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WEIGHT OF NEW-BORN RABBITS IN RELATION TO THEIR NUMBER AND POSITION WITHIN THE UTERUS IN UNILATERALLY OVARIECTOMISED DOES

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ABSTRACT

One of the ovaries of 36 Pannon White rabbit does was removed at 16 weeks of age. The does were first bred at 18-24 weeks of age. On the 30th/31st day of pregnancy parturition was induced by oxytocin injection. The kindling order and the weight of the newborn rabbits were recorded between the 1st and the 6th parity. (In the ovariectomised does the kindling order corresponds to the position of foetuses in the uterine horn.) The effect of litter size on birth weight was significant: in the litters with 2, 6 and 10 rabbits the averages of individual weight were 69.5, 56.9 and 49.7 g respectively. Independently of litter size, the largest embryo was found at the ovarian end of the uterine horn (69.3, 60.1 and 54.3 g in the litters with 2, 6 and 10 rabbits respectively). The smallest embryo was the second from the cervical end (53.5 and 37.2 g in the litters with 6 and 10 kits respectively). The weight of new-born rabbits positioned nearest to the cervix was intermediate.

INTRODUCTION

Earlier experiments (LEBAS, 1982.; PÁLOS *et al*., 1996) have provided evidence that the number of rabbit foetuses present in the uterus and their position within it both influence their weight. In the past few years several experiments have been performed with does from which one of the ovaries had been removed (unilaterally ovariectomised or ULO does) (BLASCO *et al*., 1994; ARGENTE *et al*., 1996). The essential principle of such investigations is that the remaining ovary of does subjected to this procedure takes over the capacity of the removed ovary, and thus the number of ova shed from the remaining ovary is similar to that released from two in normal circumstances. A particular anatomical characteristic of the rabbit is the double uterus (*uterus duplex*); that is, the female has two uterine horns (i.e., two cervices) functioning independently of each other. There is therefore no crossing over between the two uterine horns, and in ULO does embryos can only enter and develop in one uterine horn. 'Overcrowding' of the uterus in this way provides the possibility for selection for uterine efficiency.

A number of experiments have been performed for the purpose of ascertaining what changes occur in the number of ova shed, the number of implantation sites, pre- and post-implantation mortality and litter size when does are deprived of one of their ovaries (BLASCO, 1996). As far as the authors are aware no researchers have yet examined the biological factors affecting the weight of the foetuses (i.e., new-born rabbits) produced by ULO does. The objective of this experiment was to establish how the weight of new-born rabbits varies depending on the number of foetuses present, their position within the uterus and the progressing number of litters produced by the doe.

MATERIAL AND METHOD

One ovary was surgically removed from 36 Pannon White does at the age of 16 weeks. Injection into the auricular vein of an anaesthetic mixture of 12 mg per kg body weight ketamin (Calypsovet) and 8 mg per kg body weight Xilasin (Rompun) was used to anaesthetise the does. One of the ovaries was held in position through an opening cut in the abdominal wall; then, after the oviduct and the blood vessels had been tied, the ovary was removed.

The does were first inseminated once they had reached a weight of 3.8 kg, at the age of 18 to 24 weeks. Parturition was induced between the 30^{th} and 31^{st} days of pregnancy (during the night), by means of 5 IU synthetic oxytocin administered by i.m. injection. The newborn rabbits were immediately taken from the doe (before they had the chance to suckle), for the purpose of recording the order in which they were born, together with their weight. (The foetuses in the one uterine horn of ULO does are born in order according to their position within the uterus: first the one adjacent to the cervix, and finally the one nearest to the oviduct.) The position of foetuses in the uterine horn was numbering from the cervical end (P1, P2, P3…) to that nearest to the oviduct (PN, where N is the number of foetuses in the uterus).

The does were inseminated again 12 days after kindling. The experimental does produced between 1 and 6 litters, depending on how long they lived. A total of 495 new-born rabbits from 71 parturitions were examined. (The few litters born containing 1, 11 or 12 rabbits or stillborn young were not included in the evaluation procedure.)

RESULTS AND DISCUSSION

The average litter size at birth produced by the ULO does (Mean: 7.66, se: 0.10) showed a significant ($P<0.05$) lag (of 14 %) in comparison with the performance of the intact does of similar age which produced litters at the same time (Mean: 8.88, se: 0.17). The size of the first litter (Mean: 7.2, se: 0.20) also proved significantly ($P<0.05$) smaller than the number of young born in the subsequent (2^{nd} to 6^{th}) litters (Mean: 7.9, se: 0.12). These findings corroborate data obtained in studies in which it has been ascertained that the first litter produced by a ULO doe is less populous, and the level of performance at first parturition is lower, than at subsequent kindlings (BLASCO, 1996; BLASCO *et al*., 1994; ARGENTE *et al*., 1996/a,b).

