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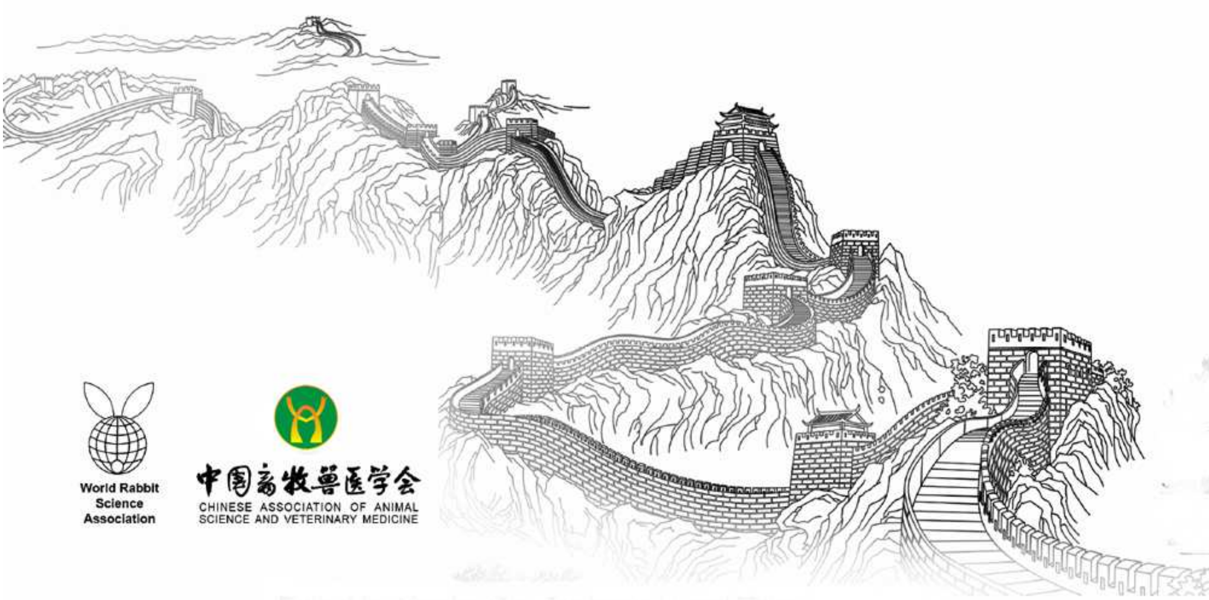

GESTATION LENGTH, LITTER SIZE AT BIRTH AND THEIR EFFECTS ON GESTATION WEIGHT GAIN, KINDLING LOSS, LIVE BODY WEIGHT OF KIT AND SURVIVAL IN DOMESTIC RABBIT IN NIGERIA

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ABSTRACT

Maternal influences play important roles in the expression of economically important traits. Domestic rabbit are well adapted to the cool temperate environments. However, there is dearth of information on the reproductive performance and the indirect maternal effects of gestation length and litter size on rabbit production in hot humid Sub-Saharan African countries. This study used the records of 532 kits born in 123 litters over two generations in a rabbit flock of 86 does and 48 bucks to determine the gestation length (GL) and litter size at birth and their effects on gestation weight gain (GWG), kindling weight loss (KWL), live body weight (LBW) of kit at birth, neonate survival and weaning characteristics in domestic rabbit. A range of 91 to 93 % of kits was born by the does on or before 33 days post-mating. 82 - 85 % of kits were born in litter sizes of 3 to 6. GL of ≤ 32 days did not significantly (P>005) influenced percent neonatal survival and mean kit birth weight. The longest GL (> 34 days) was accompanied by heavier kits, significantly (P<0.05) lower litter size and significant (P<0.05) kits born dead. GWG, KWL, LBW, litter size at weaning and litter gain increased significantly (P<0.05) with increased litter size at birth. Live body weight of kits at birth, live body weight gain from birth to weaning and weight difference among litter mate at weaning decreased significantly (P<0.05) with increased litter size at birth. Induction of kindling in prolonged gestation is recommended to reduce the death of neonate kits.

