

EFFECT OF CHANGE IN NURSING METHOD ON THE PERFORMANCE OF RABBIT DOES¹

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ABSTRACT: To study the effect of nursing method on reproduction, 232 primiparous and multiparous lactating Pannon White and NZW rabbit does were distributed proportionately among four experimental groups: **FF**: free nursing from kindling until weaning; **FC**: free nursing from day 1 to 7 and controlled nursing from day 8 to 17; **CF**: controlled nursing from day 1 to 7 and free nursing from day 8 to 17; **CC**: controlled nursing from day 1 to 17. After the 17th day of lactation, free nursing was used in all groups until weaning at 35 days of age. In controlled nursing the females could visit the nest box between 8 and 9 a.m. every day. Artificial inseminations (AI, n = 482) with 42d intervals were performed on day 10 *post partum*, within 15 minutes after nursing. The results of three consecutive kindlings were evaluated. In conclusion, it is not recommended to follow controlled nursing between 1-17th days of lactation because productivity traits were relatively poorer than in the other groups. The change from controlled to free nursing before AI did not increase productivity parameters. Conversely, the switch over from free to controlled nursing did increase the number of 21 day-old young per insemination (3.0, 4.2, 3.4 and 3.1 for FF, FC, CF and CC, respectively, $P < 0.05$) suggesting that such a change in nursing two days before AI can be an efficient biostimulation tool for improving productivity. However, young body weight at 21 days of age was considerably impaired, especially by numerically larger litters (432, 401, 414 and 417 g in FF, FC, CF and CC, respectively, $P < 0.05$), which suggests that the duration of controlled nursing must be shortened to avoid a detrimental effect on growth. Therefore, further studies are needed to determine the optimum form of controlled nursing and its long term effect on productivity.

Key words: rabbit, reproduction, sexual receptivity, nursing method.

¹ This paper is a modified version of that presentation appeared in Segundo Congreso de Cunicultura de las Américas, 19-22 Junio 2002, La Habana, Cuba

INTRODUCTION

Lactating rabbits that are sexually non-receptive at the moment of artificial insemination (AI) show significantly low reproductive performance (THEAU-CLÉMENT, 2000, BRUN *et al.*, 2002). Although sexual inactivity can be remedied by hormonal treatment with PMSG or other gonadotropins, such intervention is inconsistent with the anticipated EU provisions aimed at restricting the regular and generalised use of hormones in farm animals. Therefore, it is necessary to search for alternative tools in order to synchronise oestrus in rabbits at the moment of AI. THEAU-CLÉMENT (2000) has reviewed the effectiveness of different biostimulation methods and reported that the short-term doe-litter separation (DLS) technique can be an alternative to hormone treatments.

The success of DLS depends on its duration, the timing of nursing in relation to AI, and on the nursing method (free, controlled). The best result was obtained when does were inseminated within 15 minutes after the first nursing following doe-litter separation (SZENDRŐ *et al.*, 1999). In general, free nursing is applied before and after the stimulation. When controlled nursing was used, the favourable effect of DLS was less pronounced or absent (BONANNO *et al.*, 1999, 2000; SZENDRŐ *et al.*, 1999). So far there has been only a single report on the success of 48-hour DLS depending on the nursing method used before AI (BONANNO *et al.*, 2000). There is no information on the biostimulation effect of changing the nursing method (from free to controlled or, vice versa, from controlled to free) before AI.

Recent behavioural observations suggest that 12-25% of doe rabbits visit the nest more than once a day and probably nurse their young on more occasions (HOY *et al.*, 2000; SELZER *et al.*, 2001; HOY and SELZER, 2002). The nursing method may affect the relationship of the doe with her young, i.e. the suckling behaviour of the young and the nursing habits of the doe (BAUMANN and STAUFFACHER, 2001). MATICS *et al.* (2001) observed a higher incidence of twice-a-day visits to the nest when controlled nursing was changed to free as compared to the constant free nursing during the whole lactation. MATICS *et al.* (2003) also demonstrated a higher frequency

of some behavioural patterns such as head contact, scraping and wire biting in the group of does changed from free to controlled nursing.

Besides the free and controlled nursing group as controls, the purpose of this experiment was to study whether the change of the nursing method (from free to controlled and vice versa) two days before AI can influence the reproductive performance of rabbit does.

