THE EFFECT OF NUMBER AND POSITION OF EMBRYOS IN THE UTERINE HORNS ON THEIR WEIGHT AT 30 DAYS OF PREGNANCY

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Abstract - Weight was determined for rabbit embryos in 170 New Zealand White does in their first pregnancy. It was established that in the case of 1, 3, 6 or 9 embryos positioned in one uterine horn, the average body weight was 45.4, 38.7, 34.9 and 28.4 g, respectively. Independently of the number of embryos, the largest embryo was to be found at the ovarian end of the uterine horn (in the case of 1, 3, 6, or 9 embryos, body weight was found to be 45.4, 40.7, 38.1 and 31.7 g respectively). Where 2 or 3 embryos were present, the embryo nearest to the cervix was found to be the smallest (42.2 and 37.1 g respectively); with 4 to 6 embryos, the smallest was the second from the cervical end (37.8, 33.4 and 31.8 g respectively); when 7 or 8 embryos were present, the third from the cervix was the smallest (31.8 and 33.4 g respectively). For 4 to 9 embryos, an embryo with about average body weight was located at the cervical end of the uterine horn in the direction of the vagina. The results of the experiment demonstrate that the number of embryos in the opposite uterine horn also has an effect on the weight of the embryos. If the number of embryos present in the opposite uterine horn was lower than the average (1 to 4) or higher than the average (5 to 9), then on the side examined deviation between average weight of embryos was most frequently 0.6-3.8 g (1.3-8.6 %).

INTRODUCTION

Significant differences in the body weight of new-born rabbits can occur even within the litter. Among the medium size breeds (New Zealand White, Californian, Pannon White), birth weight generally varies between 25 and 100 g, in most cases between 50 and 65 g. According to the results of the experiments carried out by GARCIA and VICENTE (1991), rabbits born with a weight of less than 35 g are incapable of survival, but, evenso, only half of those with a birth weight of between 35 and 40 g reach the age of 21 days. The birth weight below which the chance of survival is critical can be estimated at approximately 40-45 g. Similar results were obtained by SZENDRÔ and BARNA (1984) in their trials with New Zealand White rabbits.

Rabbits with a lower birth weight are disadvantaged in the suckling period with respect to their littermates. After weaning to solid feed they cannot compensate for the lag caused in the suckling period, and therefore the effect of birth weight is still visible even in the weight at 12 weeks of age (SZENDRÔ, 1984).
The number of young in the litter exercises the most significant effect on birth weight, since, in the case of mothers giving birth to fewer young, the supply of nutrients to each embryo during pregnancy is better. According to SZENDRÔ (1978), in litter sizes of between 6 and 11 young, an increase in litter size of one individual results in a decrease in average weight of 1.9 g.

According to the trials carried out by LEBAS (1982), difference in birth weight between littermates is dependent on the position of the embryos in the uterine horns. On the basis of examinations of 28-day-old rabbit embryos, the position next to the ovary was found to be the most advantageous, the second position from the cervix the most disadvantageous, while the embryo situated next to the cervix again showed body weight approaching the average.

In the course of his investigations with pig embryos, BECZE (1982) established that there is a relationship between the development of the embryo and its position in the uterus. After the 70th day of pregnancy, the embryos implanted in the centre of the uterine horn show better development than those implanted in the caudal or distal region. ASHWORTH (1991) demonstrated a linear relation between the position of the embryo in the uterus and its body weight; a quadratic relation was also demonstrated between the position of the embryo and its body length on the 30th (± 3) day; the larger and longer embryos were situated in the centre of the uterine horn. On the contrary, PERRY and ROWELL (1969) found the heaviest pig embryos to be in the end of the uterine horn nearest to the ovary on the 31st day of pregnancy.

The aim of the present study was to determine the effect of number and position of rabbit embryos in the uterine horns on their weight.

MATERIALS AND METHODS

The embryos situated in the uterine horns of 170 anaesthetised nulliparous New Zealand White rabbit does were examined on the 30th day of pregnancy. The experimental material originates from a toxicological experiment, from which the data relating to the control (untreated) rabbits were collected and evaluated.

After opening of the abdominal cavity, the whole reproductive tract was taken out. The entive length of the uterine horns was opened up, and after removal of the placents the embryos were weighed individually. The position of each embryo within the uterus was recorded, such that in each of the two uterine horns the embryo lying closest to the ovary was numbered as 1. the next (in the direction of the vagina) as 2, and so on, up to the last embryo, lying closest to the cervix. The position of any embryo which had died after implantation was also recorded.