In conformity with the literature, the average weight of the young born to the primiparous does (47.9 g) was significantly ($P<0.05$) lower than that recorded for the subsequent (2^{nd} to 6^{th}) parturitions (53.9 g) (Table 1). Primiparous does are still increasing their own weight while undergoing their first pregnancy, and therefore the supply of nutrients reaching the foetuses is reduced (XICCATO, 1996; SZENDRŐ, 1986).

The relation between the litter size and individual weight of newborn rabbits is expressed by the following linear regression and correlation coefficient:

$$W = 64.7 - 1.61\ LS \qquad r = -0.34$$

where

W = individual weight at birth, g

LS = litter size.

As litter size increased average individual weight at birth was found to decrease from 69.5 g (in litters of 2) to 49.7 g (in litters of 10) (Table 2). Similar findings have been reported by KROGMEIER and DZAPO (1991) and SZENDRŐ (1986).

Table 1. Effect of parity and position of foetuses in the uterine horn on the weight of newborn rabbits (g)

Parity order	Position in the uterine horn						Total		
	PN			P1 to (PN-1)					
	n	Mean	SEM	n	Mean	SEM	n	Mean	SEM
1st		48.0[a]	2.7		47.9[a]	1.0	136	47.9[a]	1.0
2nd to 6th		58.3[b]	1.4		53.1[b]	0.6	359	53.9[b]	0.69
Total	76	55.3[A]	1.3	419	51.7[B]	0.6	495	52.3	0.5

[a, b] : Different letters within a column denote differences at $P \leq 0.05$.
[A, B] : Different letters within a row denote differences at $P \leq 0.05$.
P1 denotes the foetus nearest to the oviduct, P2 to P10 the other positions collectively.

Table 2. Effect of litter size and position in the uterine horn on birth weight in ULO does (g)

Position of foetuses within the uterine horn (from the cervix towards the oviduct)		**Litter size**								
		2	3	4	5	6	7	8	9	10
		Number of litters								
		4	4	5	7	17	12	12	6	4
P1	Mean	69.7	53.7	55.4	61.3	57.6[ab]	49.8[ab]	53.0[ab]	51.2[a]	55.0[c]
	SEM	3.48	9.6	5.81	3.04	3.05	3.46	3.75	5.99	2.74
P2	Mean	69.3	47.7	52.2	55.2	53.5[b]	42.8[b]	47.6[b]	44.0[a]	37.2[a]
	SEM	5.55	6.5	6.5	4.91	1.76	1.99	2.55	5.70	3.12
P3	Mean		55.7	55.4	62.6	55.5[ab]	48.7[ab]	51.8[ab]	48.0[a]	44.5[abc]
	SEM		12.8	4.1	3.07	1.88	2.42	2.59	8.21	2.84
P4	Mean			59.8	65.3	56.1[ab]	48.6[ab]	53.2[ab]	48.2[a]	48.3[abc]
	SEM			7.22	1.91	2.39	3.49	3.37	4.82	3.53
P5	Mean				66.0	58.7[ab]	50.5[ab]	53.2[ab]	48.0[a]	49.3[abc]
	SEM				3.67	2.09	2.89	2.75	7.31	1.45
P6	Mean					60.1[a]	50.3[ab]	53.6[ab]	50.0[a]	52.3[bc]
	SEM					2.50	2.77	2.46	5.41	1.76
P7	Mean						56.7[a]	53.8[ab]	50.4[a]	53.0[abc]
	SEM						2.81	2.40	6.28	3.51
P8	Mean							56.7[a]	51.8[a]	54.0[ab]
	SEM							2.51	5.68	1.73
P9	Mean								54.3[a]	53.7[abc]
	SEM								3.71	4.33
P10	Mean									54.3[bc]
	SEM									4.67
Total	Mean	69.5	51.9	55.7	62.0	56.9	49.6	52.8	49.5	49.7
	SEM	2.93	4.90	2.83	1.88	0.95	1.13	1.01	1.91	1.31

[a, b, c] = Values within columns with different superscripts are different ($P < 0.05$).

Position PN (the nearest to the oviduct) seems to be the most favourable within the uterus, and, regardless of litter size, position P2 (second one to the cervix) was found to be the least advantageous although the differences were only significant for litters of six or more. A continuous decreasing tendency in weight at birth could be observed between position PN and P2 as litter size increased. The young which had been situated nearest to the cervix (P1) were of

intermediate weight (Table 2). This tendency was not as clear in the case of the primiparous does as with later parities (Figure 1).

These findings provide only partial corroboration of the observations made with respect to intact does (LEBAS, 1982; PÁLOS *et al.*, 1996). Although these previous studies also found the largest foetus to be the one positioned nearest to the oviduct (PN), the smallest foetus developed in position P1, P2 or P3 depending on the number of foetuses within the uterine horn (2-3, 4-6 or 7-9). This deviation between experimental results may be attributable to the fact that in the earlier studies an influence may have originated from the foetuses in the other uterine horn, while the number of litters produced by the doe may also have exerted an effect. In the present study there were only foetuses in one uterine horn in the ULO does, and these does also produced several litters (between 1 and 6). The reason for positions PN and P2 being advantageous is that the blood supply to the foetuses in these positions is better (DUNCAN, 1969; DEL CAMPO and GINTHER, 1972), and they have more freedom for growth than those which are flanked on both sides by their litter mates. Similar conclusions were reached by CHRISTENSON *et al.* (1987) and KNIGHT *et al.* (1977) in experiments performed with pigs; they concluded that the length of the section of uterus available per foetus influences the growth of the foetuses.