MATERIALS AND METHODS

The experiment was carried out at the Gödöllő rabbit farm. The doe rabbits were kept individually in flat-deck wire-mesh breeding cages (60×60×30 cm) in a closed and temperature-controlled building (15–20 °C) with 16 hours of light per day. A commercial rabbit diet (DE 10.3 MJ/kg, crude protein 17.5%, ether extract 3.1%, crude fibre 13.9%) and drinking water from a valve-type automatic water system were available *ad libitum*.

At the start of the experiment, primiparous and multiparous Pannon White and New Zealand White rabbit does (n=232) were homogeneously allotted into four groups after parturition (Fig 1), ensuring the absence of relevant differences in genotype, parity order, body weight of does (4010–4043 g), litter size at birth (total:

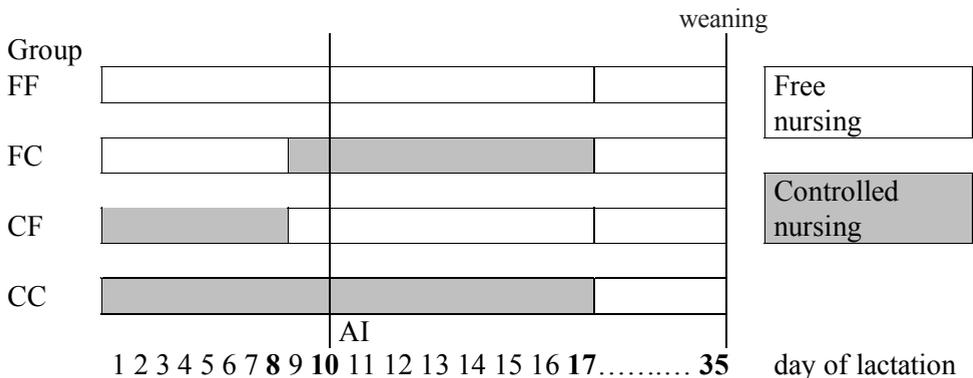


Figure 1: Experimental groups.

8.1–8.4; alive: 7.9–8.3), and litter weight (499–509 g) after equalisation to eight pups per litter.

Controlled nursing was ensured by a wire mesh inserted between the external side wall of the cage and the nest box hung on that wall from the outside. Does could enter the nest once a day, between 8 and 9 a.m. FC does were first closed from the nest on day 8 (on Wednesday) at 9 a.m., and CF does were allowed free access to the nest from that time on. From day 17 of lactation to weaning at 35 days of age free nursing was used in all groups.

Three consecutive series of AI's (n = 482) with 42d intervals and fresh semen were practised on *postpartum* day 10 (on Friday) in the morning soon after GnRH injection. In the controlled-nursing groups the does were inseminated within 15 minutes after nursing. Therefore, in the case of FC and CC rabbits, the nursing method involved a 24 to 25 hours DLS on the two days before AI. Dead or discarded does (due to illness or litter loss) were replaced by lactating mothers respecting genotype, parity and live weight at the subsequent insemination.

Sexual receptivity was determined on the basis of the colour and swelling of the vulva at the moment of AI (UBILLA *et al.*, 2000). Pregnancy was tested by abdominal palpation on days 10–14. Kindling rate was calculated as a ratio of delivered per inseminated females. Does were weighed after delivery, at the moment of AI and on day 17 of lactation. Daily feed consumption between kindling and insemination as well as between insemination and day 17 of lactation was calculated. Litter size at birth (total, alive), at 21 and 35 days of age were recorded (fostering to 8-9 pups per litter was performed within the groups). Litter weight before fostering was measured at birth (born alive) and then at 21 and 35 days of age, and used for calculating the individual body weight of kits at birth, at 21 and 35 days of age. Productivity was expressed as number and weight of rabbits per AI.

The fixed effects of nursing method (four levels) were statistically evaluated by analysis of variance and by the chi-squared test, using the STATGRAPHICS 6.0

programme package involving also the impact of the three repetitions (series of AI). Litter size was included as a co-variable in estimating the litter weight and individual body weight of the young and in feed intake of mothers.

RESULTS AND DISCUSSION

Sexual receptivity was not affected by the nursing method (Table 1). Comparing sexual receptivity in free and controlled nursing does without 48-hour DLS, BONANNO *et al.* (2000) reported values (54 and 59%, respectively) similar to our results. Pregnancy rate improved by 13% in FC compared to FF group (69 vs. 56%, $P=0.051$). Comparing free nursing without DLS, BONANNO *et al.* (2000) found a non-significant increase in kindling rate when using 48-hour DLS (47% vs. 69%), but – in contrast to this study – they noted a higher kindling rate (68%) also in the group of does subjected to permanent controlled nursing up to day 11 post partum. No differences were found in kindling rate.

