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under different keeping conditions**

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NURSING BEHAVIOUR OF DOMESTICATED AND WILD RABBIT DOES UNDER DIFFERENT KEEPING CONDITIONS

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ABSTRACT

Infrared video technique observations during several thousand 24-hour-periods showed that wild and domesticated rabbit does nurse their pups more than once a day with light-dark-change (switch off light under artificial light programme, onset of dusk under natural lighting) as a zeitgeber for nursing activity. A high percentage of sucklings take place during darkness so that mother-litter-separation during the night influences species-specific nursing behaviour. With increasing space allowance and with cage enrichment percentage of days with two or more sucklings shows a decreasing tendency.

INTRODUCTION

Two different opinions are prevalent in literature considering nursing behaviour in rabbit doe:

- 1) Domesticated rabbit does nurse their pups only once a day and there is a weak mother-child-relationship (e.g. ZARROW et al. 1965, KRAFT 1976, HUDSON and DISTEL 1982, SCHLEY 1985, WULLSCHLEGER 1985, BIGLER 1986, PETERSEN et al. 1988, STAUFFACHER 1988, JILGE 1994, SCHLOLAUT 1995).
- 2) Rabbit does nurse more than once a day (SCHULTE and HOY 1997, SEITZ 1997).

The objective of the investigations was therefore to answer the question of nursing frequency. Moreover, it should be investigated whether more than one nursing a day is a species-specific behaviour in rabbit or an abnormal behaviour of rabbit does kept in cages of insufficient size. Under the aspects of animal welfare the question has to be answered how often rabbit does nurse their pups and how housing condition influences nursing behaviour of rabbits. Also, the actual discussion on long-lasting mother-litter-separation (24 up to 48 hours) as a „biostimulation“ (e.g. THEAU-CLÉMENT and MERCIER 1999, VIRAG et al. 1999) requires distinct results considering lactating activity of rabbit does.

MATERIALS AND METHODS

Own investigations were performed with domesticated rabbits of different breeds or hybrids under various cage keeping conditions and with wild and domesticated rabbits in two free range areas. Domesticated rabbit does predominantly of White New Zealand (NZW) and ZIKA hybrids respectively, were housed in the following cages:

- flatdeck cages measuring 50 x 60 x 45 cm (width, depth, height) with nestbox (35 x 35 x 30 cm) outside of cage and plastic slatted floor (6 IR video observed cages; 85 litters)
- get-away-cages measuring 50 x 70 x 45/70 cm (width, depth, height - in the front part 45 cm, in the rear part of cage 70 cm height) with an elevated seat for the doe (50 x 20 x 20 cm) and a nestbox of the same type - standard cage = 1 time size (10 cages)

- get-away-cages with 1.5, 2 and 3 times the standard width (3 cages per version) (total number of 95 litters from 23 NZW and 7 ZIKA multiparous does).

Different rabbit breeds of various size (21 litters of 21 does; 7 breeds, 3 does per breed) were kept in 6 traditional concrete cages (80 cm x 80 cm x 60 cm; width, depth, height) with straw as bedding material. At the research station Oberer Hardthof of our Institute of Animal Breeding and Genetics two free ranging areas were installed measuring about 150 m² each. In one area wild rabbits (1 buck, 2 does), in the other domesticated rabbits (NZW: 1 buck, 2 does) are kept. 11 litters of 6 wild rabbit does and 15 litters of 8 NZW does were included. Two artificial nestboxes per area were built consisting of wooden walls, with straw as litter material and with one tube as entrance. Outlet of tube ends in a heap of soil outside the nestbox.

A commercial diet was fed ad libitum. Water was applied by nipple waterers or troughs. Natural lighting and artificial light regimes respectively were used. Light periods were mostly set at 12 hours light a day (60 Watt). 21 NZW hybrid does were kept under 16 hours and 20 does under 8 hours light a day in flatdeck cages described from 1st to 11th parity. All does without those in free ranging were artificially inseminated and kept in experimental cages over the whole period.

Behavioural studies were conducted with infrared video technique described by HOY (2000). Permanent recordings were made over 24 hours with a minimum of two days per week up to the whole suckling period of 28 days so that all nursing events were documented.

Several thousand 24-hour-periods were observed under various housing conditions. Suckling event was characterized by typical body position of the doe sitting in the nest, by duration of stay at siblings and by a specific sequence of behavioural pattern before and after nursing (SEITZ 1997). The mean number of suckling events per 24 hours on average of all days and all does per group and the mean duration of nursing event were compared by Student-Newman-Keuls Test and the differences between experimental groups in the percentages of days with ≥ 2 nursings per day were tested with Chi-Square Test in contingency tables (SPSS 8.0 for windows).

