EFFECT OF NURSING METHODS ON PRODUCTIVITY IN LACTATING RABBITS

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ABSTRACT

This work studied the effects of different nursing methods applied before and after insemination (AI) on productivity of does. 173 Pannon White and New Zealand White (NZW) rabbits were divided into four groups, according to parity, litter size and genotype. Control group (C) nursed freely from day 1 to 35 of lactation. In W2+3 group, free-nursing does were separated by wire-mesh insertion from their litters on day 9 (from 9:00) and can nurse controlled (8:45 to 9:00) on day 10, 11, 12 and 13. AI was done within 15 min after controlled nursing on day 11 *post partum*. The does returned to the constant free nursing from 8:45 on day 14. The same timing of nursing and AI was adopted in N2+3 group but with carrying the nest-box each day into another room. In N2 group, the daily removal of the nest-box occurred on day 9 and 10, and immediately after AI on day 11, the does had free access to the nest again. With 42-day reproduction cycle, 485 AI's were performed. After recording the number of born alive, an intra–group egalisation to 8 pups per litter was done. Fertility improved (P=0.001) in W2+3 (59.3%), N2+3 (60.0%) and N2 (50.4%) groups compared to C group (33.3%). The number of born alive was higher (P=0.024) in N2+3 group (8.88), than in N2 (7.84) and C groups (7.24), while it was intermediate in W2+3 group (8.26). Controlled suckling increased (P=0.019) the 35 days' weaning weight (908 vs 945, 942, 937 g in C, W2+3, N2+3, N2, respectively) with no impact (P=0.155) on litter size (7.06, 6.69, 7.03, 6.83, respectively). The highest increase in productivity (weight of weaned and slaughter rabbits in group) was found in N2+3 group (by 73-86%), however, it also improved by 54-76% in W2+3 and by 44-51% in N2 groups compared to free nursing (C).

Key words: rabbit, nursing method, reproduction, growth.

INTRODUCTION

In intensive production systems rabbits are artificially inseminated (AI) on a fixed day, 9 to 11 days *post partum*. However, fertility is low in does that are simultaneously lactating and sexually non-receptive on the day of AI (THEAU-CLÉMENT and MERCIER, 2003). A 2 days' 24 h dam-litter separation (DLS) before AI, ruptured by 10 min daily suckling, improved fertility by 15% without decrease in weaning weight compared to free nursing

(BONANNO *et al*., 2004). Beside 12% higher fertility, controlled nursing 2 days prior to AI and on subsequent days tended to increase even the number of born alive by 6% (EIBEN *et. al*., 2004).

The dam-litter behavior can be influenced by mutual olfactory and visual stimuli affecting the regulation of neuroendocrine system (GONZÁLEZ-MARISCAL, 2001). DLS can be employed by different ways. Inserting a wire-mesh between the doe and its litter means inhibition of suckling with free olfactory, acoustic and visual contact. Using a metal plate permits olfactory communication when the top of the nest-box is from wire-net. More similar to natural condition is the total separation, i.e. removing the mother or its litter. RODRÍGUEZ-DE LARA *et al*. (2003) found that relocation of does into another room in cages separated from their litters 8-10 h before AI resulted in 1.6 more total born without any change in fertility compared to free nursing.

This work studied the effects of controlled nursing with wire-mesh insertion for 2+3 days (before+after AI) and by removing the nest-box for 2+3 or 2 days on productivity of does.

MATERIAL AND METHODS

The trial was conducted in Gödöllő, between July and December 2003. At starting, 173 Pannon White and NZW does were randomly distributed into four groups according to litter size, genotype and parity. Delivered does remained in their initial group and 32, 20, 16 and 24 females and 20, 6, 7 and 10 does considering the same factors were used as replacement at 2nd and 3rd parturition, respectively. The does were housed in wire-mesh cages (60x60x30 cm) with access to a nest-box hung outside on the cage. In the air-flow ventilated building with 16 h daily lighting, the temperature was 15-20 °C with peaks of 23-25 °C in summer. Rabbits were fed *ad libitum* a pelleted diet (10.3 MJ DE/kg, 17.5% c. protein, 3.1% ether extract, 13.9% c. fibre).