Total litter size, alive and at 21 days of age were highest in group FC (Table 2). Nevertheless, the difference from FF does was significant only at 21 days of age. BONANNO *et al.* (2000) observed the same tendency: compared to free nursing without DLS (born alive: 7.6), free nursing with 48-hour DLS resulted in higher litter size

Table 1: Effect of nursing method on sexual receptivity at the moment of AI, on pregnancy and kindling rate.

	Group				Effects	
	FF	FC	CF	CC	Group	Repetition
Receptivity, %	57 (71 of 125)	53 (67 of 126)	47 (59 of 125)	59 (73 of 124)	NS	0.001
Pregnancy rate, %	56 (68 of 121)	69 (83 of 120)	62 (76 of 122)	58 (69 of 119)	NS	NS
Kindling rate, %	46 (56 of 121)	58 (70 of 120)	49 (60 of 122)	45 (53 of 118)	NS	NS

NS: Non significant ($P>0.05$)

(7.9) and was numerically lower (7.1) in permanently controlled nursing. Comparing free nursing without DLS and free nursing with 24-hour DLS, MAERTENS *et al.* (2000) observed a significant increase in litter size at birth in the latter case (7.5 vs. 8.2, respectively), while THEAU-CLÉMENT and MERCIER (2002) reported a similar but non-significant difference (9.5 vs. 11, respectively).

Litter weight and individual body weight were primarily affected by litter size and series of insemination (repetition). It seems however, that these traits were also influenced by the method of nursing, namely the duration of controlled suckling. Comparing constant free nursing with a single 24-hour DLS before insemination, MAERTENS *et al.* (2000) did not find a significant difference in 29d weaning weight (677 g and 667 g), as was also noted by THEAU-CLÉMENT and MERCIER (2002) when the rabbits were 35 days old (942 g and 965 g). When the 24-hour DLS was applied longer, on two days before AI, the 35 d weaning weight (777 g and 780 g) still corresponded to that of the free-nursed control (BONANNO *et al.*, 2004). In our case, the controlled nursing in both groups FC and CC lasted much longer, until the 17th day of lactation, which may have impaired the growth rate of the kits.

Litter loss was not influenced by the nursing system (Table 2). Behind the increased 21-35 days mortality in group FC could be the smaller body weight of pups that grew up in larger litters. BONANNO *et al.* (2004) reported lower suckling losses from day 9 to 35 and therefore higher litter size at 35d weaning (7.2 vs. 7.0) in case of 24-hour DLS for two successive days before AI, but with free nursing thereafter than for the constant free nursing.

The number of 21-day-old rabbits produced per AI is a result of fertility and rearing ability. This parameter, which indicates productivity was significantly 24-39% higher in FC group (Table 2). However, controlled nursing until the 17th day of lactation in this group certainly impaired the 21 and 35 days individual body weight of kits, and also caused higher young mortality. Despite this detrimental effect, the other two productivity indicators, the weight and number of weaned rabbits per AI were 20-35% higher, in FC group than in the other three groups.

Table 2: Impact of nursing method on litter size, litter weight, individual body weight, young mortality and on productivity.

