7th World Rabbit Congress, Valencia Spain, 2000
Volume A, 125-132

INFLUENCE OF THE NUMBER OF SUCKLING YOUNG ON REPRODUCTIVE PERFORMANCE IN INTENSIVELY REARED RABBITS DOES

FORTUN-LAMOTHE L.*[1], ROCHAMBEAU H. DE, LEBAS F.*, TUDELA F.****

* INRA, Station de Recherches Cunicoles, BP 27, 31326 CASTANET-TOLOSAN Cedex France
**INRA Station d'Amélioration Génétique des Animaux, BP 27, 31326 CASTANET-TOLOSAN Cedex France
[1]e-mail : lamothe@toulouse.inra.fr

ABSTRACT

The aim of this experiment was to study the influence of the number of suckling young on reproductive performance in intensively reared rabbits. Females were allowed to suckle 4 (group 4R; n=126), 7 (group 7R; n=127), or 10 kits (group 10R; n=126). They were presented to the male the day after the parturition and were slaughtered at the 4th weaning (28 days) to study body composition.
Survival of does during experiment was similar in all groups (61.2%). The number of services per conception tended to be higher in the 10R than in the 4R group (1.36 vs 1.26; P<0.1). The number of rabbits born alive was higher in the group 10R (8.9 vs 8.1 and 8.2; P<0.01) and mortality rate of rabbits during lactation was similar in the three groups. The weight of rabbits at weaning was related to the number of suckling young (P<0.001). At slaughter, the 10R group had lower carcass weight (-8.0 and -5.5%) and adipose tissues (-65 and -41%) than the two other groups (P<0.001).
In conclusion, nursing a large litter has a harmful influence on fertility, individual kit weight at weaning and body composition of females at weaning. A large suckling litter seems to increase the litter size at following parturition. Our results could not demonstrate any effect of the number of suckling rabbits on the survival of mothers or their kits.

INTRODUCTION

Rabbit does can be mated immediately after parturition and throughout lactation. As a general rule, however, fertility and prolificacy are lower in lactating than in non-lactating females (THEAU-CLÉMENT and ROUSTAN, 1992; FORTUN-LAMOTHE and BOLET, 1995). The effect of intensity of lactation, i.e. the number of suckling young, on reproductive performance was poorly studied. SZENDRÖ (1992) and AUMANN *et al.* (1984) studied the effect of the number of suckling young on reproductive performance without equalisation at birth. Consequently, the effects of litter size at birth and of the number of suckling young were partly confounded.

FORTUN and LEBAS (1994) and GARCIA and PEREZ (1989) equalised the litters at birth and studied the effect of the number of suckling young on reproductive performance of rabbit does. They showed that lactation reduces foetal growth and survival, and these harmful effects increase with the size of the suckled litter. However, the influence of the number of nursed young on the reproductive performance at following parturitions remains to be studied in such an experimental design. Additionally, FORTUN and LEBAS (1994) showed that mobilisation of body reserves during lactation is correlated to the number of kits nursed. A large depletion of body stores could be detrimental to subsequent reproductive life. Therefore, it seems interesting to study the effect of the number of suckling young on survival of the females and their reproductive performance in the longer term.

The aim of this work was to study the influence of the number of suckling young on reproductive performance at later parturitions and the duration of productivity in multiparous rabbit does, independently of litter size at birth.

7th World Rabbit Congress, Valencia Spain, 2000
Volume A, 125-132

MATERIAL AND METHODS

Animals

The experiment was conducted in 1996 and 1997 for 16 months. Three hundred and seventy nine rabbit does (strain 1077) were assigned at the first parturition to one of the three experimental groups: females were allowed to suckled 4 rabbits (group 4R; n=126), 7 rabbits (group 7R; n=127), or 10 rabbits (group 10R; n=126). Sisters were assigned to different groups. The adjustment of litter size was done within two days after the parturition. Young rabbits were kept with their mothers as much as possible. The heaviest young rabbits were withdrawn and then fostered to reach the litter size fixed by the protocol. The lightest young rabbits were eliminated when young rabbits were in excess. Suckling rabbits were weaned at 28 days of age. Females were presented to the male (strain 2066) the day after the parturition. A diagnosis of pregnancy (abdominal palpation) took place 10 days after the parturition. Does, which were not pregnant, were presented to the male the day after palpation. Does were discarded for two reasons: pathology or infertility (3 consecutive sterile mating or 6 consecutive male refusals). A pregnant nulliparous doe immediately replaced each dead or eliminated doe.

