) were collected using Camry Electronic Balance, Model EK5350 and Camry Dial Spring Balance. The litter size (LS) for each of the does was also recorded.

Data Analysis: Data collected from this research were subjected to Analysis of Variance (ANOVA), correlation matrixes and multiple regression using Statistical Package for Social Sciences (SPSS) version. 16. $P<0.05$ was accepted as significant. The ANOVA results were presented as means ± standard error of means, while correlation statistics result was presented as matrixes in table.

RESULTS

The result showed significant difference ($p<0.05$) on the effect of breed on BWBM, BWAM and BWAK (Table 1). DUT (2218.33 ± 86.49 g) had the highest value of BWBM. This was followed by NZW (2006.14± 71.02 g) and the least in the cross between NZW and DUT (1912.00 ± 57.32 g). However for BWAM, DUT (2415.83 ± 90.06 g) had the highest value and was followed by NZW x DUT (2261.25 ± 69.43 g) with the least value observed in NZW (2154.29 ± 113.95 g). BWBK was not significantly different ($p>0.05$) across the breeds, however, NZW had numerical higher value of (2597.14 ± 95.86) and the least BWBK value was observed in NZW x DUT (2424.00 ± 109.44 g).

Table 1: Effect of breed on body weight of dam before and after mating and kindling, litter size and litter weight

BREED	BWBM	BWAM	BWBK
NZW	2006.14 ± 71.02^{ab}	2154.29 ± 113.95^{ab}	2597.14 ± 95.86^{ns}
DUT	2218.33 ± 86.49^{b}	2415.83 ± 90.06^{b}	2496.67 ± 103.33^{ns}
NZW x DUT	1912.00 ± 57.32^{a}	2261.25 ± 69.43^{a}	2424.00 ± 109.44^{ns}
	BWAK	**LS**	**LW**
NZW	2382.86 ± 94.06^{b}	5.57 ± 0.30^{ns}	291.43 ± 10.56^{ns}
DUT	2356.67 ± 82.75^{b}	5.50 ± 0.52^{ns}	259.58 ± 20.88^{ns}
NZW x DUT	2070.00 ± 55.32^{a}	5.80 ± 0.20^{ns}	304.00 ± 7.48^{ns}

a, b: Values within each group with different superscripts differ significantly (p<0.05); ^{ns} = Not significant (p>0.05), NZW - New Zealand White; DUT = Dutch; NZW x DUT = Cross between New Zealand White and Dutch, BWBM = Body weight before mating; BWAM = Body weight after mating; BWBK = Body weight before kindling; BWAK = Body weight after kindling; LS = Litter Size; LW = litter weight

Breed significantly had effect on BWAK with values for NZW (2382.86 ± 94.06 g) and DUT (2356.67 ± 82.75 g) significantly higher (p<0.05) than that of NZW x DUT (2070.00 ± 55.32 g). Litter size and litter weight were not significant (p>0.05) across breeds but were numerically higher in NZW x DUT than NZW and DUT (Table 1).

The multiple regression summaries on the effect of dam's weight and litter size on litter weight are presented in Table 2. The multiple correlation coefficient (r) value was 0.998 and the coefficient of determination (R Square) was 0.995. These high values indicated that the model used was very reliable. The model also showed significant effect (p<0.05) of the effect of dam's weight and litter size on litter weight across the breeds of rabbits in this study.

The multiple regression coefficients on the effect of dam's weight and litter size on litter weight indicated that only the weight after kindling was significantly (p<0.01) affected amongst all the parameters considered (Table 3). Under the unstandardized coefficients, litter size was the best contributor to litter weight with a coefficient value of -5.306. The negative value implied that with an increase in litter size, there will be a corresponding decrease in litter weight. Other coefficient values were BWBM (0.000), BWAM (-0.035), BWBK (0.279) and BWAK (-0.212).

The Pearson's correlation coefficient between breed, body weight of dam before and after mating/kindling, litter size and litter weight indicated that significant relationships were observed between BWBM and BWAM (r = 0.569); BWBM and LW (r = 0.440); BWAM and BWBK (r = 0.493) and BWAK (r = 0.711) (Table 4). Also, there were high significant relationships between BWBK and BWAK (r = 0.811) and between LS and LW (r = 0.765). There were negative relationship between breed and all parameters considered except for LS and LW.