	Group				SE	Effects			
	FF	FC	CF	CC		Group	Repe- tition	Litter size	Inter- action
Number of litters	56	65	60	50					
	Litter size								
total born	7.47	7.75	7.70	7.20	0.19	NS	NS	-	NS
born alive	7.27	7.73	7.42	6.97	0.19	NS	NS	-	NS
at 21 days of age	6.45 ^a	7.24 ^b	6.91 ^{ab}	6.72 ^{ab}	0.12	0.05	NS	-	NS
at 35 days of age	6.34	6.58	6.67	6.64	0.13	NS	NS	-	NS
	Litter weight, g								
at birth	501	511	515	519	5	NS	0.002	0.001	NS
at 21 days of age	2878 ^a	2703 ^b	2788 ^{ab}	2797 ^{ab}	23	0.08	0.02	0.001	0.02
at 35 days of age	5912	5666	5799	5712	45	NS	0.001	0.001	NS
	Individual body weight, g								
at birth	70	69	71	71	1	NS	0.008	0.001	NS
at 21 days of age	432 ^a	401 ^b	414 ^{ab}	417 ^{ab}	4	0.05	0.006	0.001	0.002
at 35 days of age	922 ^a	855 ^b	886 ^{ab}	885 ^{ab}	8	0.03	0.001	0.001	0.08
	Young mortality, %								
litter loss	8.9 (5/56)	6.2 (4/65)	5.0 (3/60)	8.0 (4/50)	-	NS	NS	-	-
from day 0 to 21	8.4 (34/403)	6.7 (34/509)	7.5 (34/451)	7.7 (28/362)	-	NS	NS	-	-
from day 21 to 35	1.7 ^a (7/403)	6.5 ^b (33/509)	3.1 ^a (14/451)	1.9 ^a (7/362)	-	0.001	NS	-	-
from day 0 to 35	10.2 (41/403)	13.2 (67/509)	10.6 (48/451)	9.7 (35/362)	-	NS	NS	-	-
	Number of rabbits produced/AI								
at birth	3.41 ^{ab}	4.52 ^a	3.81 ^{ab}	3.29 ^b	0.22	0.05	-	-	-
at 21 days of age	2.99 ^b	4.15 ^a	3.36 ^{ab}	3.06 ^b	0.19	0.05	-	-	-
at 35 days of age	2.92	3.87	3.23	2.91	0.19	NS	-	-	-
	Weight of weaned rabbits/AI, g								
	2687 ^{ab}	3384 ^a	2757 ^{ab}	2498 ^b	161	0.05	-	-	-

Means within a row with different superscripts differ.
NS: Non Significant ($P < 0.05$).

Corresponding body weight ranking of does was recorded at kindling, at AI and on the 17th day of lactation among groups (Table 3). The nursing system did not influence the feed consumption of doe rabbits. The relatively higher feed intake of FC mothers after kindling was also related to bearing and delivery of larger litters.

Controlled nursing is not recommended between day 1 and 17 of lactation because productivity traits were relatively poorer than in the other groups. The change from controlled to free nursing before AI did not significantly increase productivity parameters in comparison with continuous free nursing. The significantly highest value in the number of 21-day-old young per insemination obtained in group FC switched over from free to controlled nursing means that such a change in nursing two days before AI can be an efficient biostimulation tool. However, the body weight of young at 21 days of age was considerably impaired especially in numerically larger litters, which indicates that the duration of controlled suckling must be shortened to avoid its disadvantageous effect on growth.

The benefit of changing the nursing method two days before AI is that, in contrast to 36-48 hours DLS, here the young are separated from the does for a shorter time. Several observations suggest that the nest visits of does follow a diurnal rhythm, and the nursing peak usually occurs in the early evening hours, after dark (SEITZ *et al.*, 1997; HOY *et al.*, 2001; MATICS *et al.*, 2001). With this in view, adapting rabbit does to nursing in the morning hours may induce the same effect and related physiological changes as 24 to 48 hours of DLS.

Separation of the doe from her young means an intervention in the doe-litter relationship, which has both ethological (WASSERZIER *et al.*, 1997) and animal welfare (VERGA, 2000) implications to be considered. This is indicated by the fact that a 48-hour DLS changes the stress and pituitary hormone levels of suckling kits (BOITI *et al.*, 2001, 2002, REBOLLAR *et al.*, 2002), temporarily reduces their digestive capacity (ESPINOSA *et al.*, 2002) and so decreases their growth (BONANNO *et al.*, 2002ab). Nevertheless, further experiments are necessary to precisely define how to apply a change in nursing system capable of increasing the doe's productivity without

Table 3: Effect of nursing method on body weight and feed intake of doe rabbits.

	Group						Effects				
	FF	FC	CF	CC	SE	Group	Repetition	Litter size	Doe body weight	Pregnancy	Interaction
	Doe's body weight, g										
after kindling	4249	4200	4087	4182	31	NS	NS	-	-	-	NS
at insemination	4579	4482	4435	4392	33	NS	***	-	-	-	NS
at 17th day of lactation	4619	4572	4407	4463	38	NS	***	-	-	NS	NS
	Doe's feed intake, g/day										
kindling-AI	427	432	429	425	4	NS	***	***	***	-	NS
AI-day 17	400	395	399	413	4	NS	***	***	***	NS	NS

*** $P < 0.001$.

NS: Non Significant ($P < 0.05$).

impairing young growth. In accordance with BONANNO *et al.*, (2004) a controlled nursing performed only two days before insemination seems to be a good compromise, but besides shortening the period of controlled nursing after AI, the durability of the efficacy of this method has to be tested.

Acknowledgements: Financial support for the research was obtained from the Ministry of Agriculture and Regional Development (project no. KF-173/4/00).

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