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EFFECT OF DIFFERENT MANAGEMENT METHODS ON THE NURSING BEHAVIOUR OF RABBITS

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Abstract: The aim of the experiments was to examine the nursing behaviour of does under different management methods. A continuous video recording with time lapse recorder (24 hours a day) was used. The experimental groups were: FF: Free nursing between parturition and day 16 (n=10 does); FC: Free nursing between parturition and day 9 and controlled nursing between day 10 and 16 (from 08:00 a.m. to 08:30 a.m., n=10); CF: Controlled nursing between parturition and day 9 and free nursing between day 10 and 16 (n=10); HF: The access to the nest box was free during an interval of 16 hours/day (from 04:00 p.m. to 08:00 a.m.) between parturition and day 16 (n=8). All does were observed between the 1st and 9th day, 74.8 percent of the does nursed once a day and 25.2% nursed more then once a day. The same values were 78.4 and 21.6 percent between the 10th and 16th day. In the CF group, a higher frequency of more than once-a-day-nursing was observed (36.2% of all cases). Between 1st and 9th and 10th and 16th day in the FF group 74.5 and 84.6% of nursing events were in the period of darkness (between 09:00 p.m. and 05:00 a.m.). The corresponding figure in the CF group was 39.3 because of the high frequency of double nursing. It seems that the change from controlled nursing to free has a significant effect on the increased frequency of double nursing. The interval between the evening and morning nursing events of twice-a-day-nursing does was 8 hours and 42 minutes. The duration of daily nursing was decreased during the period of observation. The duration of once a day nursing was significantly shorter than that of the first or the second nursing event of does that nursed twice a day. When changed from free to controlled nursing (Group FC) the behavioural patterns of the doe become nervous (head contact, scraping, wire biting) as can be frequently observed several hours before the nest box is opened. Does tend to adapt to the new nursing method within a few days.

Key words: rabbits, nursing, behaviour.

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INTRODUCTION

According to numerous studies (ZARROW *et al.*, 1965; LEBAS, 1969; HUDSON and DISTEL, 1982) rabbit does nurse their kits only once a day. This observation is the basis of applying controlled nursing. Some recent studies have shown that a certain proportion of does suckle their kits twice or more in 24 hours (HOY and SELZER, 2002). These sometimes conflicting results have prompted us to study the most important characteristics of nursing behaviour under different types of nursing management by 24-hour observation. The main benefit of the double nursing is not yet known. The aspects of nursing by two does were previously reported (SZENDRÕ *et al.*, 2000). Alteration of the nursing management systems from free to controlled may be a relevant method for oestrus activation (biostimulation) (BONANNO *et al.*, 2004 ; EIBEN *et al.*, 2002).

Nursing behaviour of does is not yet completely known. There is even less information on the effects of changing the time of nursing or the type of nursing management. These issues may also have an impact on the animal welfare and milk-supply regarding doe and kit. The objetive of this paper is analyse the characteristics of nursing behaviour under different types of nursing management by 24-hour observation.

MATERIALS AND METHODS

The experiments were conducted on Pannon White rabbits at the University of Kaposvár. The does were kept in cages made of spot-welded wire and having a basic area of 275 × 600 mm (measured without the feeder and the nest). The rabbits were fed a commercial pellet *ad libitum* and drinking water was also available *ad libitum* from nipple drinkers. The nest tray, sunk into the 550 × 240 mm nest area within the cage, was bedded with wood shavings. The door on the wall separating the cage and the nest area could be closed. Nine kits of average body weight were placed in each litter. Any kits dying during the experiment were replaced with kits

of the same age and similar body weight; thus, litter size did not change during the experiment. The does used for the experiment were held under a controlled nursing system before entering the experiment.

The following five experimental groups were formed:

FF: the does had free access to the nest for a period of 16 days from the time of kindling (n=10 does). This is a common method in practice.

CC: the does had access to the nest from 08:00 to 08:30 a.m. for 16 days from kindling (n=10 does). This is a common method in practice.

FC: from kindling up to day 9 there was free nursing, then from day 10 to 16 the does were allowed to enter the nest only once a day, from 08:00 to 08:30 a.m. (n=10 does). This method could be interesting for the biostimulation aspect.