Table 1 : Evolution of the rabbit doe population in each group during the experiment.

Group	4	7	10
Initial number	126	127	126
Eliminated for infertility	24	26	22
Eliminated for pathology	8	11	13
Dead	9	17	17
Alive at the end	85	73	74
* follow imposed reproductive rhythm	43	36	26
* don't follow imposed reproductive rhythm	42	37	48

Females were bred in individual wire cages, laid out in flat deck in a closed building. The duration of illumination was of 16 hours per day. Does were fed with a commercial pelleted feed which meet with actual nutritional recommendations for breeding does (XICCATO, 1996). Water was available continuously from automatic valves.

Does were weighed at the first palpation after parturition (i.e. 11 days after parturition), at parturition and at weaning (28 d). Number of services per conception, number of alive and dead kits at birth, litter size after equalisation and at weaning were recorded. Litters were weighed at birth and at weaning. All females were slaughtered after weaning of the fourth litter in order to study body composition and the weight of carcass (muscles + bones), skin, full digestive tract, adipose tissues and liver were recorded at that time.

Statistical analyses

Data were analysed by variance analysis, using the GLM procedure from SAS library. For the traits related to the doe (duration of the reproductive life, number of litters produced) the main fixed effect was treatment (4R, 7R or 10R). For traits related to litters and some parameters of fertility (number of service per conception does fertilised at the post partum mating), the treatment, the parity and their interaction were used as fixed effects. Interaction between treatments and parity was non-significant for most of the parameters studied and are not presented in the paper. On the other hand, significant interactions are discussed. When treatments differed, comparisons of the means were tested using the Bonferroni t-test procedure.

7th World Rabbit Congress, Valencia Spain, 2000
Volume A, 125-132

RESULTS

Eleven percent of the does died and 27 % of the does were discarded during the experiment (Table 1). Of the 379 initial females, 232 were present at the end of the experiment (85, 73, and 74 in the groups 4R, 7R and 10R respectively). There was no difference among the three groups concerning elimination of the does.

Table 2 : Effects of the number of suckling young (4, 7 or 10) on the parameters of fertility.

Group	4	7	10	Root MSE	P>f
No does	126	127	126		
Average duration of career (days)	265	265	267	43.2	0.93
Mean number of litters per doe	3.29	3.17	3.21	1.19	0.74
Total number of litters	284	273	271		
Parturition interval (days)	35.8 a	37.2 ab	37.8 b	11.1	0.09
Services per conception	1.26 a	1.29 ab	1.36 b	0.58	0.09
Post partum fertilisation (%)	77	76	70	43	0.11

The theoretical parturition interval was 32 days, but actual parturition interval was 37 days. The actual parturition interval (+2 days) and the number of services per conception (+0.1) tended to be higher (P<.10) in the group 10R than in the 4R group (Table 2). The number of females that followed the reproductive rhythm imposed during the experiment (*post partum* fertilisation), tended to be higher in the 4R than in the 10R group (34 % vs 21%; P=0.056). In the same way, the percentage of females that were fertilised at the *post partum* mating, tended to be lower in the 10R than in the two other groups (P=0.11). The average duration of career and the mean number of litters produced per does were similar in the three groups.

The number of rabbits born alive was higher (+9%; P<.01) in the group 10R than in the two other groups (Table 3). A significant interaction between experimental groups and parity was found for the percentage of kits born dead (P<0.01). For the second litter, the percentage of kits born dead tended (P<.10) to be higher in group 10R (9.1% vs 4.4% in group 4R and 4.8% in group 7R). For the 4th litter, the percentage of kits born dead was lower (P<0.01) in group 10R than in the two other groups (3.4% vs 11.4% in group 4R and 12.1% in group 7R).

Table 3 : Effects of the number of suckling young on litter size at birth and litter growth.