RESULTS AND DISCUSSION

In 1045 x 24-hour-periods observed in flatdeck cages one, two and three or more nursings per day occurred at 55.9, 34.4 and 5.4 percent of all days respectively. No nursing took place in 4.3 percent of all 24-hour-periods (Figure 1). The highest percentage of days with two or more sucklings per day (66.2 %) was found in the second week of lactation. It seems to be an opposite dynamics of frequency and duration of nursing during suckling period. While mean number of nursings per day was highest in the second suckling week average duration of nursing event was at a minimum. The overall mean of nursing duration was 203 ± 39 sec ($n = 1486$ nursing events) with a decreasing trend towards the end of lactation.

Rabbit does show distinct circadian rhythm of nursing activity if they are kept under artificial light regime. Light-dark-change is a significant zeitgeber (timer) for nursing behaviour. Under artificial lighting conditions with a light(L)-dark(D)-rhythm of 12 : 12 (from 5 am to 5 pm) more than 25 percent of 1534 nursing events took place in the first two hours of darkness (Figure 2). Only few nursings occurred during light period from 5 am to 5 pm. If

L : D-rhythm (12 : 12) is put off by one hour (6 am to 6 pm) the peak in nursing activity was postponed simultaneously by one hour (SEITZ 1997). In both artificial light regimes highest number of sucklings occurred during the first hour of darkness.

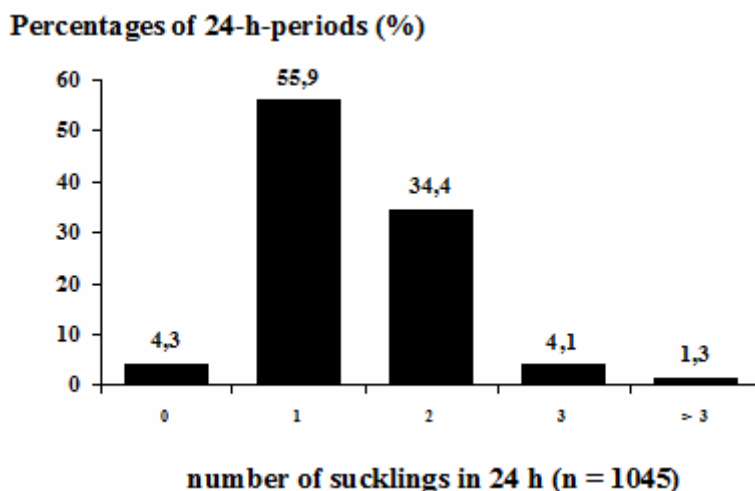


Figure 1: Percentages of days with 0, 1, 2, 3 and ≥ 3 suckling events in 24 hours

Under natural lighting condition nursing behaviour is related to dusk. In three rounds from March/April to July a peak in nursing activity was found after begin of dusk (SEITZ 1997). In contrast the morning dark-light-change under artificial light conditions or the onset of dawn under natural lighting caused no increase in nursing activity.

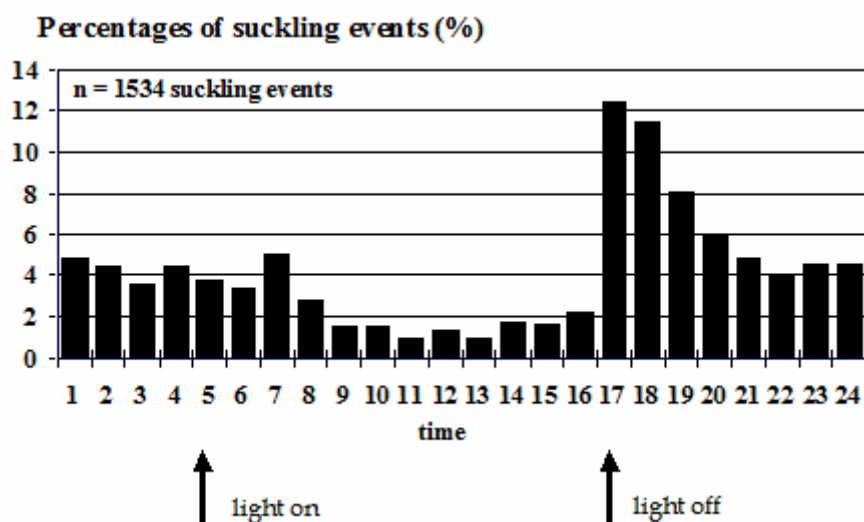


Figure 2: Distribution of nursing events in does under artificial light

Comparing two artificial light regimes with L : D of 16 : 8 or 8 : 16 significantly higher number of suckling events were found under the short light day programme with a 16-hour-period of darkness (1.36 nursings per day) (Table 1). In both light regimes a peak in nursing activity occurred after switching off the light.