CF: from kindling up to day 9 the does were allowed to nurse their kits only from 08:00 to 08:30 a.m., then between days 10 and 16 they had free access to the kits (n=10 does). The question is how the frequency of twice-a-day-nursing alters after changing the nursing method.

HF: during the first 16 days of nursing the does had free access to the nest from 04:00 p.m. to 08:00 a.m., while the door was closed (n=8) between 08:00 a.m. and 04:00 p.m. (n=8 does). This method is used for nursing by two does (Szendrő *et al.*, 2000).

On day 17 the door was opened in the nest boxes of all groups.

During the experiment the nursing behaviour of the does was monitored from the time of kindling up to day 16. That period was divided into two phases: the first phase lasted from kindling up to day 9, while the second from day 10 to 16. In Groups CF and FC the type of nursing was changed on day 9.

The rabbit building had a lighting period of 16L:8D. In addition to natural light coming in through the windows on the side-walls, artificial lighting (with neon lights)

was also provided. For the period of darkness (between 09:00 p.m. and 05:00 a.m.) two 40-W light bulbs emitting red light were installed on the ceiling, 1.5 m above the cages. At the cage floor level the light intensity was 1 lux. Twenty four hour observation was performed using the following video technique: Colour CCTV Camera : WV-CL 834/Panasonic, Time Lapse Recorder : AG-6040/Panasonic, Colour Monitor : WV-CM 2000/Panasonic. The video camera allowed us to monitor five cages (one doe from each group) simultaneously. The position of the camera was changed every 24 hours above 5 does that kindled on the same day; thus, a 24-hour recording of a given doe was made on days 1, 3 and 5 or on days 2, 4 and 6.

During evaluation of the videotapes the following parameters were recorded: the number of nursing events per day, the starting time of nursing (the doe enters the nest and assumes the posture typical of nursing) and the end of nursing (the doe jumps out of the nest), the distribution of nursing events in 24 hours was calculated, the length of nursing, in twice-a-day nursing the interval between two nursing events.

Using the Observer/VTA programme (HOY, 2000) the behaviour of does in front of the nest box was studied in detail in Groups FC and CC between 09:00 p.m. and one hour after nursing. In that study the incidence of three patterns of behaviour (number of events per doe and hour) were recorded: head contact: the doe puts her head to the entrance of the nest, scraping: the doe is scraping at the entrance to the nest, biting: the doe is biting the wire mesh of the cage at the entrance to the nest.

Statistical evaluation of the experimental data was performed by single-factor analysis of variance (length of nursing) and by the chi-squared test (distribution of nursing events and incidence of behavioural patterns), using the SPSS 9.0 programme package. When comparing the duration of nursing per nursing event in the case of once-a-day and twice-a-day nursing, the days after kindling were taken into account as a covariant.

RESULTS AND DISCUSSION

Daily nursing events:

Contrary to most data of the literature (Zarrow *et al.*, 1965; Hudson and Distel, 1982; Lebas, 1969; Schlolaut, 1995), summing the nursing behaviour (n = 224) the does entered the nest box to suckle twice in 22.8% of the cases and three times in 0.9% of the cases throughout the entire period of observation, irrespective of the experimental group. This proportion is similar to that reported by Selzer *et al.* (1999). However, the overhead position of the camera did not allow us to determine with complete certainty whether nursing actually took place. Based on several behavioural signs, Hoy and Selzer (2002) claim that these events can be regarded as actual nursing with high certainty. Also in the case presented in this paper, several factors indicated that the does really nursed the kits in all cases.

During the entire observation period (days 1-16) 85.9% and 14.1% of FF does showed single and double nursing, respectively (Table 1). The frequency of single nursing of this group exceeded that of the overall mean (76.6%).

During the first 9 days of observation Groups FF and FC can be considered identical as far as treatment is concerned (up to that day, does of both groups were allowed to suckle the kits freely). Still, a substantial difference can be found between the two groups in the frequency of nursing (Table 1). This probably arises from the individual behavioural differences between rabbits of the two groups. Namely, two does in Group FC regularly nursed the kits twice on all days of observation. In contrast, in Group FF twice-a-day nursing occurred only occasionally. As in the stock studied, 15 does suckled only once during each observation while three does consistently visited the nest twice, it may be assumed that an individual (genetic) predisposition may also play a role in the multiple nursing events per day.