Key words: Birth weight, Gestation, Hot climate, Litter size, Survival, Weaning

INTRODUCTION

The success of any rabbit production enterprise depends on the number of kits per litter (Nofal *et al*., 2005) and survival kits from birth to weaning (Rashwan and Marai, 2000). According to Khalil and Mansour (1987) and Afifi *et al.* (1989), litter traits at birth and or weaning are doe (maternal) traits and the mating buck has little or no effects. Environment plays a significant role in the determination of reproductive traits. More information is still needed on gestation length and litter size performance and the indirect maternal influence of litter size and gestation length on rabbit production in hot humid climates. The aim of this work is to determine gestation length and litter size performance and their indirect maternal effects on gestation gain, kindling weight loss, live body weight of kits and neonate survival in domestic rabbit reared under the hot humid climate of Nigeria.

MATERIALS AND METHODS

Animal and Experimental Design

The annual rainfall, relative humidity, and temperature of the locations of the experiment was 600-1416 mm per annum, 57.9-84.0% and 19.7-37.0^0 C, respectively. The breeding flock consist of 48 bucks and 86 does of non-descript breed. Animals were housed in hutches measuring about 72 cm × 62 cm ×52 cm. Kits and does were fed mash diet containing 46.59% rice bran, 25.00% palm kernel cake, 15.50% rice offal, 1.50% Oyster shell, 0.55% bone meal and 0.50% salt. Feed (80 - 350g/doe/ day) and water (150 - 350ml/doe/ day) supplied varied with physiological state of the animal. The mash diet was supplemented with forage *ad libitum*. Does were taken to bucks for mating. Combination of gestation grunt, 7th day weight increment and abdominal palpation was used to confirm pregnancy. Straw for nesting was supplied into the kindling apartment or box after 28th day of pregnancy. A total of 532 kits were born in 123litters. Kits were weaned at 4 weeks. Dry does were re-mated within one week postpartum (in total neonatal deaths) or within one week after weaning their kits.

Data Collection

Data collected were: Gestation Length (GL; difference between date at kindling and date of successful mating), Litter Size at Birth (LSB), Gestation Weight Gain (GWG; difference between doe weight at mating and its weight one-day pre-partum), Kindling Weight Loss (KWL; difference in doe weight one-day pre-partum and its weight after kindling), Live Body Weight (LBW) of litter and kit, Neonatal Mortality (NM; approximately number born dead per litter). Litter Size at Weaning (LSW), Survival Rate to Weaning (SRW), Weaning Litter Gain (WLG; differences between litter birth and weaning weights), Kit Weight Gain (KWG; differences between kit birth and weaning weight), weight difference among litter mates at weaning and Weaning Sex Ratio (WSR). The records of gestation length were further used to compute the proportion of litters kindled per gestation period. Live body weights were obtained using either triple beam balance (OHAUS, 2610 capacity) or top loading balance (10kg capacity).

Statistical Analysis

Data collected were tested for significance (α = 0.05) using the mean comparison K-test. The mathematical model used is: $Yij = U + \alpha i + eij$. Where U, αi, and eij = overall mean, fixed effect of gestation length or litter size and error residual, respectively. A significant difference between two means was assumed where the calculated K-value was greater than 1.96.

RESULTS AND DISCUSSION

The proportion of kits that were born on or before the 29th, 30th, 31-33th and ≥ 34th day postpartum in generation 1were 0%, 6.91%, 83.74% and 7.32%, respectively. Corresponding values for kits born in the second generation were 2.71 %, 12.20 %, 68.8 % and 8.82 %, respectively. Long gestation period (≥ 33 days) resulted in significantly (P<0.05) low LSB and significantly (P<0.05) high LBW (Table 1). Neonatal mortality per litter was nominally high for kits born ≤30 days post-mating and among kits born ≥ 33 days post-mating (Table 1).

