

## INVESTIGATIONS ON THE USE OF AN ELEVATED PLATFORM IN GROUP CAGES BY GROWING RABBITS

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**ABSTRACT:** The investigation was carried out with altogether 511 caged growing rabbits (ZIKA) in 4 rounds with a duration of 8 wk each. Animals were housed at 35 d in collective cages (n=16; 0.625 m<sup>2</sup>/rabbit), half of them equipped with an elevated platform. Water and molassed-crude-fibre-blocks were fed *ad libitum* during the whole fattening period. Pellets were given additionally by a hopper during the last 2 wk. In 5-min-intervals the number of rabbits “staying on the platform”, “staying under the platform” and “staying in front of the platform” - including the behavioural pattern “staying at the feeder” was infrared video-recorded and observed at 3 consecutive days (at the beginning, in the middle and at the end of the fattening period). The behavioural patterns were continuously analysed for 72 h and summarised in hour-values (24 h a day, thrice per fattening period for each group). Rabbits showed a circadian rhythm in the use of the elevated platform. During the night, up to 70% of the rabbits stayed on the elevated platform, whereas during daytime (lighting period) at most 40% of the rabbits stayed under the platform. During the fattening period, the percentage of rabbits staying on the elevated platform was decreasing. The use of the elevated platform had no significant influence on health and performance of the rabbits (daily weight gain, mortality rate, morbidity rate and body lesion score). So, it can be concluded that the elevated platform could be an adequate environmental enrichment for growing rabbits in group cages.

**Key Words:** growing rabbits, environmental enrichment, elevated platform, circadian rhythm.

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### INTRODUCTION

Bigler (1986) demonstrated that domesticated rabbits show a circadian rhythm of resting/activity behaviour with two peaks, as do wild rabbits. Selzer (2000) found a circadian rhythm of haunting and leaving a rabbit burrow in wild rabbits kept in free range.

Domesticated rabbits kept in conventional cages live in a limited space. As a result, rabbits in single cages can show stereotypic behaviour such as hair chewing and bar gnawing (Gunn and Morton, 1995). Group housing systems for growing rabbits are more acceptable than single housing, since they allow the animals to socialise and show a large variety of behavioural patterns.

The cages should be equipped with environmental enrichment to enable the rabbits to perform species-specific behaviour. The aim of an environmental enrichment is to prevent stereotypic behaviours and allow a high level of animal welfare (Verga, 2000; Hoy, 2005; Hoy and Verga, 2006). Rabbits in enriched cages showed more activity than those in cages without enrichment

(Jekkel *et al.*, 2008). The kind of enrichment (elevated platform, gnawing stick, straw, mirror) and the modality of occupation (gnawing at the stick, scratching in the straw, jumping on the platform or staying under it, looking in a mirror) by the rabbits may vary considerably and the effect on behaviour and performance of the rabbits can also be quite different. An elevated platform could enrich the rabbit cage in such a way that the rabbits may jump on the platform or sit under it. Maertens *et al.* (2004) showed that rabbits were using the platform more frequently in the second part of the growing period if it was available. In that research, the elevated platform in combination with a low stocking density resulted in a higher feed intake and weight gain during early fattening. Performance during the mid or late fattening period was not affected significantly. Due to the additional space of the elevated platform, the rabbits can use a larger area. Postollec *et al.* (2008) showed that the use of the elevated platform (wire grid) appears to depend upon the total space available. Use of the elevated platform was linked to the total space available, so in small pens (10 rabbits per pen) the platform functions as an additional area for all behavioural patterns whereas in large pens (60 rabbits per pen) its use was mainly limited to short bursts of physical exercise. An elevated platform could be also useful as a “look out point”, providing important weight-bearing exercise and helps to build bone strength (Hawkins *et al.*, 2000). Contradictory results regarding daily growth rate in enriched cages were shown by Jehl *et al.* (2003) and Postollec *et al.* (2003). Whereas Jehl *et al.* (2003) showed an equivalent daily growth rate in cages with and without an elevated platform, Postollec *et al.* (2003) showed a significantly reduced daily growth rate in enriched cages with an elevated platform.

The aim of this study was to investigate the influence of an elevated platform on behaviour, health and performance of group caged growing rabbits.

