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Litter Size in Rabbits Managed at Dagwom Farm, Vom

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Abstract: The research was conducted at the Dagwom Farm of the National Veterinary Research Institute (NVRI), Vom. Data from crosses of California, Chinchilla, New Zealand White, Kotonou and Angora rabbits were used to assess the effects of year, season and gestation length on litter traits of breeding rabbits. A total of 1600 breeder rabbit records of five years were used. Litter size at birth and at weaning, gestation length and survival rate to weaning (SRW) were subjected to analysis. Results revealed that litter size at birth and at weaning averaged to 6.39 ± 0.05 and 4.86 ± 0.06 kits, respectively. Average SRW and gestation length were 76.06 ± 16.15 % and 30.28 ± 0.04 days, respectively. Significant ($P<0.001$) difference between years, seasons and gestation lengths were observed in litter size at birth and at weaning. SRW was only affected ($P<0.05$) by year. Differences between years and seasons were not significant in gestation length. A significantly ($P<0.01$) high correlation coefficients were obtained for litter size at birth and at weaning (0.758), litter size at birth and SRW (-0.581) as well as between litter size at weaning and SRW (0.824). This study revealed that the best productivity of the rabbit does remarkably could be appropriately mated between July and September with average gestation length between 27 and 30 days.

Key words: Litter size · SRW · Gestation · Rabbits

INTRODUCTION

Animal protein is one of the most important components of human meals and its consumption varies from country to another. In many developing countries, including Nigeria, there is inadequate consumption of animal protein [1]. The average consumption of animal protein in Nigeria is estimated at 4.5 g/head/day compared with the minimum recommended requirement of 35 g/head/day [2]. The cost of conventional sources of animal protein (cattle, sheep, goat, poultry and pig) has gone out of the reach of the common man that forms more than 70 % of the entire population. This is due to intimidating prices [3]. In a bid to solve this problem, the alternative and cheaper sources of high quality animal proteins like the rabbits (*Oryctolagus cuniculus*) are being harnessed [1, 4]. This is because the rabbit has a high reproductive potential which encompasses high fecundity and prolificacy, short generation interval, short gestation period, early sexual maturity of six to eight months (180-240 days) and low cost of feeding [5]. This is the reason for most small-scale farming families managing rabbitries in castes, living rooms, garages, open yards, backyards or sheds [6]. This species of animal, which were first domesticated by the Europeans, has a wide variety of breed families [7]. These breeds have resulted from natural mating (both in the wild and in constructed hutches) and through artificial insemination (AI). There is a great deal of variation between the breeds in terms of size, shape, coat colour, precocity, prolificacy, growth rate, age at maturity, litter size and kitten mortality [8, 9]. All things being equal, the last two parameters are the most critical to most rabbit farmers. This is because both parameters are affected by a number of factors including feed, water, pests, predators, fright, management, temperature, season and gestation length [10]. This study was directed towards assessing the effect of both gestation length and the seasons on litter size in rabbits for five years.

MATERIALS AND METHODS

Location and Climate: Vom is a town in Jos South Local Government Area of Plateau State. It is about 24 km to Jos-the capital city of Plateau State. It is located between latitudes 9° 43^{1} and 9° 44^{1} N and between longitudes

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8° 45[1] and 8° 47[1] E [11]. Its annual rainfall figures range between 1300mm and 1500mm and its maximum and minimum daily temperature average 28.6°C and 17°C, respectively. Its relative humidity is about 20.16% in the dry season and it could be as high as 80.45% in the rainy season [12].

Experimental Animals: Crosses of California; Chinchilla, New Zealand white, Kotonou and Angora were used. The Kotonou breed was introduced into the farm to reduce inbreeding of rabbits. It is black with White stripes, has erect earlobes, good conformation, disease resistant, good production record and very active. The other crossbred rabbits do not have specific patterns due to random mating. These rabbits were kept indoors in hutches of 120 x 60 x 60 cm, respectively in length, width and height. There were separate hutches for bucks, nesting and for growers. Hand mating was being practiced in which case the does were taken to the bucks. Routine management practices were adequately and appropriately carried out.

The major feed for the rabbits on the rabbitry farm was pelleted grower mash. The proportions of the ingredients used in formulating the pellets are presented in Table 1. The rabbits were also fed forages, which included Elephant grass, Rhodes grass, *Stylozanthes* species, *Centrosema* species and Alfalfa. Vegetables like cabbage, lettuce and post-harvest materials like groundnut stalk, sweet potato leaves, maize leaves etc. were also fed to the rabbits when available.

These plant materials which were given at least once a day; usually in the afternoon served as supplement to the feed given to the rabbits. Before being fed to the rabbits, they were chopped, washed with salt and are sun-dried. This was done to reduce possible anti-nutritional factors, which are harmful to the rabbits.