Table 1: Number of nursing events in 24 hours in rabbit does kept under different artificial light regimes with 16 hours and 8 hours light per day

Light programme	Statistics of frequency of nursing in 24 hours				
	Number of observed nursings	\bar{x}	s	Min	Max
L : D = 16 : 8	425	1.15	0.43	0	4
L : D = 8 : 16	363	1.36*	0.55	1	4

* $p < 0.05$

The results indicate that rabbit does are dusk and dark active animals that prefer to nurse their pups after onset of dark and during the night. Thus, separation of mother and litter during this period influences natural species-specific behaviour and could have a negative impact on animal welfare.

With increasing space allowance and with cage enrichment (tunnel to the nestbox, wood pieces and hay for engagement) the percentage of days with two or more sucklings shows a decreasing trend. In get-away-cages with standard size (50 x 70 x 45/70 cm) two or more nursing events in 24 hours occurred at 29.9 percent of all days (average number of nursings per day: 1.37). In experimental get-away-cages measuring 150 x 70 x 45/70 cm (3 times width) two or more suckling events were observed at 22.4 % of all 24-hr-periods (mean frequency of nursing: 1.25 per day) (Table 2). The differences were not significant ($p > 0.05$).

Table 2: Percentages of days with two or more suckling events in 24 hours and mean number of nursings per day in get-away-cages of various size with or without enrichment

Cage size	Cages without enrichment		Cages with enrichment	
	Percentage of days with ≥ 2 nursings per day (%)	Number of nursings per day	Percentage of days with ≥ 2 nursings per day (%)	Number of nursings per day
Get-away-cage of standard size (50 x 70 x 45/70 cm)	29.9	1.37	29.5	1.32
Get-away-cage 1.5 x width	34.3	1.44	29.1	1.33
Get-away-cage 2 x width	24.9	1.26	24.2	1.25
Get-away-cage 3 x width	22.4	1.25	11.3	1.11
Total number of days	329		328	

In structured get-away-cages of the same size but with enrichment like a tunnel as entrance to the litter box, wood pieces in the cage and daily hay given for engagement the same tendency was visible but at a lower level of nursing activity (Table 2).

Between seven rabbit breeds of various body size differences in mean number of nursings per day and in percentages of days with two or more suckling events in 24 hours were found. Frequency of nursing per 24 hours was not related to rabbit strain. Body weight had, however, an effect on mean duration of suckling event. With decreasing body weight of rabbit breed average duration of nursing is shortened (Table 3). Large rabbit breed does like Deutsche Widder and Helle Großsilber nursed their pups 230 sec and 223 sec respectively per nursing event whereas small rabbit strain does (e.g. Fuchskaninchen, Widderzwerge) showed a mean duration of nursing of 192 sec ($p < 0.05$). Number of nursings a day and mean duration of nursing event were not influenced by litter size as SEITZ (1997) has already demonstrated for NZW does.

Table 3: Percentages of days with two or more suckling events in 24 hours, mean number of nursings per day and mean duration of suckling event in different rabbit breeds

Rabbit breeds (German terms)	Percentage of days (%)	Number of nursings in 24 hr	Number of nursings	Mean duration of nursing event (sec)
Deutsche Widder	66.0	1.77	94	230
Helle Großsilber	66.7	1.85	89	223
Weißer Neuseeländer (NZW)	30.4	1.30	73	211
Rote Neuseeländer (NZR)	35.7	1.36	19	205
Fuchskaninchen	78	2.10	86	192
Rhönkaninchen	0	1.00	14	197
Widderzwerge	58.5	1.61	66	192

$P > 0.05$

$P < 0.05$

Results presented in table 2 and 3 indicate that with increasing space (more space for small breeds in given cages) nursing activity tends to decrease perhaps caused by the possibility for doe to go away from pups.

Our studies in two free range areas (with a total number of 6 wild and 8 domesticated rabbit does (NZW) demonstrated that both domesticated and wild rabbit does nurse their pups more than once a day. Out of 104 observed 24-hr-periods two and three nursing events per day were found at 28.8 % of all days in wild rabbits (1.28 nursings a day on average). Domesticated rabbits nursed their siblings on average of 257 days with a mean frequency of 1.12 times in 24 hours (12 % of all days with two or three nursings) ($p < 0.05$).

Most suckling events happened between dusk and dawn with no significant differences between wild (84.6 % of all nursings during night) and domesticated rabbits (83.2 %).

CONCLUSIONS

Based upon our investigations it can be concluded that

1. Wild and domesticated rabbit does of different breeds nurse more than once a day.
2. With increasing size of keeping system and enrichment frequency of nursing tends to decrease.

3. Light-dark-change influences onset of suckling event as a zeitgeber for biorhythm.
4. Most of sucklings take place from dusk to dawn (rabbit as a dusk-and-dark-active species).

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