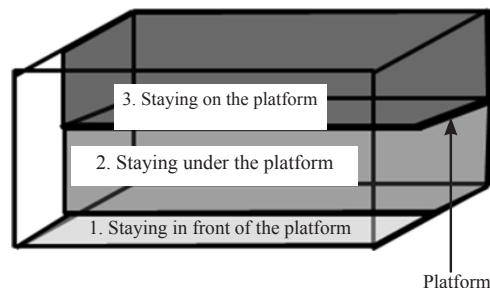
## MATERIAL AND METHODS

### *Animals and materials*

The investigation was carried out at the research station of the University of Giessen, Germany. A total number of 511 rabbits (ZIKA hybrids) in 4 fattening periods of 8 wk each were kept in standard group cages with perforated floor. The group size was 16 with 0.625 m<sup>2</sup>/rabbit. The



**Figure 1:** Rebuilt cage with an open roof for free camera observations.



**Figure 2:** Schematic diagram of the cage and studied behaviours: 1. Staying on the platform, 2. Staying under the platform, 3. Staying in front of the platform.

cages were equipped with feeders and nipple drinkers. In half of them, an elevated platform (0.6×1 m plastic slatted floor) in a height of 30 cm was added. To achieve high visibility, the roof in those cages was open for the cameras (Figure 1). The room was air-conditioned (16-21°C). Feed (molassed-crude-fibre-blocks and additionally pellets during the last 2 wk of fattening period) and water were available *ad libitum*. The light period duration was 16 h (from 6 a.m. to 10 p.m.). The rabbits were weaned at an age of 35 d, transported to the research station and put into the cages. The duration of each fattening period was 8 wk. Animals were slaughtered at an age of 91 d. Rabbits showing signs of diseases were examined, treated with antibiotics if necessary and separated until recovery or death.

### *Methods*

At the beginning of each round, all rabbits were weighed, sexed, examined for body lesions, tattooed and equally distributed to the cages on the basis of individual weight. At the end of the fattening period, the rabbits were weighed again, examined for body lesions and transported to the slaughter house. Every second week, all rabbits were weighed and daily weight gain was calculated.

Examinations for body lesions were done at the beginning and end of every round on eight body areas: ears, head, front and hind limbs (feet), back, abdomen, tail and sexual organ (testis, vulva respectively), and a score for the severity of the lesions was given ranging from 0 (= no lesions) to 3 (= necrotic or severe lesions). The index for each rabbit could thus theoretically vary between 0 and 24.

### *Behavioural observations*

The behaviour of rabbits in the cage was continuously infrared video-recorded at the beginning (45 d old rabbits), in the middle (66 d old rabbits) and at the end (89 d old rabbits) of the fattening period during 24 h in each fattening stage, as described by Hoy (2000). In each round, the rabbits in all cages were observed for 72 h in which the recordings took place simultaneously for all groups.

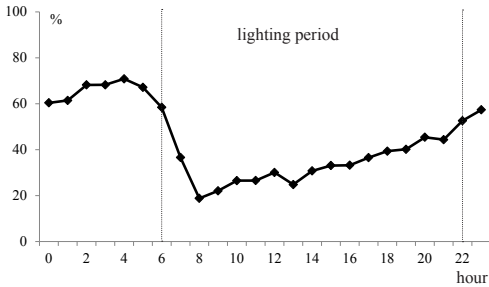
The number of rabbits staying on, under and in front of the elevated platform (Figure 2) was analysed for 24 h using “The Observer<sup>®</sup>” programme (Noldus, NL) in five-minute-values and summarised in hour-values (24 h a d, thrice per fattening period for each cage). The behaviour “staying in front of the elevated platform” was subdivided into the number of rabbits staying at the feeder or occupying with a material which was available in each cage or showing neither of these two behaviours at the moment of observation.

### *Statistical analysis*

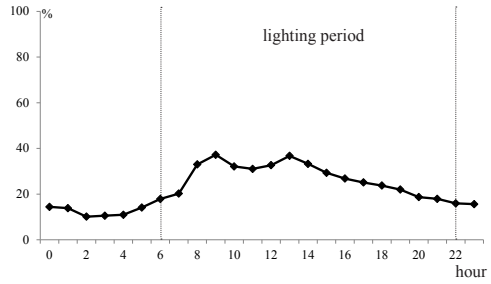
Statistical data analysis was carried out using SPSS 15.0 for Windows. The daily weight gain data were normally distributed so they were analysed using a linear model including as fixed effects the housing system (with or without elevated platform), the round and the interaction between both. Since the other data were not normally distributed, they were analysed using nonparametric Kruskal-Wallis-Test and Pearson Chi-square-test.