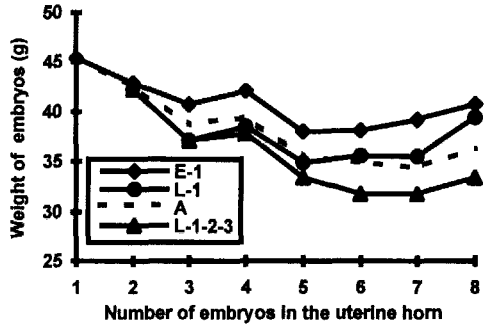
Of the 170 does examined, in 32 cases more than two dead embryos were found, and these individuals were excluded from further investigations. Five on the 276 uterine horns examined were found to contain no live embryos at all. In the remaining 271 uterine horns, examinations were carried out to determine number of embryos, the relation between their position and their weight, and how the number of individuals positioned in the neighbouring uterine horn influences the body weight of individual embryos.

RESULTS AND DISCUSSION

The average and relative weights of the embryos, according to the number of embryos presented in Table 1. The average weight of the embryos shows a decreasing tendency with increasing number of individuals present in the uterine horn. Taking the weight of one single embryo present in the uterine horn as 100 %, the average weight of 3 embryos can be seen to be 85.2 %, that of 6 embryos 76.9 %, and that of 8 embryos 79.9 %.

In the case of two embryos and more, embryo number 1,"E-1" (the nearest to the ovary) is always the heaviest. In the case of 2 or 3 embryos, the last one "L-1"(the nearest to the cervix) is the lightest. For 4 and more embryos the last one is no more the smallest, its weight draws nearer to the average weight and goes beyond it for 6 embryos and more. In those cases, the second embryo from the cervix "L-2" (for 4 to 6 embryos), then the third, "L-3" (for 7 and 8 embryos), are the smallest. The rabbit embryo positioned at the cervix was seen again to be a larger individual of near-average body weight. Within the uterine horn, taking the weight of the largest rabbit embryo to be 100 %, in the case of 3, 6 or 8 embryos the weight of the smallest was seen to be 91.4, 83.5 and 81.9% respectively. (Figure 1 and Figure 2).

Figure 1 : The weight of 30-day embryos according to their position (E-1: the nearest to the ovary, L-1: the nearest to the cervix, A: average, L-1-2-3: the lightest embryo in the uterine horn)



On the basis of the data collected from the examinations carried out on the two uterine horns it can be established that the number of embryos located in the opposite uterine horn influences the weight of individuals positioned in the uterine horn examined (Table 2). In average, embryos of a uterine horn are heavier when the number of embryos in the neighbouring uterine horn is 1-4 than when this number is between 5 and 9. The difference between the two groups (1-4 vs 5-9) goes from 1.3% (1 embryo in the examined horn) to 8.6% (7 embryos in the examined horn). It can be calculated that the average difference is 8% for 6 to 8 embryos in examined horn vs 3.1 for 1 to 5 embryos. Contrary to this, in the investigations performed by HAFEZ and TSUTSUMI (1966), the development of the offspring present in the two uterine horns appeared to be independent on each other.