485 inseminations were perfomed with three consecutive series of AI's (repetition) and following a 42-day reproduction cycle. Fresh heterospermic semen diluted to 1:8 was used in the amount of 0.5 ml/doe. Mothers were given 1.5 µg GnRH analogue (Ovurelin) i.m. to induce ovulation. After recording the number of born alive, an intra–group standardisation to 8 pups per litter was done. Free nursing was practiced before and after treatments in each group. Kits were weaned at 35 days of age.

Control group (C) nursed freely from day 1 to 35 of lactation. In W2+3 group, free-nursing does were separated by wire-mesh from the litter on day 9 (from 9:00), 10, 11, 12 and 13 and could nurse controlled (8:45 to 9:00). Insemination (AI) was done within 15 min after controlled suckling on day 11 pp. Does returned to free nursing from 8:45 on day 14. The same timing protocol was adopted in N2+3 group but with carrying the nest-box into another room. In N2 group, the daily removal of the nest-box occurred on day 9 and 10, and after AI on day 11, it was immediately freely available for the rabbits.

Fertility was calculated as the ratio of parturitions to inseminations (x 100). Size and weight of litters were determined at day 1, 7, 9 (before separation), 11, 14 (before

suckling except C group), 15, 21, 35 and 70. Does were weighed at day 1, 15 and 21 of lactation, while the kits individually at 35 and 70 days of age.

The effects of treatment (C, W2+3, N2+3, N2), repetition (1st, 2nd, 3rd AI) and their interaction were estimated by analysis of variance and by chi-squared test using the STATGRAPHICS 6.0 and GENSTAT 6.1 statistical softwares. Sex as fixed effect and 35d body weight as a covariate were involved in evaluating 70d body weight. Pregnancy was included in the model estimating the change in doe's body weight. In case of litter loss prior to 9th day of lactation (before treatment) the data of the doe and its litter were excluded from the evaluation.

RESULTS AND DISCUSSION

Fertility improved (P=0.001) by 17.1, 26.0 and 26.7% in N2, W2+3 and N2+3 groups compared to C (Table 1). BONANNO *et al*. (2004) and EIBEN *et al*. (2004) reported similar increases of fertility (15% and 12%, respectively) with a split 24 h DLS for 2 days by wire mesh. On the contrary, MATICS *et al*. (2004b) did not found any effect (79-80% vs 78% in the control) by a 24 h wire-net DLS for 2 and 3 days before AI (). Thus, poor fertility – as in our case and probably due to season and parity - can be remedied by controlled nursing, whereas it has no effect when fertility is good (MATICS *et al*., 2004b). The number of born alive was higher (P=0.024) in N2+3, than in N2 and C groups (Table 1).

Table 1 Influence of nursing method on doe's reproduction

	Free nursing	W2+3	N2+3	N2	P value		
Inseminations (n)	123	118	125	119	Group	Repetition	GxR
Fertility, %	33.3^{a}	59.3^{b}	60.0^{b}	50.4^{b}	0.001	0.162	-
Born alive	7.24 ± 0.44^{a}	8.26 ± 0.34^{ab}	8.88 ± 0.34^{b}	7.84 ± 0.36^{a}	0.024	0.260	Ns
Parturition / AI	0.23 ± 0.04^{a}	0.46 ± 0.05^{bc}	0.50 ± 0.05^{c}	0.37 ± 0.04^{b}	0.001	-	-
Born alive / AI	1.59 ± 0.36^{a}	3.66 ± 0.43^{bc}	4.49 ± 0.42^{c}	2.89 ± 0.38^{b}	0.001	-	-

Suckling mortality was not affected by the treatment between 1-14 and 35-70 days of age (Table 2).

Table 2 Effect of nursing method on young mortality and morbidity

	Free nursing	W2+3	N2+3	N2	P value	
Age in days		**Suckling mortality, %**			Group	Repetition
1-9	7.06	9.14	6.90	6.04	0.062	0.001
9-14	1.41	2.10	0.90	1.46	0.178	0.001
14-21	1.21^{b}	1.47^{b}	1.70^{ab}	2.92^{a}	0.026	0.001
21-35	2.12^{b}	3.26^{ab}	2.80^{b}	4.48^{a}	0.024	0.001
1-35	11.8^{a}	16.0^{c}	12.3^{ab}	14.9^{bc}	0.019	0.001
	Mortality+morbidity after weaning, %					
35-70	9.57	13.5	11.6	10.5	0.102	0.001

Between 14 and 35 days of age, the mortality of N2 kits was higher, than in the other groups. W2+3 and N2 increased suckling mortality and tended to decrease (P=0.155)

litter size at weaning. On day 15, already returned to free suckling in each group, none treatment significantly influenced the litter size, litter weight and kit weight (Table 3).