For the use of the elevated platform hour values were performed at day- and nighttimes and nonparametric Kruskal-Wallis-Test and Chi-Square-Test by Pearson were used.

In addition to that, 8 classes for mean number of body lesions per rabbit were formed (0=0; 1=0.1-1.0; 2=1.1-2.0; 3=2.1-3.0; 4=3.1-4.0; 5=4.1-5.0; 6=5.1-6.0; 7=6.1-7.0) and cross tabulation with



**Figure 3:** Circadian rhythm of the behavioural pattern “staying on the elevated platform” summarising the results of 4 rounds (n=6518 five-min values). Significant differences between lighting and darkness period ( $P<0.01$ ).



**Figure 4:** Circadian rhythm of the behavioural pattern “staying under the elevated platform” summarising the results of 4 rounds (n=6518 five-min values). Significant differences between lighting and darkness period ( $P<0.01$ ).

chi-square-test was used to compare the frequencies of injuries between the cages and rounds respectively.

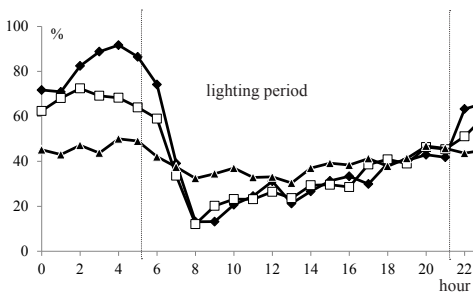
**RESULTS**

Summarising all behavioural data (n=6518 observations) from all rounds, 43.9% of all behavioural patterns observed during 72 h was staying on the elevated platform. At the onset of the fattening period, the average percentage of rabbits staying on the elevated platform was 47.8% and decreased significantly with increasing age of rabbits (43.1% in the middle of the fattening period and 40.6% at the end). No significant differences were found between the 4 rounds concerning the frequency of rabbits staying on the elevated platform.

The behavioural pattern “staying on the elevated seat” followed a circadian rhythm (Figure 3). Summarising all rounds, the number of rabbits staying on the elevated platform was significantly higher in the darkness than in the lighting period. During the darkness, up to 70% of the rabbits were observed staying on the elevated platform. At some hours at night, the percentage of rabbits staying on the elevated platform reached 100%, especially at the beginning of the growing period.

After switching on the light at 6:00 a.m., the number of rabbits staying on the platform decreased to less than 20% and increased again towards the evening.

The percentage of rabbits staying under the elevated platform was opposite to the percentage of rabbits staying on the elevated seat (Figure 4). Between 8:00 a.m. and 7:00 p.m., more than 20% of the rabbits were observed staying under the elevated platform. The differences between the added percentages of rabbits staying on the elevated platform or under it and 100% was performed by rabbits observed staying in front of the platform, most of them showing feed intake behaviour.



**Figure 5:** Circadian rhythm of the behavioural pattern “staying on the elevated platform” summarising the results of 4 rounds (n=6518 five-minute-values) subdivided into fattening stages (—●— 45, —□— 66 and —▲— 89 d old rabbits); significant differences between the fattening stages.

**Table 1:** Percentage of body lesion scores at the end of the fattening period (subdivided in classes) in rabbits kept in cages with or without an elevated platform, summarising all rounds.

	Percentage of body lesion score (classes) at the end of the fattening period								<i>P</i> -value	No.
	0	1	2	3	4	5	6	7		
WEP <sup>1</sup>	73.8	13.1	6.3	5.3	1.5	0.0	0.0	0.0	0.536	200
WOEP <sup>2</sup>	71.5	11.8	10.5	3.5	1.3	0.4	0.4	0.4		203

<sup>1</sup> WEP: With elevated platform, <sup>2</sup> WOEP: Without elevated platform. No significant differences.

The highest percentage (approximately 90%) of rabbits staying on the elevated platform was observed at the beginning of the fattening period during darkness (Figure 5). In the middle of the fattening period, the percentage of rabbits staying on the elevated platform decreased significantly in darkness but not during the lighting period. At the end of the fattening period, the lowest percentage of rabbits staying on the elevated platform was found. While in this period the percentage of rabbits staying on the elevated platform was lowest during the darkness, the frequency of staying on the elevated seat during the lighting period was highest. So, no circadian rhythm could be found at the end of the fattening period.

Moreover, no significant differences were found between cages with or without an elevated platform concerning the frequency of skin lesions (Table 1). Over all rounds, the frequency of body lesions was very low. 73.8% of all rabbits in cages with an elevated platform showed no body lesions. In cages without an elevated platform, the percentage of rabbits without body lesions was 71.5. The highest lesion score on a possible range of 0 to 24 was 7.0. Furthermore, there were no foot lesions observed.