Table 1 : Body weight of 30-day-old rabbit foetuses dependent on the number and

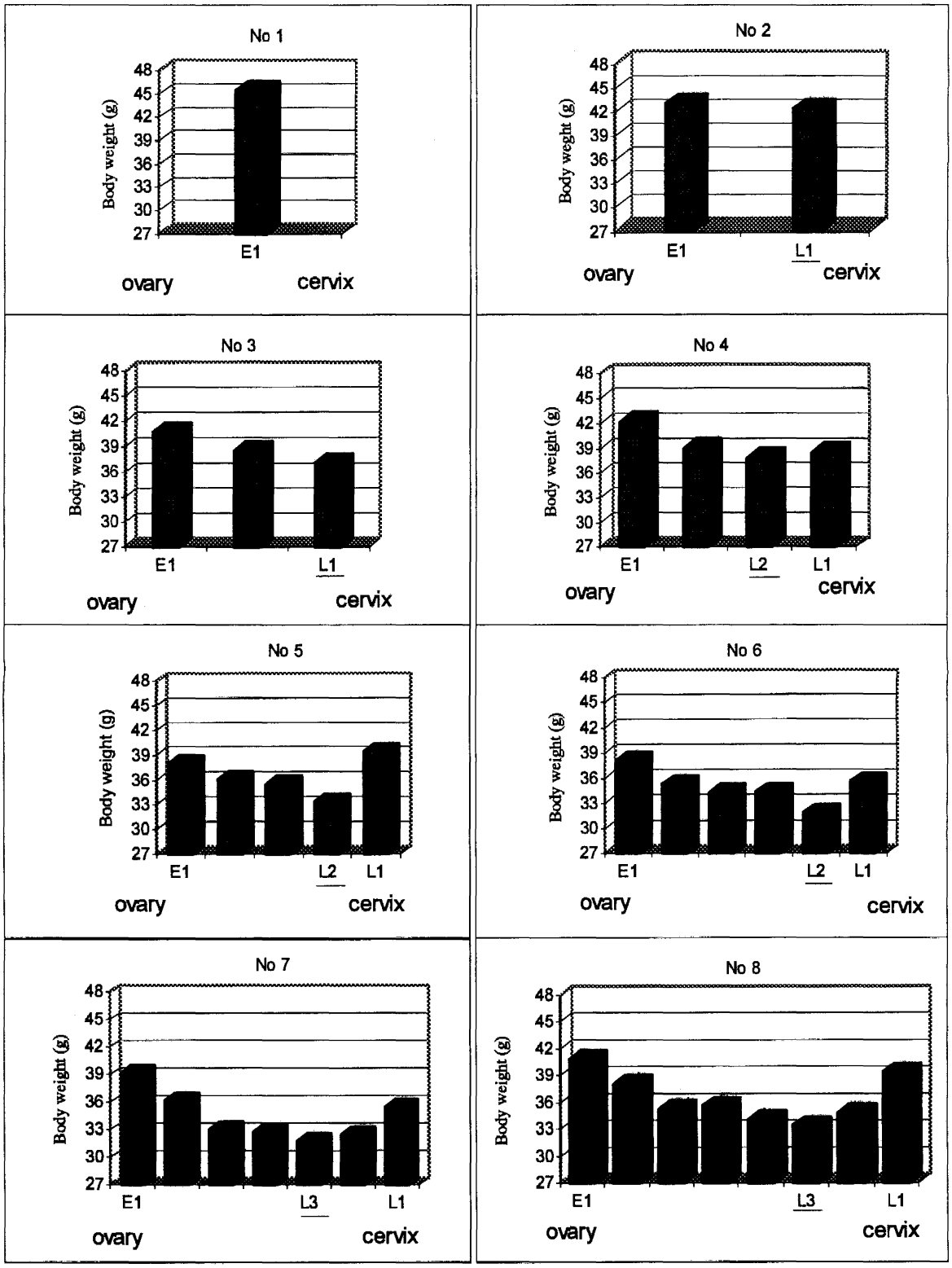
Position of embryo within the uterine horn (from the ovary towards the cervix)		Number of embryos found in the uterine horn examined											
		1		2		3		4		5		6	
		Absolute weight (g) and relative weight (%) of the embryos											
		g	%	g	%	g	%	g	%	g	%	g	%
Number of uterine horns examined		16		34		57		47		45		43	
1	Mean	45.4	100*	42.9	100*	40.7	100*	42.1	100*	38.0	100*	38.1	100*
	SD	6.9		5.5		7.0		7.6		7.3		7.1	
2.	Mean			42.2	98.4 *	38.5	94.6 *	39.0	92.6 *	36.1	95.0 *	35.3	92.6 *
	SD			5.7		6.0		7.9		6.5		7.1	
3.	Mean					37.1	91.4 *	37.8	89.8 *	35.5	93.4 *	34.3	90.0
	SD					6.4		6.6		5.7		4.8	
4.	Mean							38.5	91.4 *	33.4	87.9 *	34.4	90.3
	SD							6.9		6.2		6.5	
5.	Mean									34.9	91.8 *	31.8	83.5 *
	SD									6.5		5.8	
6.	Mean											35.6	93.4 *
	SD											6.6	
7.	Mean												
	SD												
8.	Mean												
	SD												
Overa 1	Mean	45.4	100* *	42.5	93.6 **	38.7	85.2 **	39.4	86.8 **	35.5	78.2 **	34.9	76.9 **
	SD	6.9		5.4		6.6		3.5		6.7		7.1	

Notes: * in relation to the weight of the embryo in position 1 (100 %); ** in relation to the average body weight of embryos fo

Table 2 : Body weight of 30-day-old rabbit embryos dependent on the number of embryos found in t

within the uterine horn (from the ovary towards the cervix)		Number of embryos found in the uterine horn examined												
		1		2		3		4		5		6		
		Number of embryos found in the opposite uterine horn												
		1-4	5-9	1-4	5-9	1-4	5-9	1-4	5-9	1-4	5-9	1-4	5-9	1-
Number of uterine horns examined		18	8	12	22	30	27	28	19	31	14	31	12	
1	Mean	45.3	44.7	44.7	41.2	40.6	40.9	42.7	41.3	40.6	35.4	39.6	36.4	3
	SD	4.3	9.0	5.6	4.5	8.3	5.4	7.8	7.5	6.8	7.1	6.9	9.3	
2.	Mean			44.3	40.2	39.5	37.3	40.5	37.5	37.1	35.0	36.8	33.6	3
	SD			5.5	5.5	6.7	5.0	7.5	8.7	6.5	6.5	6.8	7.9	
3.	Mean					38.0	36.0	38.2	37.5	36.1	34.7	35.1	33.5	3
	SD					7.5	4.8	6.7	6.7	5.4	6.4	5.0	4.1	
4.	Mean							38.5	36.1	33.0	33.8	35.5	34.0	3
	SD							8.4	7.0	6.0	6.7	7.4	6.5	
5.	Mean									33.9	36.1	33.2	30.5	3
	SD									5.9	7.7	7.2	6.2	
6.	Mean											37.2	33.8	3
	SD											7.4	6.9	
7.	Mean													3
	SD													
8.	Mean													
	SD													
Overall	Mean	45.3	44.7	44.5	40.7	39.4	38.1	40.0	38.2	36.1	35.0	36.2	33.6	3
	SD	4.3	9.0	5.5	5.0	7.5	5.1	7.6	7.5	6.2	6.9	6.8	6.8	
Deviation between the two groups		g	%	g	%	g	%	g	%	g	%	g	%	g
		0.6	1.3	3.8	8.5	1.3	3.3	1.8	4.5	1.1	3.0	2.6	7.2	