Group	4	7	10	Root MSE	P>f
No litters	285	274	272		
Litter Size at birth	8.6 a	8.7 a	9.3 b	2.96	0.02
Born alive	8.1 a	8.2 a	8.9 b	3.23	0.01
Born dead (%)*	8.0	6.9	5.5	18.5	0.28
Litter weight at birth (g)*	478 a	469 a	514 b	162	0.006
Mean kit weight at birth (g)*	60.0 a	60.1 a	56.7 b	14.5	0.01
No litters	410	400	397		
Litter size after equalisation	3.9	6.9	9.8		
Litter size at weaning	3.5 a	6.2 b	9.0 c	1.92	0.0001
Mortality 0-28d (%)	9.8	10.2	7.8	.25	0.62
Mean rabbit weight at weaning	607 a	523 b	451 c	187	0.0001

* a significant interaction (P<0.05) between experimental group and parity was found for the percentage of born dead rabbits, litter and individual weight at birth (see text).

Interaction between experimental groups and parity was significant for the litter weight at birth (P<0.01). In groups 4R and 10R, the litter weight at birth increased with parity. In group 7R, the

litter weight at birth was lower for the 3rd than for the 4th litter. Mortality rate of kits during the suckling period was similar in the three groups. The mean individual weight of kits at weaning was the lowest in group 10R and the highest in group 4R (P<0.001; table 3).

The change in the does' live weight during the four reproductive cycles is shown in Figure 1. Live weight was similar in the three groups throughout the experiment, except at weaning of the 3rd and the 4th litters when females of the 10R group were lighter than those of the two other groups (P<0.05).

At slaughter (weaning of the 4th litter), the weights of carcass (-8.0% and –5.5% compared to the groups 4R and 7R, respectively) and adipose tissues (-65% and -41% compared to the groups 4R and 7R, respectively) were lower (P<.001) in the 10R group than in the two other groups (Table 4). Full digestive tract was lighter in the group 4R than in the two other groups (P<0.01) while the weights of skin and liver were similar in the three groups.

Table 4 : Effects of the number of suckling young on body composition traits (g) at weaning of the 4th litter.

Group	4	7	10	Root MSE	P>f
No does	79	71	72		
Live weight (g)	3974 a	3901 a	3776 b	375	0.006
Carcass (g)	1829 a	1781 a	1683 b	189	0.001
Skin (g)	601	587	561	114	0.099
Digestive tract (g)	561 b	618 a	625 a	121	0.002
Adipose tissues (g)	60.5 a	36.2 b	21.2 c	42.5	0.0001
Liver (g)	117.4	118.9	117.7	21.2	0.90

DISCUSSION

THEAU-CLÉMENT and ROUSTAN (1992) reviewed the effect of lactation on reproductive performance in rabbit does. They showed a negative effect of lactation on fertility. The present results suggested that the effect of lactation on fertility is partly related to the size of the suckled litter because the number of service per conception tended to be higher and the percentage of females fertilised at the *post partum* mating tended to be lower in the 10R compared to the 4R group. This is in agreement with AUMANN *et al.* (1984) and SZENDRÖ (1992) who showed a decreased conception rate in females nursing a litter of large size.

Previous studies concerning the effects of lactation on prolificacy were conflicting (FORTUN-LAMOTHE and BOLET, 1995), and the effect of the number of suckling young (i.e. intensity of lactation) on this parameter was poorly studied. To our knowledge, in the previous works studying the effect of the number of suckling young on the litter size at the following kindling, size of the suckled litters were not equalised at birth (AUMANN *et al.*, 1984; SZENDRÖ, 1992). This parameter was thus not controlled, but simply observed *a posteriori* and the results thus represented, in fact, the repeatability of the litter size at birth between parities. In the present experiment, the size of the nursed litter was equalised at birth according to the experimental group, whatever the litter size born. We observed a higher number of rabbits born alive in the group of females nursing the larger litters than in the two other groups of females. On the other hand, FORTUN and LEBAS (1994) observed similar numbers of live foetuses on day 28 of pregnancy in primiparous does nursing 4 or 10 young.