**Table 2:** Daily weight gain of rabbits kept in cages with or without an elevated platform subdivided into 4 rounds.

	No.	Daily weight gain (g)				
		Initial weight (g)	Final weight (g)	Means	Standard Error	<i>P</i> -value
Round 1						
WEP <sup>1</sup>	48	0.87	2.69	33.63	0.21	0.847
WOEP <sup>2</sup>	57	0.87	2.70	33.81	0.17	
Round 2						
WEP	58	0.86	2.48	24.04	0.19	0.548
WOEP	40	0.86	2.49	23.43	0.09	
Round 3						
WEP	37	0.87	3.05	38.42	0.21	0.001
WOEP	51	0.87	2.89	35.71	0.05	
Round 4						
WEP	55	0.89	2.99	36.93	0.26	0.033
WOEP	55	0.89	2.88	34.92	0.08	

<sup>1</sup> WEP: With elevated platform, <sup>2</sup> WOEP: Without elevated platform.

Summarising all rounds, no significant differences between cages with or without platform concerning mortality (21.7 and 21.0%, respectively) and morbidity rate (26.8 and 21.0%, respectively) were found ( $P>0.05$ ). Concerning daily weight gain, the housing system ( $P<0.01$ ) and the round ( $P<0.001$ ) showed significance, whereas the interaction between both was not significant. Summarising over all rounds, rabbits in cages with an elevated platform showed a higher daily weight gain ( $33.2\pm 0.31$ ) than those in cages without an elevated platform ( $31.9\pm 0.31$ ). Analysing the 4 rounds separately, higher daily weight gains in rabbits kept in cages with an elevated platform were found in 3 rounds, including rounds 3 and 4, where the difference was significant (Table 2).

## DISCUSSION

Bigler (1986) and Selzer (2000) showed a circadian rhythm of activity in domesticated rabbits, wild rabbits respectively. A similar circadian rhythm of the use of the elevated platform was also found in our research. Comparable to the investigation of Selzer (2000), who found most of the rabbits inside the burrow between 8:00 a.m. and 4:00 p.m., we observed most of the rabbits under the elevated platform between 8:00 a.m. and 4:00 p.m. During the night, wild rabbits live outside their burrows and eat, drink and defecate (Selzer, 2000). In the current study, the growing rabbits were staying on the elevated platform during the night.

With an elevated platform, the cage will be enlarged (by 60%). With increasing age and body weight, the percentage of rabbits staying on the platform at the same time decreased from 47.8% to 40.6 % because of the larger body size of the rabbits. There was not enough space on the elevated seat to accommodate all rabbits of the group at the same time. There was no hour of the day where no rabbit was found staying on the elevated platform. So, the growing rabbits used the elevated seat throughout the whole fattening period.

Summarising all results, the elevated platform had no negative effect on mortality and morbidity rates. The relatively high percentage of sick rabbits and dead rabbits was caused by an unknown and unidentified disease (probably virus caused) of the rabbits in round 2.

Contradictory results regarding daily growth rate in enriched cages were reported by Jehl *et al.* (2003) and Postollec *et al.* (2003). Whereas Jehl *et al.* (2003) showed an equivalent daily growth rate in cages with and without an elevated platform, Postollec *et al.* (2003) showed a significantly reduced daily growth rate in enriched cages with an elevated platform. The results of our study were in contrast to both of these former works, showing a small but significant higher daily weight gain in cages with an elevated platform. In two of four rounds, rabbits in cages with an elevated platform showed a significant higher daily weight gain. In round 2, the difference was smaller (not significant), perhaps because of the unidentified disease of the rabbits in this round.

Although, the hygienic situation of the animals was not an aim of the present work, the general impression was that it was similar for both systems as rabbits in cages with an elevated platform were not dirtier than those in cages without an elevated platform. Specific further works of this respect in the future, is to be recommended.

The disadvantage of the elevated platform is the more difficult daily health control of the animals. Rabbits staying under the platform cannot be seen by a person standing in front of the cage without lifting the platform.

## CONCLUSION

The results of the present work show that the use of an elevated platform did not affect the percentage of body lesions, mortality and daily weight gain of the growing rabbits. Most rabbits were staying on the elevated platform during the night (up to 70%) and staying under the elevated platform in daytime (at most 40%).

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