Data Collection and Analysis: A total of 1600 mature crossbred does were assessed for litter size at birth, litter size at weaning, survival rate to weaning and gestation length. Gestation length was taken as the difference between the date of kindling and the date at which successful mating occurred. Litter sizes were obtained by actual counts. Weaning was done at six weeks after kindling. Survival rate to weaning (SRW) was calculated as follows:

$$SRW = \left(\frac{Litter\ size\ at\ weaning}{Litter\ size\ at\ birth}\right) \times 100$$

Table 1: Ingredients used in formulating feed pellets for rabbits at Dagwom Farm, Vom

Ingredient	Kg/tonne	Kg/½ tonne
Maize	582	291
Soya bean cake	220	110
Wheat offal	140	70
Fish meal	5.0	2.5
Limestone	5.0	2.5
Premix	2.5	1.25
Methionine	1.5	0.75
Lysine	1.5	0.75
Salt	2.5	1.25
Bone meal	40	20
Total	1000	500

Mean values for these traits were tested for significance using the Ryan, Einot, Gabriel and Welsch (REGW) multiple step-down procedure of General Linear Model analysis of variance as contained in the Statistical Package for Social Sciences [13].

RESULTS

Litter sizes at birth and at weaning, gestation length and survival rate of kittens are presented in Table 2. These reproductive performance parameters averaged 6.39 ± 0.05 kits, 4.86 ± 0.06 kits, 30.28 ± 0.04 days and 76.06 ± 16.15 %, respectively. Litter sizes at birth and at weaning were significantly ($P<0.001$) different between years, seasons and gestation lengths. The average number of kits at birth and at weaning was highest in 2002 and 2003 ranging from 7.58 to 7.73 kits and 5.33 to 5.96 kits, respectively. Similarly, higher values were recorded between July and September (7.94 and 6.28 kits), respectively for the two traits. Gestation length did not vary significantly from 30.01 to 30.62 days between years and seasons. In the same vein, survival rate of kits to weaning (SRW) was unaffected by season and gestation length. Significantly ($P<0.05$) higher values of SRW were obtained in 2001 (78.71 %) and in 2003 (78.63 %). Litter size at birth and at weaning were significantly ($P<0.001$) higher for gestation lengths of not more than 29 days.

Correlation coefficients between parameters are presented in Table 3. Correlation values between litter size at birth and other parameters were significant ($P<0.01$). Gestation length correlated negatively with litter size at birth (-0.231) as well as with litter size at weaning (-0.180). There was positive correlation between litter size at birth and at weaning (0.758).

Table 2: Effects of year, season and gestation on litter size and survival rate (%) of kittens to weaning of rabbits managed at Dagwom farm, Vom

Variable	N	LS-birth (No. of kits)	LS-Weaning (No. of kits)	SRW (%)	Gestation Length (days)
Overall	1600	6.39 ± 0.05	4.86 ± 0.06	76.06 ± 16.15	30. 28 ± 0.04
Year		***	***	*	ns
2001	69	6.20 ± 0.08^{b}	4.88 ± 0.15^{b}	78.71 ± 17.70^{a}	30. 62 ± 0.19
2002	289	7.73 ± 0.05^{a}	5.33 ± 0.09^{ab}	68.95 ± 15.50^{ab}	30. 27 ± 0.11
2003	382	7.58 ± 0.04^{a}	5.96 ± 0.09^{a}	78.63 ± 14.24^{a}	30. 20 ± 0.09
2004	477	6.50 ± 0.04^{b}	4.77 ± 0.08^{b}	73.38 ± 16.04^{a}	30. 04 ± 0.09
2005	383	3.96 ± 0.04^{c}	2.49 ± 0.09^{c}	62.88 ± 15.13^{b}	30. 55 ± 0.09
Season		***	***	ns	ns
Jan.-March	467	5.09 ± 0.07^{c}	3.67 ± 0.08^{c}	72.10 ± 18.16	30. 36 ± 0.07
April-June	408	6.35 ± 0.07^{b}	4.74 ± 0.08^{b}	74.65 ± 23.17	30. 30 ± 0.07
July-Sept.	382	7.94 ± 0.08^{a}	6.28 ± 0.09^{a}	79.09 ± 18.64	30. 01 ± 0.08
Oct.-Dec.	343	6.19 ± 0.08^{b}	4.76 ± 0.08^{b}	76.90 ± 15.18	30. 35 ± 0.08
Gestation					
Length (days)	***	***	ns		
27	21	6.95 ± 0.13^{ab}	5.19 ± 0.26^{b}	74.68 ± 12.23	
28	246	6.72 ± 0.05^{b}	5.19 ± 0.92^{b}	77.23 ± 17.62	
29	218	7.79 ± 0.05^{a}	6.30 ± 0.10^{a}	80.87 ± 14.71	
30	358	6.35 ± 0.04^{b}	4.94 ± 0.78^{b}	77.80 ± 19.35	
31	451	6.40 ± 0.04^{b}	4.64 ± 0.72^{bc}	72.50 ± 16.16	
32	214	6.10 ± 0.05^{bc}	4.70 ± 0.94^{bc}	77.05 ± 17.51	
33	47	5.72 ± 0.09^{c}	4.34 ± 0.18^{c}	75.87 ± 18.25	
34	45	5.11 ± 0.92^{c}	3.58 ± 0.18^{d}	70.06 ± 19.10	