Throughout the first 9 days does of Group CF were allowed to nurse the kits only in the morning (between 08:00 and 08:30 a.m.), while from day 10 they could enter the nest box freely whenever they wanted to. Presumably this change of the

nursing method was responsible for the higher-than-average incidence of twice-a-day and three times-a-day nursing in the second period (Table 1). The difference between Groups FF and CF was $P<0.10$. According to SEITZ *et al.* (1997), in a free nursing system does most frequently visit the nest box after dark. It appears that does in this group tried to continue the earlier practice of nursing in the morning but they also endeavoured to follow the natural behaviour pattern, i.e. nursing after dark. Presumably this may also have contributed to the higher incidence of multiple nursing events per day. If this hypothesis proves true, it may explain the relatively high incidence of twice-a-day nursing in the rabbit colony studied, in contrast to numerous earlier observations. On the experimental farm, controlled (once-a-day) nursing is the general practice. Following the logic described above it can be assumed that a similar "confusion" may have occurred in does rearing the (observed) litter in a "free nursing" system as opposed to restricted nursing of the previous litter (before the experiment), when the does were allowed to enter the nest box only in the morning hours. These does continued to follow the earlier rhythm of morning nursing followed by natural nursing in the evening. This factor should by all means be taken into account in further experiments.

The possible association between nursing events and milk-supply (applying free nursing) should be treated with caution as the results of the experiments conducted thus far showed that the litter weight of the free and controlled nursing groups (milk consumption of the kits) was similar (COSTANTINI *et al.*, 1986; SZENDRŐ *et al.*, 1999).

The nursing frequency of does in Group HF was completely identical with that of Group FF does (Table 1). Closing the nest box for 8 hours per day had no influence on the frequency of nursing.

Time of nursing:

In line with data of the literature on the diurnal distribution of nursing (TSUJII, 1988; SEITZ *et al.*, 1997) the highest number of nursing events was observed in the period of darkness (Table 2). As compared to FF rabbits, in Group FC the nursing peak showed a slight shift: between 05:00 a.m. and 01:00 p.m. nursing was observed

in 16% more cases. This can be explained by the higher number of does nursing twice, which nursed the kits at dusk and then again in the morning. This is supported by the results obtained for Group CF. In vain were these does given free access to the nest box from day 10 onward, the majority of them suckled the kits also between 05:00 and 09:00 a.m. The incidence of nursing between 05:00 and 09:00 a.m. (39.2%) is very similar to the proportion of does nursing 2 or 3 times (36.2%, Table 1), which supports the assumption that in this group the incidence of morning nursing increased as a result of twice-a-day nursing.

In Group HF, nursing occurred very frequently (17% and 25%, respectively) in

Table 1: Frequency of daily nursing events observed in the different experimental groups.

Period (days)	Daily number of nursing events	Experimental groups								Total	
		FF		FC		CF		HF			
		n	%	n	%	n	%	n	%	n	%
1-9	1	38	86.4	27	56.3	-	-	30	85.7	95	74.8
	2	6	13.6	21	43.8	-	-	5	14.3	32	25.2
	3	0	0.0	0	0.0	-	-	0	0.0	0	0.0
		44	a	48	b	-	-	35	a	127	100.0
10-16	1	29	85.3	-	-	23	63.9	24	88.9	76	78.4
	2	5	14.7	-	-	11	30.6	3	11.1	19	19.6
	3	0	0.0	-	-	2	5.6	0	0.0	2	2.1
		34	a	-	-	36	a	27	a	97	100.0

n = number of observations.
FF: the does had free access to the nest for a period of 16 days from the time of kindling.
FC: from kindling up to day 9 there was free nursing, then from day 10 to 16 the does were allowed to enter the nest only once a day.
CF: from kindling up to day 9 the does were allowed to nurse their kits once a day, then between days 10 and 16 they had free access to the kits.
HF: during the first 16 days of nursing the does had free access to the nest from 04:00 p.m. to 08:00 a.m.
a, b = different characters denote significant inter-group differences at the level of $P<0.05$ in the distribution of once-a-day nursing and multiple nursing events per da.y

the hour after the hatch of the nest box was opened. Free access to the nest box appears to exert a stimulating effect on nursing. In the subsequent 4 hours nursing was suspended, then darkness again stimulated nursing behaviour. Despite the fact that twice-a-day nursing was similar in Group FF and Group HF (Table 1), it was striking that the does of Group HF visited the nest box to nurse the kits also after daybreak (between 05:00 and 08:00 a.m.).