DISCUSSION

The results in this study revealed that breed affected body weight of does before and after mating and kindling. This may be as a result of differing hormonal responses of these dams to pregnancy and parturition. Although there were numerical differences in the values of litter size and litter weight of the rabbits in this study, the values were not significantly different across breeds. This could mean that apart from genetic factors, there are other non-genetic factors that affect litter size and litter weight. Kabir *et al.* (2012) in their study on litter traits in a diallel crossing of three rabbit breeds in Northern Guinea Savannah zone of Nigeria reported that California White rabbits produced significantly higher litter size at birth than the Chinchilla and New Zealand White does. The result of this study was also in agreement with the findings of Ozimba and Lukefahr (1991) that crossbred rabbits had higher offspring than purebred rabbits. Also, the results of this study corroborated with that of Ghosh *et al.* (2008)

Table 2: Multiple regression summaries on the effect of dam's weight and litter size on litter weight

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate	
1	0.998[a]	0.995	0.987	2.276	
	Change Statistics				
	R Square Change	F Change	df 1	df 2	Significant F Change
	0.995	121.109	5.000	3.000	0.001

[a] = *Predictors: (Constant), litter size, weight before mating, weight after kindling, weight after mating, weight before kindling*

Table 3: Multiple regression coefficients on the effect of dam's weight and litter size on litter weight

Model		Unstandardized Coefficients		Standardized Coefficients	t value	Significant level
		B	Standard Error	Beta		
1	**Constant**	175.13	251.54		0.70	0.54
	Body weight before mating	0.00	0.00	-0.02	-0.32	0.77
	Body weight after mating	-0.04	0.03	-0.28	-1.09	0.36
	Body weight before kindling	0.28	0.09	1.06	3.08	0.05
	Body weight after kindling	-0.21	0.04	-1.60	-5.96	0.01
	Litter size	-5.31	6.29	-0.08	-0.84	0.46

Table 4: Pearson's correlation coefficient of the relationship between breed, body weight of dam before and after mating/kindling, litter size and litter weight

	Breed	BWBM	BWAM	BWBK	BWAK	LS	LW
Breed	1						
BWBW	-0.06	1					
BWAM	-0.06	0.57**	1				
BWBK	-0.20	0.78	0.49*	1			
BWAK	-0.39	0.19	0.71**	0.81**	1		
LS	0.05	-0.40	0.02	0.21	0.22	1	
LW	0.04	-0.44*	-0.12	0.22	0.07	0.77**	1

*Key: * = Significant at 0.05; ** = Significant at 0.01; BWBM = Body weight before mating; BWAM = Body weight after mating; BWBK = Body weight before kindling; BWAK = Body weight after kindling; LS = Litter Size; LW = litter weight*

who observed significant ($p<0.05$) breed effects on litter weights at birth and litter size at weaning with New Zealand White breeds being superior to their California White counterparts. However, the finding of this study disagreed with the findings of Kumar *et al*. (2005) who reported no significant differences among similar breeds maintained under similar environments.

The multiple regression analysis for predicting litter weight of rabbit from litter size, weight of doe before mating, weight of doe after kindling, weight of doe after mating and weight doe before kindling revealed very high regression coefficient. This indicated that these predictors were good in predicting litter weight of rabbit. The model was significant. According to Palos *et al.* (1996) foetal and birth weight depend primarily on the number of rabbits in the uterus. However, Poigner *et al.* (2000) reported that maternal effect had significant effect on birth weight and litter size. Adeyinka *et al.* (2007) in their study on the factors affecting some traits of economic importance of rabbit in a tropical environment of Northern Nigeria stated that litter size at birth in rabbit was negatively correlated with individual rabbit weight at birth. Iraqi *et al.* (2007) in their study on estimation of genetic parameters for litter traits in Gabali rabbits raised in the north-

western coast of Egypt using multi-trait animal model reported a strong positive correlation of 0.991 between litter size at birth and litter weight at birth.

Their results also revealed that out of the entire predicting variable, litter size contributed more to the litter weight of rabbit. Weight of doe before and after mating also contributed much to the litter weight of rabbit. This implied that improving body weight of doe before and after kindling through better nutrition can as well increase litter weight. This report was in line with the report of Poigner *et al*. (2000) in their study on the effect of birth weight and litter size on growth and mortality of rabbits, in which they reported that kits from larger litter size had lower weight at weaning than the corresponding kits from smaller litter size.

The significant, high and positive correlation between body weight of doe after mating, before and after kindling could be attributed to the physiological changes that take place in the body of the doe as a result of pregnancy. The results also confirmed that increased litter size will increase litter weight. Adeyinka *et al.* (2007) had explained the importance of assessing reproductive traits especially the maternal effect of body weight and on litter size. Di-Meo *et al.* (2004) in their study on the effect of birth weight and litter size on productive performance of rabbits concluded that litter weight, despite affecting weaning weight, does not result in significant differences in growth performance and that reduction in the size of the litter from 8 to 6 kits does not improve growth performance as rabbit doe reduce their milk yield. Fadare and Fatoba (2018) reported a strong negative correlation (-0.697) between the litter size at birth and kit weight at birth and a negative correlation between the pre-weaning mortality and kit weight at birth.

Conclusion: The results of this study revealed that breed and doe's body weight effected litter weight and number of rabbits raised in south – south Nigeria. From the regression model, it was also unveiled that, litter size was the best contributor to litter weight of rabbits. Furthermore, a high correlation between BWBM and BWAM was observed. Furthermore, BWAK had high correlation with BWAM and BWBK. This information can be harnessed in improvement programmes of rabbits in Nigeria.

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