FORTUN *et al.* (1993) reported an increased foetal mortality (observed on day 28 of pregnancy) in lactating compared to non-lactating primiparous rabbit does. This harmful effect of lactation

increased with the size of the suckled litter (GARCIA and PEREZ, 1989; FORTUN and LEBAS, 1994). This is in agreement with the higher percentage of kits born dead observed at the second kindling in the 10R group of females. However, present results suggested that the percentage of kits born dead was not influenced by the number of suckling young in multiparous rabbit does.

It should be noted that a significant interaction between the number of suckling young and parity was observed for the percentage of kits born dead, as well as for the litter weight at birth. Therefore, conclusions obtained in primiparous females must be applied with prudence to multiparous ones.

We observed an inverse relationship between the litter size and the weaning weight in agreement with CERVERA *et al.* (1988) and SZENDRÖ *et al.* (1996). LEBAS (1969; 1987) and McNITT and LUKEFAHR (1990) have shown that milk production increases with the number of suckling rabbits, but individual milk intake decreases. We found no effect of litter size on the mortality of kits during lactation. SZENDRÖ *et al.* (1996) reported a higher mortality during the three first weeks of lactation in litters of 10 compared to litters of 6 rabbits (22.2% vs 6.8 %).

During lactation, nutrient requirements are very high and feed intake increases to supply needs for milk production. LEBAS (1987) showed that feed intake is correlated to the size of the suckled litter. That could explain the higher weight of the full digestive tract in females suckling the larger litters. However, the increase of feed intake which occurs during lactation is generally insufficient to supply the needs for milk production and mobilisation of body reserves is necessary to meet the nutritional deficit (PARIGI-BINI *et al.,* 1992). The present results showing lower weights of carcass and adipose tissues in 10R does that fed larger litters than in those that fed small litters demonstrated that the extent of body reserve mobilisation increases with the size of the suckled litter. This is in agreement with previous results obtained in primiparous does (FORTUN and LEBAS, 1994).

Our results did not demonstrate any effect of the number of suckling rabbits on the percentage of dead or eliminated does. These results suggest that the mobilisation of body reserves that occurred when does nursed large litters did not have a negative influence on the medium-term survival of females.

CONCLUSION

The experimental design enabled us to evaluate the effects of the nursed litter size, independently of the litter size born. It can be concluded that nursing a large litter has a harmful influence on fertility, mean rabbit weight at weaning and body composition of females at weaning. On the other hand, these results suggest that a large suckling litter may be associated with an increase of the litter size at the following parturition. Our results did not demonstrate any effect of the number of suckling rabbits on the survival of kits during lactation or the medium-term survival of females.

Acknowledgements : the authors would like to acknowledge the SELAP workers (“Langlade unit”) for their technical assistance

REFERENCES

AUMANN J., ZIMMERMANN E., DEMPFLE L., 1984. Factors affecting litter size in rabbits with post-partum insemination. *3rd World Rabbit Congress, Roma, Italy,* **2**, 96-103.

CERVERA C., ALBERICH M.J., BLAS E., SIMPLICIO J.B., 1988. Evaluation of diet and remating interval after parturition on the growth of litters of different size. *4th World Rabbit Congress, Budapest, Hungary,* **3**, 30-35.

FORTUN L., LEBAS F., 1994. Influence of the number of suckling young and the feed level on foetal survival and growth in rabbit does. *Ann. Zootech.*, **43**, 163-171.

FORTUN L., PRUNIER A., LEBAS F., 1993. Effects of lactation on fetal survival and development in rabbit does mated shortly after parturition. *J. Anim. Sci.*, **71**, 1882-1886.

FORTUN-LAMOTHE L., BOLET G., 1995. Les effets de la lactation sur les performances de reproduction chez la lapine. *INRA, Prod. Anim.*, **8**, 49-56.

GARCIA F., PEREZ A., 1989. Efectos de la lactacion y numero de lactantes sobre la monta, ovulacion y supervivancia fetal hasta el parto, evaluados por laparoscopia, en conejas multiparas. *ITEA*, **80**, 3-10.

LEBAS F., 1969. Alimentation lactée et croissance pondérale du lapin avant sevrage. *Ann. Zootech.*, **18**, 197-208.