Regarding nursing by two does (SZENDRŐ *et al.*, 2000) the nursing activity of the first doe is confined to the morning whilst the second doe can freely enter the nesting box between late evening and morning. Based on the observations of does that had free access to the nest box exact times of nursing were determined and the occurrence varied between 04:00 p.m. and 08:00 without showing a pronounced peak. The dark period in general and its onset can not be considered as an interval of time. 19% of does nursed their kits during the 3-hour period prior to the morning admission. This period seems too short for the kits to be hungry enough to be nursed by the second doe at 08:00 a.m.

In the case of does nursing twice a day, the average interval between the evening and the morning nursing was 8 hours and 42 minutes while the interval between the morning and the evening nursing was 15 hours and 18 minutes. In the case of twice-a-day nursing the does most often suckle their kits again 8–11 hours after the first nursing. There were differences among the experimental groups in the time of the first and second nursing. In Group FF and FC the first nursing mostly occurred between 08:00 and 10:00 p.m. and the second between 5:00 and 10:00 a.m. In Group CF, after the 10th day the first nursing consistently took place between 04:00 and 11:00 p.m. while the second nursing occurred between 05:00 and 08:30 a.m. in 82% of the cases. Group HF does always nursed their kits between 04:00 and 06:00 p.m. for the first time and 75% of them suckled their kits between 03:00 and 08:00 a.m. for the second time.

Length of nursing:

Figure 1 shows that the length of nursing (per nursing event) was similar in

does nursing once and twice. During the entire period of observation, the length of once-a-day nursing was significantly (P<0.01) shorter than that of the first and the second nursing event in the case of twice-a-day nursing. HUDSON and DISTEL (1982) observed that the kits prepared themselves for the regular daily arrival of their dam in advance. While in the interval between two nursing events the kits huddle together silently and sleep in the bedding material of the nest, one hour before the expected time of nursing they tend to become increasingly active and emerge from the hair covering the nest to wait for their dam. When the litter was covered with bedding material before nursing, the length of nursing increased because of the additional time needed by the kits to emerge from the bedding material and start to suck. It may be assumed that rabbit kits suckled once a day tend to prepare for the arrival of their dam, while in the case of twice-a-day nursing, when the interval between two nursing events is shorter, the kits are probably having a rest and sleeping "unprepared", hidden in the bedding material of the nest when the doe jumps into the nest box. For this reason nursing appears to last longer in this case.