Table 3 Effect of nursing method on pre-weaning traits

	Free nursing	W2+3	N2+3	N2	P value		
Age	mean ± se	mean ± se	mean ± se	mean ± se	Group	Repetition	GxR
in days	**Litter size**						
7	7.52 ± 0.08	7.29 ± 0.09	7.48 ± 0.08	7.56 ± 0.09	0.116	0.001	ns
15	7.29 ± 0.10	7.02 ± 0.11	7.36 ± 0.10	7.32 ± 0.11	0.101	0.001	ns
21	7.19 ± 0.12	6.90 ± 0.12	7.24 ± 0.12	7.13 ± 0.12	0.181	0.001	ns
35	7.06 ± 0.13	6.69 ± 0.13	7.03 ± 0.13	6.83 ± 0.13	0.155	0.001	ns
	Litter weight, g						
1	514 ± 6	506 ± 6	523 ± 6	515 ± 6	0.228	0.001	ns
7	1052 ± 18	1025 ± 18	1077 ± 18	1078 ± 18	0.130	0.001	ns
15	1920 ± 31	1851 ± 32	1958 ± 31	1908 ± 32	0.119	0.001	ns
21	2573 ± 43	2511 ± 44	2656 ± 43	2554 ± 44	0.112	0.001	ns
35	6411 ± 115	6319 ± 120	6557 ± 114	6431 ± 118	0.544	0.001	ns
	Calculated body weight, g						
1	64 ± 1	63 ± 1	65 ± 1	64 ± 1	0.228	0.001	ns
7	139 ± 2	140 ± 2	144 ± 2	142 ± 2	0.146	0.001	0.018
15	264 ± 3	264 ± 3	268 ± 3	262 ± 3	0.526	0.001	0.004
21	359 ± 4	367 ± 4	372 ± 4	362 ± 4	0.161	0.001	0.025
35	908 ± 9^{a}	945 ± 9^{b}	942 ± 9^{b}	937 ± 9^{b}	0.013	0.001	0.005
	Daily weight gain, g/day						
9-15	15.8 ± 0.3	15.5 ± 0.3	15.5 ± 0.3	14.8 ± 0.3	0.148	0.001	0.054
15-21	15.9 ± 0.4^{a}	17.2 ± 0.4^{b}	17.2 ± 0.4^{b}	16.7 ± 0.4^{ab}	0.044	0.001	ns
21-35	39.2 ± 0.5^{a}	41.5 ± 0.5^{b}	40.8 ± 0.5^{b}	41.1 ± 0.5^{b}	0.002	0.001	0.001
1-35	24.8 ± 0.3^{a}	25.9 ± 0.3^{b}	25.8 ± 0.3^{b}	25.7 ± 0.3^{b}	0.013	0.001	0.006

W2+3 and N2+3 kits surpassed (P=0.053) C sucklings in weight gain between 15 and 21 days of age. Then, rabbits in each DLS gained better (P=0.003), than in C group until weaning (Table 3). MATICS *et al*. (2004a) reported higher frequency of daily nest visits when DLS does returned to free nursing. It can explain the better growth-rate in our DLS groups after day 15.

Despite the larger weaning weights, DLS rabbits gained poorer (P=0.001) and reached smaller (P=0.001) 70-days body weights, than C rabbits (Table 4).

Production longevity was better in W2+3 and N2+3. In relation to fertility, from the does at starting higher proportion of W2+3 and N2+3 were able to take part at 2nd AI (30%, 60%, 67%, 38%; P=0.001) and at 3rd AI (14%, 48%, 40%, 27%; P=0.005) than C or N2. Consequently, the average parturitions calculated from the number of does with 0, 1, 2 or 3 kindlings were higher for W2+3 and N2+3 (0.43, 1.06, 1.09, 0.73; P=0.05) and both the number of deliveries and born alive per AI were higher (P=0.001) in W2+3 and N2+3, than in the other two groups (Table 1).

