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Evaluation of optimal slat distance in slatted floor for rabbits using Behavioural Studies

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Abstract

Perforated floor systems (slats, wires) are widely used in large rabbit units. Floor type and especially slat distance might be critical with regard to behaviour of does and especially young rabbits. Behavioural studies were performed on 32 individually housed does from insemination to weaning and on 170 young rabbits from birth to weaning to find the optimal distance between slats. The width of all slats was 10 mm and the distance between slats in the experimental groups was 10, 12, 14 or 16 mm respectively. In addition to the plastic slatted floors a wired floor with 14 mm distance between wires was tested for young rabbits as well.

The results show that does orientate themselves relative to the position of the slats depending on the slat distance. On a floor with larger distance between slats does prefer to orientate crosswise to the slats, squat significantly more frequently and tended to gnaw at the cage more often. The experiment with young rabbits revealed that the floor type significantly affected the quality of movement. Furthermore, a significant age by floor type interaction was detected for unsteady movements. The high frequency of unsteady movements of rabbits at the age of seven days tended to increase with slat distance and was the highest for wired floor (14 mm). Problems moving around occurred in 21-day-old rabbits on 16 mm distant plastic slats and 14 mm distant wire floor only. At weaning age no substantial problems in this regard were detected on any floor type. Considering other aspects, e.g. hygiene and incidence of pododermatitis as well, only plastic slats with distance 14 mm are regarded as acceptable.

Introduction

Perforated floor systems are widely used in large rabbit units since excrements are removed fast and easily. Most popular are wired floors made of galvanized iron. Wire, 2.5 to 3 mm in diameter is bite proof, easy to clean and has other hygienic advantages compared to other material. But the footpads of rabbit does are stressed, especially when kept for long times on such floors, and footpad injury (*pododermatitis ulcerosa)* occurs frequently and these does often have to be removed (Schlender-Böbbis, 1999). Plastic slatted floors with a slat distance of 10 or 12 mm are less suitable for does compared to a larger slat distance because does produce large and soft faeces pastilles after giving birth (up to 19 mm wide and 26 mm long) blocking the slats easily (Schlender-Böbbis, 1999). Floor type and especially slat distance might be critical with regard to the behaviour of does and especially young rabbits during the first weeks of life. Different alternative floor types have been tested by several other authors (Schley, 1989, Stauffacher, 1992, Drescher, 1994, Lange, 1995, Rommers and Meijerhof, 1996), but no acceptable solution combining features like being bite proof, durable, clean and economical has been found yet. We undertook behavioural studies to find the optimal slat distance for does and young rabbits.

Material and Methods

A flat deck unit with 32 individually housed rabbit does was used at the Institute of Animal Science, Bonn University. The cages were arranged in two rows and were of the dimensions (width, depth and height) 50 x 70 x 42.5 cm with solid rear and sidewalls made of galvanized iron and a nest box and feed trough attached in the front. Nipple drinkers were installed in the rear. The floor material consisted of green T-shaped plastic slats with slightly rounded tops to allow urine to drain off quickly (MIK, Marienhausen, Germany). The width of all slats was 10 mm and the distance between slats in the experimental groups was 10, 12, 14 or 16 mm respectively. The slats were orientated crosswise to the depth of the cage. The does` stable was lighted naturally by a row of windows on one side and additionally by artificial light to enable 15 hours of light per day constantly. Room temperature varied between 16 and 20 °C and relative humidity between 44 and 54 %.

Experiment 1: A total of 32 ZIKA-hybrid does were individually housed in 1993 at the age of 10.5 wk. All does were artificially inseminated at 15.5, 21.5 and 27.5 wk (42-day-rhythm). Young rabbits were kept together with the does for the first 35 days. Behavioural studies were performed on does from the day of artificial insemination to weaning for the first and the third reproductive cycle and on young rabbits from birth to weaning for the second and third litter. The investigations on does were carried out four times per day (twice in the morning and twice in the afternoon) on two non-consecutive days per week by direct observation. 15 minutes after entering the stable and allowing all does to notice the presence of an observer, two neighbouring does were approached. After two minutes of allowing these does to adjust to the immediate presence of the observer, the behaviour expressed at that moment was recorded. This procedure was then applied to the next two neighbouring does in the same manner and repeated for all does after finishing the first round of observations. On the observation days noise was kept to a minimum in order to avoid exogenous effects on the behaviour. Behavioural traits as defined by Hassenberg (1965) and Kraft (1976) are described in detail by Schlender-Böbbis (1999). In does the following traits were observed: compact or crouching down position, belly position, belly side position, side position, sitting upright, squatting, washing itself, gnawing at cage/ floor. In does lying or sitting, we additionally recorded the orientation relative to the position of the slats, i.e. parallel, crosswise or diagonal.