Figure 2 : The effect of number and position of embryos in one uterine horn on their weight at 30 day of pregnancy (E1: the nearest to the ovary, L1: the nearest to the cervix, L1, L2, L3: the smallest embryo in the uterine horn)



The differences observed in the weight of the embryos can be explained by the functioning of the thyroid gland, blood supply to the uterus and the amount of space available to the embryos. Histomorphological examination of the thyroid glands of the embryos indicates that there is an endocrine relation in deviations in the development of embryos of the same litter. That is to say, in the case of the embryos of lower body weight, the function of the thyroid gland also decreases during the embryonic phase (BECZE, 1981).

PERRY and ROWELL (1969) observed in their work on pigs that the major blood vessels supplying the uterus interlace the mesometrium, and reach as far as the embryos situated in the central part of the uterine horn, and therefore the embryos situated in that region are in an advantageous position with respect to nutrient supply.

The results of our experiments demonstrate that the number of embryos located in the opposite uterine horn also influences the weight of the embryos positioned in the uterine horn examined. That is to say, if less space is available to the embryos, their body weight decreases. The classic experiment carried out by VENGE (1953) also seems to support this. VENGE compared the body weights at birth of small-body types transplanted into large-body types, and large-body types transplanted into small-body types. In comparison with the normal birth weights of the large- and small-body types (70 and 41 g respectively), the body weight at birth of large-body offspring transplanted into small-body types decreased to 51 g, while that of small-body offspring transplanted into large-body types increased to 65 g. It is true that embryos with a higher metabolic intensity enjoy an advantageous position with regard to the maternal physique, as in the case of necessity the mother mobilises her own reserves in the interest of the appropriate development of the embryo. In the case of other species, when small- and large-body types are crossed, birth weight of the offspring is regulated by the dimensions of the physique of the mother (BEZCE, 1981), body weight at birth is influenced not only by nutrition during the embryonic phase but also by the amount of space available to the embryos. In a similar way, embryos situated at the two ends of the uterus are in an advantageous position over embryos positioned in the central region, surrounded on both sides by other embryos.

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Enfluß von anzahl und position der kaninchen-embryonen im gebärmutterhorn auf ihr gewicht am 30. trächtigkeitstag - 170 zum erstenmal trächtige Neuseeländer-Häsinnen wurden hinsichtlich des Gewichts ihrer Embryonen am 30. Trächtigkeitstag untersucht. Es wurde festgestellt, daß das Durchschnittsgewicht bei 1, 3, 6 und 9 Embryonen im Gebärmutterhorn 45.4, 38.7, 34.9 und 28.4, g beträgt. Unabhängig von der Embryonenzahl war der größte Embryo immer am Ende des Gebärmutterhorns über dem Eileiter zu finden (bei 1, 3, 6 und 9 Embryonen 45.4, 40.7, 38.1 und 31.7 g). Bei 2-3 Embryonen befand sich der kleinste an erster Stelle nach dem Gebärmuttermund (42.2 und 37.1 g), bei 4-6 Embryonen war der kleinsten an zweiter Stelle hinter dem Gebärmuttermund (37.8, 33,4 und 31.8 g), und bei 7-8 und Embryonen war der kleinste an dritter Stelle hinter dem Gebärmuttermund)31.8 und 33.4 g) zu finden. Bei einer Embryonenzahl zwischen 4 und 9 befanden sich diejenigen mit annäherndem Durchschnittsgewicht in dem Teil des Gebärmutterhorns, das sich in der Nähe der Scheide befindet. Die Ergebnisse des Versuchs zeigten, daß auch die Embryonenzahl im benachbarten Gebärmutterhorn Einfluß auf das Embryogewicht hat. Befanden sich im benachbarten Gebärmutterhorn 1-4 bzw. 5-9 Embryonen, betrugen die Gewichtsunterschiede auf der untersuchten Seite meistens 0.6-3.8 g (1.3-8.6 %).