Table 1: Effect of gestation length on LSB, LBW, NM/L and %LX/LT

Gestation Length		No. of litter	No. of kits	LSB	NM/L	LBW	%LX/LT
G1	29	1	5	5.00 ± 2.05^{a}	0.00 ± 0.00^{a}	54.00 ± 0.00^{c}	2.03
	30	4	17	4.25 ± 2.05^{a}	0.00 ± 0.00^{a}	39.17 ± 6.37^{b}	6.91
	31	11	57	5.18 ± 1.34^{a}	0.00 ± 0.00^{a}	44.52 ± 6.31^{bc}	23.17
	32	23	111	4.83 ± 58^{a}	0.09 ± 0.28^{a}	51.26 ± 7.32^{c}	45.12
	33	8	38	4.75 ± 0.97^{a}	0.00 ± 0.00^{a}	48.89 ± 6.12^{c}	15.45
	34	1	5	5.00 ± 0.00^{a}	0.00 ± 0.00^{a}	40.00 ± 0.00^{bc}	2.03
	> 34	2	3	6.50 ± 0.50^{b}	0.50 ± 0.50^{a}	31.43 ± 1.43^{a}	5.29
G2	< 29	2	8	4.00 ± 0.00^{b}	0.50 ± 0.50^{a}	39.29 ± 6.96^{b}	2.71
	29	6	25	4.17 ± 0.90^{b}	0.67 ± 0.75^{a}	24.00 ± 3.27^{a}	8.47
	30	9	37	4.00 ± 1.49^{b}	0.22 ± 0.42^{a}	31.10 ± 5.19^{b}	12.20
	31	16	6	4.25 ± 1.15^{b}	0.00 ± 0.00^{a}	35.41 ± 7.32^{b}	23.05
	32	14	63	4.50 ± 1.24^{b}	0.14 ± 0.35^{a}	39.19 ± 6.76^{b}	21.36
	33	20	69	3.45 ± 1.50^{ab}	0.25 ± 0.62^{a}	44.54 ± 9.24^{b}	23.39
	34	5	13	2.60 ± 1.02^{a}	0.20 ± 0.40^{a}	44.07 ± 5.54^{b}	4.41
	>34	3	13	4.33 ± 1.25^{b}	0.00 ± 0.00^{a}	50.34 ± 6.34^{b}	4.41

Means in the same column with the same superscript are not significantly different (P > 0.05), G1 and G2 = Generation 1 and 2, respectively. NM/L, LSB, LBW = Neonatal Mortality per Litter, Litter Size at Birth, Live Body Weight, respectively.

GWG, KWL, LBW, LSW and WLG increased significantly (P<0.05) with increased LSB (Table 2). However, KBW tend to decrease with increased LSB. LSW increased significantly (P<0.05) with increased LSB. SRW, WLG and KWG were significantly (P<0.05) influenced by the litter size at birth (Table 3). Weight difference among litter mate at weaning increased significantly (P<0.05) with increased LSB. Litter size and weight of kits in the present study were within the range obtained by Lebas *et al*. (1986) and Orunmuyi *et al* (2006) in their reports on preweaning litter characteristics in rabbit. The number of kits born within 31 to 33 days post-mating was similar to 72 % reported by Wilson and Dudley (1952) in their study in rabbit breeds and crosses. The higher neonatal loss that accompanied long gestation length in the present work agreed with the earlier report of Patridge *et al*. (1981) in their work on purebred and cross bred commercial rabbits. A similar result was obtained by McNitt and Moody (1991) in their study of four medium breeds of rabbits in Louisiana. The use of prostaglandin F2α as a cost effective means of reducing mortality in long gestation have been suggested (Patridge *et al*., 1981).

Table 2: Effects of Litter Size at Birth on GWG, KWL, LBW, KBW, %NM and %LX/LT in domestic rabbit