*Experiment 2:*Behavioural experiments were carried out on 170 young rabbits from the second and third litter of does from experiment 1. For this experiment five empty cages were used with four cages equipped with plastic slatted floor (10, 12, 14 or 16 mm distance between slats respectively) as described in Experiment 1 and in contrast the fifth cage was equipped with wired slatted floor (rounded wire with diameter 3 mm and distance 14 mm). At the age of 7, 14, 21, 28 and 35 d all the young rabbits were marked, removed from their “home” cage and placed pair wise without doe at random in one of the five “foreign” cages (about 34 young rabbits per floor type). For a total of 10 minutes every one-minute the behaviour was recorded and the animals were brought back to their respective mother thereafter. The traits observed were: crawling, lolloping, running, orientating, straightening up, sitting, lying, washing itself, gnawing at cage/ floor. Additionally the quality of movement on the floor was evaluated. In case of slipping off or straddling of the limbs the movement was categorized as unsteady.

Statistical analysis was done using the SAS-program package. Traits with higher frequency were approximately normal distributed. Analysis of variance for ethological traits in does was performed within experiment (1^{st} or 3^{rd} reproductive cycle) with distance between

slats (10, 12, 14 *vs*. 16 mm) as the main effect and cage row ("window" *vs*. "no window") as the correction effect. Data from the experiment with young rabbits were jointly analysed considering age (7, 14, 21, 28, 35 d) and floor type (10, 12, 14, 16 mm plastic vs. 14 mm wire) as main effects and litter number (2, 3) as the correction effect.

Results and Discussion

Experiment 1

Results of the individual observations on does during the first and third reproductive cycle with regard to their position on the slatted floor are given in table 1. Does that died during the experiment were excluded from the analysis. Strikingly similar frequencies were observed in both reproductive cycles. A large percentage of "others" in table 1 is due to does in nest boxes during observation. About half of the does were lying during observations independent of age.

Table 1: Position of does observed on all floor types combined (frequency in %)

Trait expression	**Reproductive cycle**			
	1		**3**	
	Mean	**S.E.**	**Mean**	**S.E.**
Compact/crouching down position	8.7	1.6	8.7	1.5
Belly position	11.4	1.5	13.7	2.3
Belly-side/ side position	29.5	2.1	28.1	2.4
Sitting upright	27.7	1.3	31.3	1.9
Squatting	11.3	0.9	15.1	1.6
Others	11.4	-	3.1	-
	S 100		*S 100*	
Number of does observed	31		24	
Number of observations per doe[1]	72		72	

[1]four individual observations per day (twice in the morning and twice in the afternoon) on two non-consecutive days per week in nine weeks per reproductive cycle

Table 2: Additional activities observed in does (frequency in %)

Trait	**Reproductive cycle**			
	1		**3**	
	Mean	**S.E.**	**Mean**	**S.E.**
Washing itself	18.1	1.2	23.5	1.8
Gnawing at cage	7.1	1.8	1.4	0.3
Gnawing at floor	2.2	0.4	1.4	0.3
No additional features	72.6	1.8	73.7	2.0
	S 100		*S 100*	

Out of all additional traits observed and listed in table 2, about 20 % of the does were engaged with washing themselves during observation, older does showing this behaviour

more often than younger ones. In contrast younger does engaged more frequently in gnawing (and scratching) at the cage and floor. Furthermore, does were often found lying in direct contact with part or all their young ones, the latter were even frequently found lying on top of their mother.

Prime interest was given to the effect of slat distance on doe behaviour. Only selected traits are presented (table 3). Obviously the animals orientate relative to the position of the slats depending on the slat distance. While 21.3 % of does on slatted floor with 10 mm slat distance were found to orientate parallel to the slats, this percentage was much lower on a floor with 16 mm slat distance (7.3 %). On a floor with larger distance between slats does preferred to orientate themselves crosswise to the slats, squat significantly more frequently and tended to gnaw at the cage more often when the slat distance was large. These results demonstrate, that does distinguish between different slat distances and change their behavioural pattern in order to adjust to the situation. Schlender-Böbbis (1999) found no significant effect of slat distance on incidence and degree of footpad injury (*pododermatitis ulcerosa*). It is not clear to what extent animal welfare is affected by these findings.

Table 3: Effect of slat distance on selected behavioural traits in does (frequency %)

Trait **Trait expression**	**Slat distance in mm**				**Significance Level**
	10	**12**	**14**	**16**	
Number of does[1]	16	11	15	13	
Orientation of does…					
... parallel to slats	21.3	19.8	12.0	7.3	*
... diagonal to slats	43.3	45.8	45.1	46.0	n.s.
... crosswise to slats	35.4	34.4	42.9	46.7	*
	S 100	*S 100*	*S 100*	*S 100*	
Position of does²					
Squatting	11.0	11.7	15.0	16.1	*
Additional activities³					
Gnawing at cage	4.0	4.4	3.5	5.4	n.s.