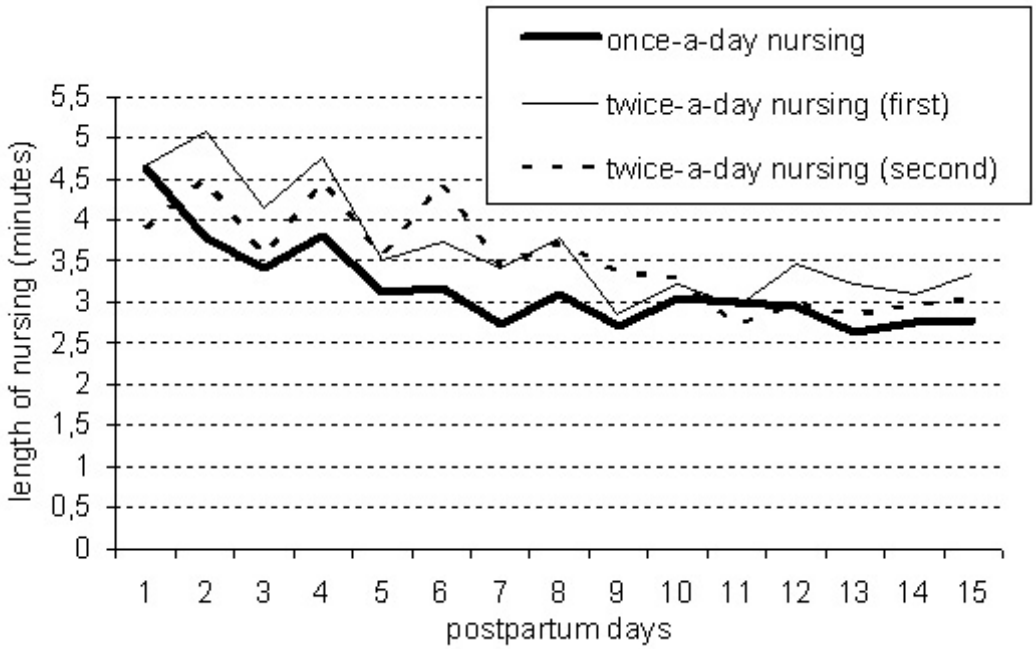

Figure 1: Length of nursing (per nursing event) in does nursing their kits once a day and twice a day.

Effect of changing the nursing method on the behaviour of does:

In comparison with does in Group CC, in Group FC we studied the behaviour patterns that could be brought into connection with the doe's exclusion from the nest box and her nervousness (head contact, scraping, wire biting) in the hours before opening the nest box and during the hour following it. According to BAUMANN and STAUFFACHER (2001) these behaviour patterns were typical of the period of darkness and of the period preceding and immediately succeeding the nursing.

In Group CC head contact, which indicates the gentle approach of the doe to the nest (checking, looking in), could rarely be observed between 09:00 p.m. and 05:00 a.m. (Table 3). Head contact became more frequent between 05:00 and 07:00 a.m., in the hour preceding nursing it reached a value several times higher than the

Table 2: Distribution of nursing events by parts of the day (%).

Periods (hours)		Experimental groups			
		FF	FC	CF	HF
		Days 1-9			
9 p.m-5 a.m.	dark	74.5	56.5	-	48.9
5 a.m.-1 p.m.	light	21.6	37.6	100	19.2[1]
1-9 p.m.	light	4.0	6.0	-	31.9[2]
		a	a		b
		Days 10-16			
9 p.m.-5 a.m.	dark	84.6	-	39.3	56.2
5 a.m.-1 p.m.	light	15.4	100	39.2	18.8[1]
1-9 p.m.	light	0.0	-	21.6	25.0[2]
		a		b	c

[1]: 3-hour period (05:00-08:00 a.m.); [2]: 5-hour period (04:00-09:00 p.m.).
FF, FC, CF, HF: see Table 1.
a, b, c = different characters denote significant inter-group differences in the distribution of nursing events by part of the day ($P<0.01$).

Table 3: Incidence of the three behavioural patterns number of event per doe and hour in Groups CC and FC.

	Day 10			Day 12			Day 14			Day 16			Total		
	head	scr.	bit.	head	scr.	bit.	head	scr.	bit.	head	scr.	bit.	head	scr.	bit.
Group CC															
9-11 p.m.	0.25			0.75			0.25						0.31		
11 p.m.-1 a.m.	0.25			0.50			0.25			0.25			0.31		
1-3 a.m.				0.50									0.13		
3-5 a.m.	0.50			0.75			0.75		0.25	0.50			0.63		0.06
5-7 a.m.	2.00		1.00	1.25			2.00	0.25	1.25	0.25			1.38	0.06	0.56
1 h before nursing	7.00	2.50	8.00	3.50	4.00	9.00	8.50	3.50	17.50	4.00	1.50	10.50	5.75	2.88	11.25
1 h after nursing	3.50	0.50		3.00	3.00	0.50	4.00		5.50	3.00	1.00	4.00	3.38	1.13	2.50
Group FC															
9-11 p.m.	1.75			1.50		0.25	0.25			1.75	0.50		1.31	0.13	0.06
11 p.m.-1 a.m.	2.25			3.50			0.50			0.50			1.69		
1-3 a.m.	3.50	0.50	1.50	3.50	1.00	1.00	1.25	0.50		1.50	1.00	0.25	2.44	0.75	0.69
3-5 a.m.	4.00	4.00	6.75	5.00	2.25	3.25	2.00	2.50	2.25	2.00	1.50	1.50	3.25	2.56	3.44
5-7 a.m.	4.50	4.75	11.50	6.50			3.75	1.50	3.25	6.75	1.75	4.25	5.38	2.00	4.75
1 h before nursing	4.50	7.50	12.50	11.00	9.50	12.50	4.50	2.00	5.50	5.00	1.50	5.00	6.25	5.13	8.88
1 h after nursing	10.50	1.00	5.00	6.50			7.50		6.00	4.00	2.00	1.00	7.13	0.75	3.00
	NS	*	***	NS	***	*	NS	***	***	***	NS	***	***	***	***