SRW = Survival rate to weaning Means for groups in homogenous subsets are similar.
* = P<0.05 *** = P<0.001 ns = Not significant
n = Number of observations LS = Litter size

Table 3: Correlation coefficients among reproductive parameters studied in rabbits managed at Dagwom farm, Vom

Variable	Litter size at birth	Litter size at weaning	Gestation length
Litter size at weaning	0.758**		
Gestation length	-0.231**	-0.180**	
Survival rate	-0.581**	-0.467**	0.824**

** Correlation coefficient is significant at P<0.01

DISCUSSION

Litter size, which is the number (count) of kits at birth, is affected by the genetic composition and nutrition of the doe among other factors [1, 14]. The productivity of does is highly dependent on the litter size at birth and at weaning; such that the more kits the doe kindles and weans, the greater the profitability of the enterprise [15]. The average size of litter at birth (6 kits) obtained in this study is very similar to what several researchers have reported. Litter size at birth of 6 and 7 kits was reported, respectively, for Japanese White and New Zealand White rabbits [16]. A similar report of 7 kits per litter was reported for New Zealand White [17], while, Irekhore [14] observed an average of 6 kits per litter in four different breeds of rabbits. On the other hand [5] reported an average litter size of 5 kits among crosses of New Zealand White and Chinchilla rabbits. It appears that, on the average, 6-8 kits is the most common range of litter size at birth.

The figure obtained in this study may be attributed to breed and strain of rabbits, body weight, age at sexual maturity and nutrition [18]. Litter size is subject to inverse maternal effect because 'mothers' or 'dams' who were themselves born in large litter size tend to have smaller litter size due to reduced body weight [19]. An optimal breeding age for rabbits has been reported [20] to be six months (180 days) such that rabbits that attain sexual maturity below and above this optimal age are said to be small and large breeds, respectively. Accordingly, they would have low and high litter sizes, which are outside the optimal range of 6-8 kits. In rabbit [1] and [21] reported that, inadequate nutrition may lead to ovarian inactivity and cessation of estrous in many cases; and consequently low litter size.

These reports suggest that the breed of rabbits studied were medium in size and which could reach sexual maturity at about six months of age. These rabbits must have been adequately fed with required nutrients hence they were able to optimally produce especially between

July and September when forages were in abundance. Some significantly higher sizes of litter at birth and at weaning have been observed by [19] for gestation lengths up to and including 32 days versus 29 days obtained in this study.

The small litter sizes obtained in this study were probably associated with longer gestation lengths. This agrees with the submissions of [22] and [23]. This occurrence may be attributed to litter weight and hormonal activities as gestation length prolongs. It has been observed by [22] that longer gestation lengths are accompanied by higher neonatal losses which results to higher proportion of still births (kits born dead). This report suggests that does with optimum gestation lengths of not more than 30 days could be selected for optimal performance.

Mean litter size at weaning in this study was 4.86 kits. This is similar to 4.9 kits observed in New Zealand White rabbits [5]. A lower value of 3.6 kits was reported by [24]. Litter size at weaning in this study was generally lower than at birth. This observation is in agreement to the findings of [18]. The decrease in litter size at weaning was as a result of pre-weaning mortality of kittens. Pre-weaning mortality may be due to breed, nest building, milking ability, mothering ability; all of which are heritable [14]. The size of litter at birth is also one important contributing factor to pre-weaning mortality [19]. Larger litter sizes increase competition for teat position. Severe competition may lead to death of weaker kits. Likewise, the quantity and quality of hair in the nest affect survival rate of kits leading to lower number of kits reaching weaning.

Survival rate, which is the ratio of the number of kits at weaning to that at birth, is one of the most important tools for measuring the overall profitability of the rabbit enterprise. Survival rate in the present study ranged between 62.88 and 80.87 %; with more than 70 % of the values falling in the 73 to 100 % range [19]. This suggests that the experimental animals were optimally prolific for breeding replacements, especially during the peak of the rainy season (July-September) when forages are abundant. All parameters studied, except gestation length excelled in the year 2002. This was probably due to better management. Gestation length did not vary with year nor with season.

The negative correlation between litter size at weaning and gestation length (-0.180) and the positive correlation between litter sizes at birth and at weaning (0.758) revealed that when gestation is prolonged, there would be fewer live kittens produced and weaned. Prolonged gestation may cause stress which may lead to weakness or even dead of kittens at birth. Undue extension of gestation may be attributed to age; with does outside the age range of 2 and $2^1/_2$ years standing a high risk.

In conclusion, the best productivity of the rabbit does remarkably could be appropriately mated between July and September with average gestation length between 27 and 30 days at Dagwom farm.

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