[1]both reproductive cycles combined; [2]other trait expressions not listed: refer to *table 1*; [3]other trait expressions not listed: refer to *table 2*; * $p \leq 0.05$; n.s. $p > 0.05$

Experiment 2

Results of experiment 2 on young rabbits are presented in table 4 separately for each age group. As expected young rabbits' behaviour changed significantly during the first five weeks of life. The 7-day-old rabbits moved preferably by crawling and spent substantial amounts of time orientating themselves. Since the animals are still blind at this age, they most likely sniffle their environment. Significantly less time was spent resting, i.e. lying and sitting compared to animals at a higher age. Two-week-old animals spent a lot of time running around while the need to orientate was still present. Running and orientating declined thereafter and straightening up (another form of orientation) and especially resting became dominant "activities". The results of the analysis of variance did not reveal any significant effects of the floor type, i.e. slat distance on these behavioural traits nor were any significant age by floor type interactions detected.

The results on movement quality in young rabbits on slatted floor are given in table 5. On day 7 young rabbits were very unsteady when placed on slatted floor in an unknown

environment but the frequency of unsteady movements declined rapidly and steady movements and resting were significantly higher as they grew older. The quality of movement was significantly affected by the floor type and a significant age by floor type interaction was detected for unsteady movements (tables 5 and 6). The high frequency of unsteady movements of rabbits at the age of seven days tended to increase with slat distance and was highest for wired floor (14 mm). But even at the smallest slat distance of 10 mm almost half of the movements were classified as unsteady. Up to the age of 14 days young rabbits usually stayed in the nest box and were not accustomed to slatted floor. However the movements were steadier on slats with smaller distance. 21-days-old rabbits had problems moving around on 16 mm plastic slats and 14 mm wire floor only. At weaning age no substantial problems in this regard were noticed on any floor type.

Table 4: Activity of young rabbits on slatted test floors (frequency %)

Trait	Age in d					Significance		
	7	**14**	**21**	**28**	**35**	**A**	**F**	**AxF**
Number of animals	150	160	140	170	170			
Crawling	49,5^{a}	9,4^{b}	0,6^{b}	0,1^{b}	0,0^{b}	***	n.s.	n.s.
Lolloping	0,2^{b}	3,7^{ab}	6,8^{a}	5,0^{ab}	3,6^{ab}	*	n.s.	n.s.
Running	0,1^{c}	33,3^{a}	26,0^{ab}	19,8^{b}	13,8^{b}	***	n.s.	n.s.
Orientating	10,8^{a}	10,5^{a}	1,9^{b}	0,3^{b}	0,0^{b}	***	n.s.	n.s.
Straightening up	1,3^{b}	1,8^{b}	5,4^{ab}	7,3^{a}	8,5^{a}	***	n.s.	n.s.
Sitting/lying	37,6b	38,7b	55,5a	61,6a	67,5a	***	n.s.	n.s.
Others	0.5	2.6	3.8	5.9	6.6			
	S 100	*S 100*	*S 100*	*S 100*	*S 100*			

A = age, F = floor type (for details refer to text); *** p≤ 0.001; * p≤0.05; n.s. p>0.05; a, b, c, = different letters within row mark significant differences (p ≤ 0.05)

Table 5: Effect of age on movement quality in young rabbits on slatted floors

Trait	Age in d					Significance		
	7	**14**	**21**	**28**	**35**	**A**	**F**	**AxF**
Steady movement	3,3^{c}	16,6^{b}	30,1^{a}	32,7^{a}	29,4^{a}	***	**	n.s.
Unsteady movement	61,8^{a}	42,1^{b}	11,4^{c}	2,2^{c}	0,4^{c}	***	***	**
No movement/Resting	34,9^{b}	41,3	58,5^{a}	65,1^{a}	70,2^{a}	***	n.s.	n.s.
	S 100	*S 100*	*S 100*	*S 100*	*S 100*			

Legend: see table 4

Table 6: Frequency distribution of unsteady movements depending on floor type and age of young rabbits[1]

Floor type	Age in d				
	7	**14**	**21**	**28**	**35**
10 mm plastic	47,1	10,4	3,5	0,6	0,3
12 mm plastic	57,4	30,0	6,5	0,9	0,0
14 mm plastic	54,6	52,8	6,6	1,2	0,3
16 mm plastic	63,6	62,9	16,6	3,1	0,9
14 mm wire	71,1	54,3	23,6	5,0	0,3

[1] frequency sum over steady movement, unsteady movement and resting = 100; age by floor type interaction highly significant ($p \leq 0.01$)

Conclusion

- Judging by their behaviour, the present investigation showed that does and young rabbits kept on slatted floors are clearly aware of the slat distance.
- Does increasingly avoid orientation parallel to the slat position on slatted floor with large slat distance.
- Young rabbits showed unsteady movements on slats with larger slat distance up to the age of 28 d.
- Considering behavioural criteria as well as clinical and hygienic criteria, plastic slats of width 10 mm and distance 14 mm proved to be acceptable for both does and young rabbits.

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