head = head contact; scr. = scraping; bit. = wire biting. CC: the does had access to the nest from 08:00 to 08:30 a.m. for 16 days from kindling. FC: from kindling up to day 9 there was free nursing, then from day 10 to 16 the does were allowed to enter the nest only once a day, from 08:00 to 08:30 a.m.
NS: non-significant, *P<0.05, ***P<0.001.

previous number, and it remained fairly high (although tending to decrease) also in the hour following the nursing. In Group FC between 09:00 and 11:00 p.m. the incidence of head contact was already at the level typical of Group CC between 05:00 and 07:00 a.m. Subsequently the incidence of this behaviour pattern tended to increase but in the hour before nursing it did not deviate markedly from the incidence observed in Group CC. The head contact was significantly higher ($P<0.01$) in Group FC than in the CC on day 16 and in all cases. The effect of time between day 10 and 16 was significant only in Group FC.

In Group CC, scraping at the entrance of the nest was observed practically only before nursing and then, with a slightly decreased incidence, in the hour after nursing (Table 3). In contrast, in Group FC this behaviour pattern, indicating the nervousness of the doe, already occurred from 01:00 a.m. and its incidence gradually increased. On day 10 and 12, in the hour before nursing the incidence of scraping behaviour was more than twice as high as in the does of Group CC. Although does started to scrape at the entrance early (after 1 hour) also on days 14 and 16, the incidence of scraping in the hour before and after nursing was no longer higher than in Group CC. The differences between Group CC and CF were significant on day 10, 12, 16 and all cases ($P<0.01$). The effect of time between day 10 and 16 was significant only in Group FC.

A similar observation was made for biting of the wire mesh covering the cage at the entrance. In Group CC, wire biting was usually recorded after 05:00 a.m. for the first time (Table 3). This form of nervous behaviour was the most frequent in the hour before nursing, while after nursing its incidence decreased markedly. In Group FC wire biting was usually observed two hours earlier, after 01:00 a.m., and its incidence gradually increased up to one hour before nursing. However, on days 10 and 12 the incidence of wire biting in the hour before nursing was not substantially different in the two groups, and on days 14 and 16 it decreased to a much lower level in Group FC does than in Group CC. The differences between Group CC and CF were significant ($P<0.01$) on all days and the time between day 10 and 16 was also significant ($P<0.01$) in both groups.

The behavioural nervousness, which was more frequently observed in group CF may have an impact on the oestrus and or number of ovulated zygotes hence alteration of nursing management systems from free to controlled may be an alternative biostimulating method of PMSG treatment. With regard to animal welfare aspects, the changing of the nursing management system is more beneficial than dam-litter separation (DLS).

CONCLUSIONS

The processing of 24-hour video recordings of nursing does seems to support the statements according to which does may nurse their kits up to twice or three times a day. The number of does nursing their kits more times a day increases when once-a-day nursing is changed to the free nursing system. Such does try to follow their previous habits (i.e. nursing in the morning) and the natural nursing behaviour (i.e. nursing in the evening). Presumably, individual genetic differences also play a role in determining how many times a doe nurses her kits in a day. Does most often nurse their kits in the hours after dark. Closing the nest box for several hours and then opening the creep-hole stimulates does to visit the nest and nurse their kits, even if the time of opening the creep-hole falls outside the period of natural nursing activity. In the case of once-a-day nursing, behavioural patterns indicating nervousness of the doe (head contact, scraping, wire biting) can be observed with high frequency in the hour before the nest box is opened. When changed over from free to controlled nursing, these behavioural forms appeared with higher frequency and several hours earlier. Thus, the alteration of nursing management systems may be a more suitable biostimulating method than PMSG treatment.

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