TRAITS	1 – 2	3 – 4	5 – 6	>6	OVERALL
G1 GWG	0.00±0.00^{a}	273±51^{b}	279±82^{bc}	452±124^{c}	288±109^{bc}
KWL	50±0.00^{a}	134±47^{a}	212±89^{b}	327±119^{b}	199±101^{b}
LBW	60±17.00^{a}	184±41^{b}	251±34^{d}	280±26^{d}	221±68^{c}
KBW	52±14^{a}	54±19^{a}	47±9^{a}	39±8^{a}	48±9^{a}
%NM	0.00	1.25	2.21	0.00	1.62
%LX/LT	7.69	29.49	52.56	10.26	100.00
G2 GWG	177±77^{a}	162±78^{a}	279±182^{a}	-	196±126^{a}
KWL	109±48^{a}	150±57^{a}	195±49^{c}	200±0^{c}	158±61^{b}
LBW	56±22^{a}	138±37^{b}	178±38^{c}	202±79^{bc}	141±55^{b}
KBW	44±14^{b}	40±8^{b}	35±^{a}	29±11^{ab}	39±9^{a}
GL	32.56±1.33	31.67±2.27^{a}	31.57±1.52^{a}	32.0±0^{a}	31.75±1.91^{a}
%NM	8.00	8.67	5.09	6.67	6.87
%LX/LT	13.60	48.80	36.00	1.60	100.00

Means in the same column (and in the same generation) carrying the same superscript are not significantly different (P > 0.05), GWG, KWL, LBW, KBW, %NM and %LX/LT have been defined in the methodology

Table 3: Effects of litter size at birth on weaning characteristics in domestic rabbit

LSB	No of Kits	LSW	SRW	LGW	KWG	LMWD	WSR
1	5	1.00±0.00^{a}	100.00±00^{bc}	379.00±167^{abc}	379±107^{cd}	0±0^{a}	0.80±0.4^{b}
2	8	1.60±99^{b}	80.00±24.50^{ab}	423±136^{bc}	285±35^{abc}	20±20^{bcd}	0.50±35^{ab}
3	25	2.27±75^{cd}	75.82±25.05^{a}	533±278^{cd}	261±101^{ab}	45±38^{cdef}	0.50±32^{b}
4	58	2.90±1.09^{d}	72.50±27.27^{a}	676±316de	240±93^{a}	44±35^{af}	0.43±32^{b}
5	111	3.83±1.23^{ef}	75.86±23.71^{a}	828±363^{eg}	219±67^{a}	71±42^{efg}	0.51±0.25^{b}
6	74	4.63±1.50^{fg}	77.06±24.85^{a}	1131±45^{fg}	235±66^{a}	50±37^{f}	0.44±0.25^{b}
7	26	5.20±1.17^{g}	74.80±20.72^{ab}	1044±335^{g}	200±29^{a}	100±37^{gh}	0.46±0.34^{ab}
8	8	8.00±00^{h}	100.00±0.00^{c}	1655±0.00^{h}	207±0^{a}	115±0^{h}	0.25±0.00^{a}

Means carrying the same superscript on the same column are not significantly different (P>0.05).LSW, SRW, LGW, KWG, LMWD, WSR = Litter Size at Weaning, Survival Rate to Weaning, Litter Gain at Weaning, Kit Weight Gain, Litter Mate Weight Difference and Weaning Sex Ratio, respectively

The heavier birth weight associated with longer gestation may be due to the fact that such kits had more time to develop and gain weight. Sandford (1986) stated that litter weight is a function of gestation length and the shorter the gestation length the lighter the individual weights of the young that will be produced. However, Orunmuyi *et al* (2006) reported that gestation length does not exert significant effect on weaning weight of kits. The higher pre-weaning mortality observed in large litters may be due to increased competition for teat position. The influence of LSB on LSW and LGW observed in this study agree with the earlier report of Ozimba and Lukefahr (1991) and Rao *et al*. (1977), respectively. The present results agree with the observation of Khalil *et al*. (1987) that kits from small litters grow faster than those from large litters. The result on littermate weight difference suggests that does mothering ability decreased with increased litter size. There is therefore the need to foster some kits born in large litters. Overall sex ratio fell within the range (49 $\pm$ 8.7 to 51 $\pm$ 8.6 percent) reported by Milovanov *et al*. (1982). If a primary sex ratio of 1:1 is assumed, then the present study indicated that there is a higher preweaning survival of female kits than males, especially in litter sizes of more than five kits.

CONCLUSION

It is concluded that gestation length and litter size of kits influenced the investigated traits. There is therefore the need to induce kindling in does facing prolonged gestation. There is also the need for improved management of kits born in large litters to ameliorate the adverse effect it may have on the individual birth weight as well as pre-weaning weight and viability of young.

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