LEBAS F., 1987. Influence de la taille de la portée et de la production laitière sur la quantité d'aliment ingérée par la lapine allaitante. *Reprod. Nutr. Dévelop .*, **27**, 207-208.

McNITT J.I., LUKEFAHR S.D., 1990. Effects of breed, parity, day of lactation, and number of kits on milk production of rabbits. *J. Anim. Sci.*, **68**, 1505-1512.

PARIGI-BINI R., XICCATO G., CINETTO M., DALLE-ZOTTE A., 1992. Energy and protein utilization and partition in rabbit does concurrently pregnant and lactating. *Anim. Prod.*, **55**, 153-162.

SZENDRÖ Z., 1992. Effect of litter size at mating on the reproductive performance of does. *J. Appl. Rabbit Res.*, **15**, 538-544.

SZENDRÖ Z., PALOS J., RADNAI I., BIRO NEMETH E., ROMVARI R., 1996. Effect of litter size and birth weight on the mortality and weight gain of suckling and growing rabbits. *6th World Rabbit Congress, Toulouse, France*, **2**, 365-370.

THEAU-CLÉMENT M., ROUSTAN A., 1992. A study on relationships between receptivity and lactation in the doe, and their influence on reproductive performance. *5th World Rabbit Congress, Corvallis, USA*, 55-62.

XICCATO G., 1996. Nutrition of lactating does. *6th World Rabbit Congress, Toulouse, France*, **Vol 1**, 29-46.

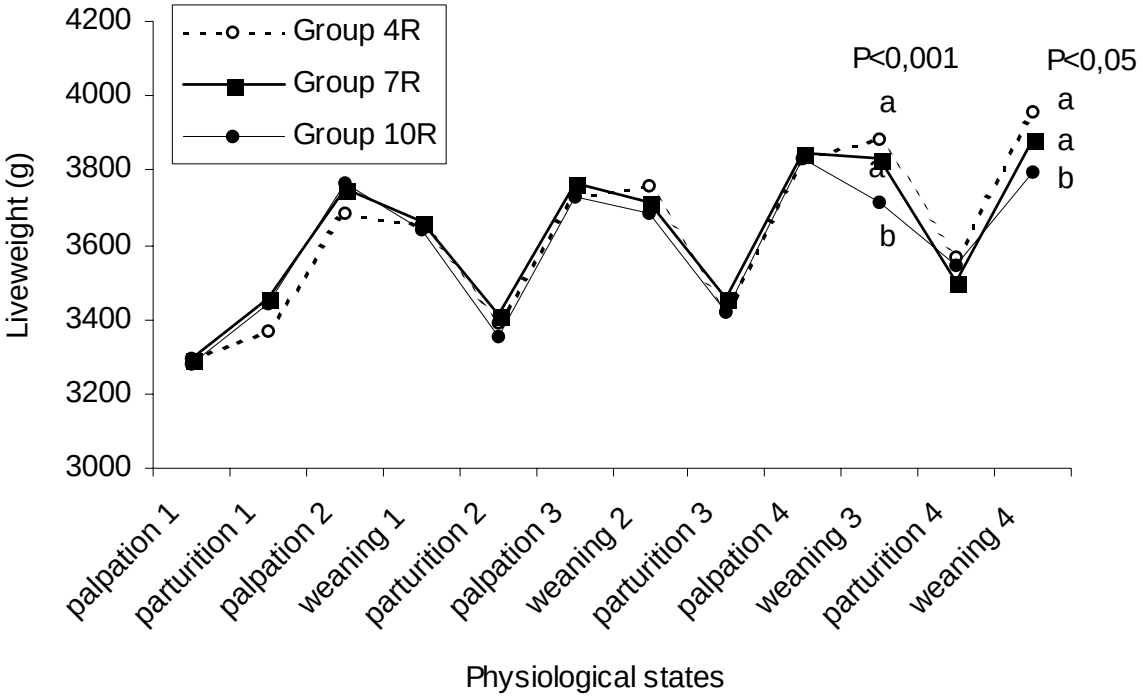

Figure 1: Evolution of the females live weight during the experiment (1st palpation to 4th weaning)