CONCLUSIONS

On the basis of the findings of this study and the data available in the literature the following conclusions can be drawn.

- The weight of newborn rabbits is dependent on litter size and the position of the foetuses within the uterus.
- As in intact does, it seems that the most favourable position is the end of the uterus towards the oviduct; regardless of litter size, in ULO does the second foetus from the cervix is in the least advantageous position. Weight at birth decreases progressively from position PN to position P2, but the rabbit born first (P1) is of intermediate weight.

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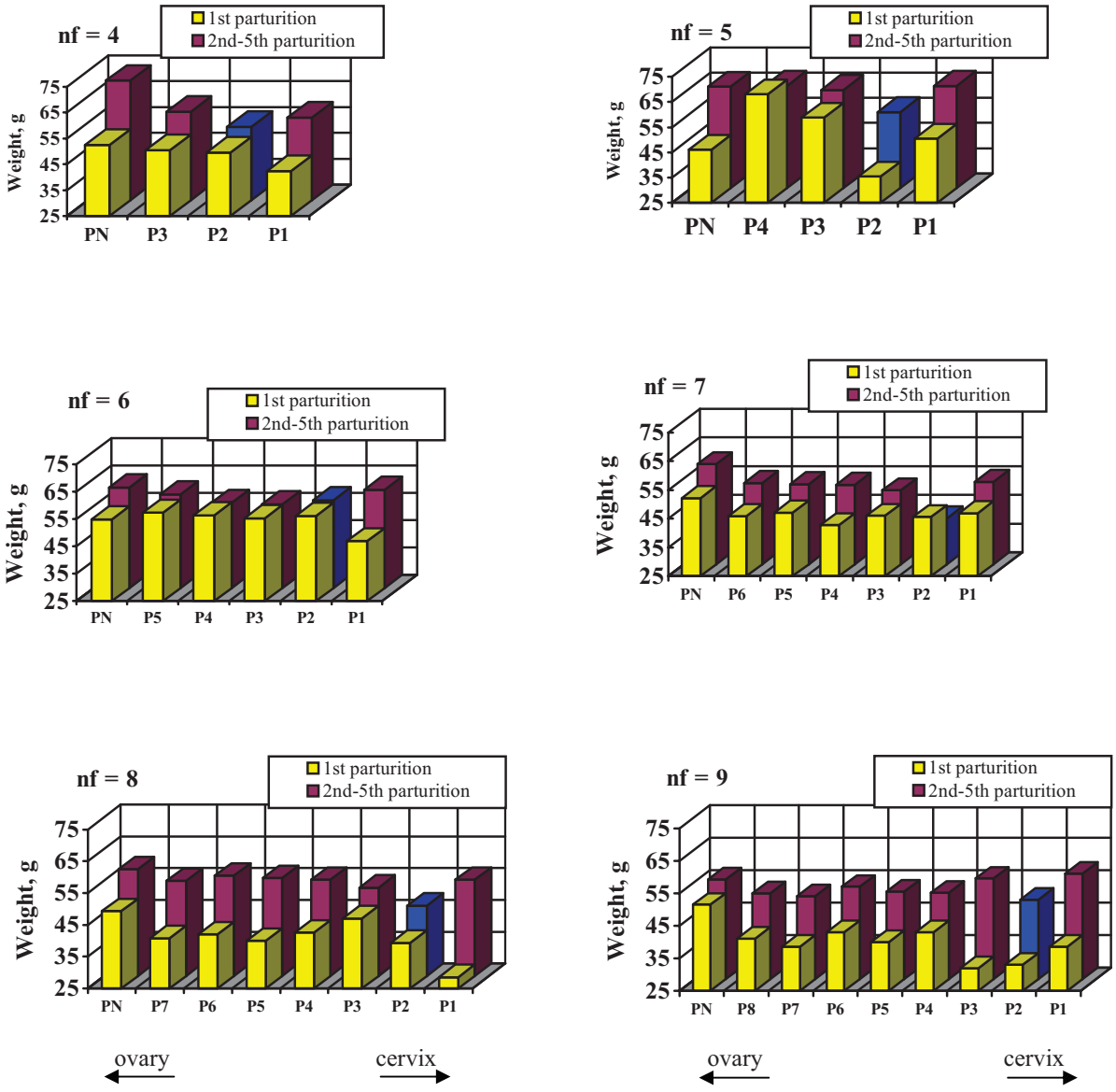

Figure 1: Effect of position within the uterine horn and litter size on the weight of new-born rabbits from primiparous and multiparous does (nf = number of foetuses)

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