Table 4 Effect of nursing method on post-weaning traits

	Free nursing	W2+3	N2+3	N2	P value			
Number of litters 35d weanlings	120 n = 851	107 n = 721	120 n = 840	108 n = 743	Group	Repetition	Sex	GxR
Age in days	mean ± se	mean ± se	mean ± se	mean ± se				
	Individual body weight (measured), g							
35	904 ± 4^{a}	941 ± 5^{b}	935 ± 4^{b}	931 ± 5^{b}	0.001	0.001	-	0.001
70	2334 ± 9^{a}	2299 ± 10^{b}	2297 ± 9^{b}	2304 ± 10^{b}	0.011	0.001	-	0.025
70*	2365 ± 7^{a}	2274 ± 8^{c}	2291 ± 7^{bc}	2300 ± 7^{b}	0.001	0.001	0.01	0.001
	Daily weight gain, g/day							
35-70	40.6 ± 0.2^{c}	38.4 ± 0.2^{a}	38.8 ± 0.2^{ab}	39.0 ± 0.2^{b}	0.001	0.001	-	0.001
	Number of rabbits per doe							
70	6.17 ± 0.16^{b}	5.53 ± 0.17^{a}	6.12 ± 0.16^{b}	6.02 ± 0.17^{b}	0.024	0.001	-	ns
	Weight of fatteners per doe, kg							
70	14.48-± 0.37^{a}	12.71 ± 0.39^{b}	14.07 ± 0.37^{a}	13.92 ± 0.39^{a}	0.009	0.001	-	ns

*covariate: Individual body weight of rabbits at 35d (P<0.001)

Total weight of weaned rabbits per group (212.5, 373.3, 394.4 and 320.5 kg, in C, W2+3, N2+3 and N2 groups, resp.) was calculated as multiplying fertility (Table 1) by 35d litter size (Table 3) and by the 35d individual weight of kits (Table 4). The weight of fatteners was assessed as multiplying fertility by the number and by the weight of 70d rabbits per doe (Table 4). This value was 485.9, 745.7, 841,3 and 697.8 kg in C, W2+3, N2+3 and N2 groups, resp. On the basis of these productivity indexes, the impovement was 75.7%, 85.6% and 50.8% in weaning weight, while 53.5%, 73.1% and 43.6% in finishing weight in W2+3, N2+3 and N2, respectively, compared to C group. Thus, N2+3 was the most effective that surpassed also W2+3 treatment by 9.9 to 19.6 % in productivity.

The nursing method had no influence on the body weight of does (Table 5).

Table 5 Effect of nursing method on body weight of does

	Free nursing	W2+3	N2+3	N2	P value			
Lactation day	mean ± se	mean ± se	mean ± se	mean ± se	Group	Repetition	Pregnancy	GxR
1	4270 ± 37	4278 ± 38	4332 ± 37	4233 ± 38	0.301	0.001	-	ns
15	4568 ± 36	4508 ± 37	4556 ± 36	4528 ± 37	0.654	0.001	0.824	ns
21	4580 ± 37	4588 ± 37	4617 ± 36	4537 ± 37	0.494	0.001	0.508	ns

CONCLUSIONS

Our results indicate that the fertility of lactating does can be impoved successfully by a temporary 24 h DLS for 2 days before AI. Moreover, the increase in rate of fertility compared to free nursing seems to be relatively higher with nest-box removal (+17%) than by wire-mesh separation. Similarly to other studies, this DLS is not able to increase the number of kits born alive. Nevertheless, the efficacy of this DLS is confirmed by the 44-51% increase in productivity.

Compared to a 2-days DLS prior to AI, a further tendency to 9% higher fertility can be achieved when the DLS is practiced also on subsequent 3 days, regardless of the type of separation. However, the DLS by wire net for 2+3 days reduced the young survival and thus the number of slaughter rabbits. After all, especially due to the higher fertility, a 54-76% better productivity can be expected with wire-net DLS adopted through 5 days compared to free nursing.

Benefit of the most laboursome method, i.e. the daily removing of nest-box for 5 days, is that beside the high fertility, here also the number of born alive can be increased in contrast to the other DLS. In summary, though the productivity was the best and by 73-86% higher in does separated by nest removal for 5 days than in C females, this method is laborious and can not be applied in large farms. Apart from this, each of these studied DLS methods can be recommended aiming to increase the productivity of lactating does.

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