

RABBITS' PREFERENCE FOR CAGES AND PENS WITH OR WITHOUT MIRROR

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ABSTRACT

Five week-old Pannon White rabbits were housed in a closed climatized rabbitry and randomly assigned to pens (56 rabbits) having a basic area of 1 m² with a stocking density of 16 and 12 rabbits/m² or to 18 individual cages (0.24 m²; 1 rabbit/cage; stocking density of 4 rabbits/m²). The pens and the cages were divided into 2 parts and animals could move freely among the 2 parts through swing doors. The vertical sides of one part of the pens and cages were completely covered with mirrors while the other part was covered with white plastic panels. A 24 hour video recording was performed twice a week using infrared cameras and the number of rabbits in each pen and cage was counted with a frequency of 15 minutes (96 times a day). The duration of the trial was 6 weeks. The lighting period was 16L/8D. Rabbits were fed *ad libitum* a standard diet and water was available *ad libitum* from nipple drinkers. Throughout the entire rearing period 67% of the individually caged rabbits showed a preference for the part of the cage enriched with mirrors (P<0.001). This preference slightly decreased with increasing age. The strong preference toward the part of the cage provided with mirror walls was independent of the time of day. That is, during the active period (11:00 pm – 05:00 am), which corresponds to the dark part of the day, rabbits still preferred the mirror-side even though they were not able to see their own reflected image at that time. Neither rearing rabbits in groups under different stocking densities (12 vs. 16 rabbits/m²) nor the presence of conspecifics reduced the interest toward mirrors. 65% of animals living at the stocking density of 16 rabbits/m² and 61% of those living at the density of 12 rabbits/m² were found on the side with mirrors (P<0.001) during all the recordings. Group-penned rabbits showed a decisive preference toward mirrors during the active period (71 to 74% for stocking densities of 12 and 16 rabbits/m², respectively; P<0.001). The results suggest that the mirrors' presence offers some advantages, perhaps related to comfort and welfare that could be used as environmental enrichments for fattening rabbits. However, the installation costs should be taken into account before considering their use for long time individually caged animals and for group-penned rabbits.

Key words: Rabbits' preference, Mirrors, Plastic panel, Individually caged, Group-penned.

INTRODUCTION

The current intensive rabbit breeding system for meat production holds small groups of animals in wire cages with a barren environment. In Italy and Hungary the rabbits are, most often, pair caged, because live performances are best expressed, ear lesions and other aggressive behaviours are decreased (Maertens and Van Herck, 2000; Princz *et al.*, 2005; Princz *et al.*, 2008), mortality rate is reduced (Dal Bosco *et al.*, 2002), and the carcass yield is higher (Dal Bosco *et al.*, 2002; Dalle Zotte *et al.*, 2008), compared to larger group-housed rabbits. On the other hand, rabbits kept as laboratory animals in social isolation, can display physiological symptoms of stress, i.e. stereotypic behaviours such as cage chewing, which are relieved by the presence of conspecifics (Held *et al.*, 1995). These stereotypic behaviours are much less frequent in pair-caged rabbits reared for meat production (Mirabito *et al.*, 1999; Dal Bosco *et al.*, 2002; Princz *et al.*, 2007).

One of the main objections to the caged rabbit housing is the barren environment. To avoid this problem several enrichment forms have been studied (e.g., plastic platform, hiding box, gnawing stick) with regard to productive performance, and the behaviour and welfare of growing rabbits (Maertens *et al.*, 2004, Luzi *et al.*, 2005; Princz *et al.*, 2008).

Mirrors have also been shown to temporarily enrich the environment of some animals when they are kept in partial isolation. Thus, mirrors can reduce stereotypic weaving in horses (McAfee *et al.*, 2002), the endocrine and physiological responses to partial isolation in sheep (Parrott *et al.*, 1988), the heart rate and movement in isolated cattle (Piller *et al.*, 1999).

The objectives of this study were to examine how mirrors influence the rabbits' free choice towards cages enriched with mirrors on their walls instead of cages provided with plastic panels and to investigate this preference according to the rabbits' stocking density, age and time of day.

MATERIALS AND METHODS

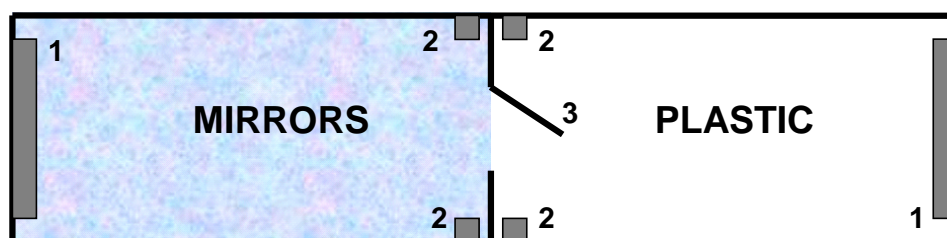
Five week-old Pannon White rabbits were housed in a closed climatized rabbitry (room) in Kaposvár University (Hungary). The lighting period was 16L/8D. The temperature of the rabbitry was kept constant at 18°C. The rabbits were fed *ad libitum* a commercial pellet between the ages 5 to 11 weeks. From 5 to 9 weeks of age the diet contained 14.5% crude protein, 17.5% crude fibre, 2.0% ether extract, 10.3 MJ DE/kg, 50 ppm Tiamulin, 500 ppm Oxitetracline, 1 ppm Diclazuril; from 9 to 11 weeks of age the diet contained 16.0% crude protein, 16.0% crude fibre, 3.0% ether extract, and 10.6 MJ DE/kg. Water was available *ad libitum* through nipple drinkers.

Fifty-six rabbits were housed in pens having a basic area of 1 m² with a stocking density of 16 rabbits/m² (2 pens) or 12 rabbits/m² (2 pens) while 18 rabbits were individually caged (0.24 m²) with a stocking density of 4 rabbits/m². The pens and the cages were divided into 2 parts and animals could move freely between the 2 parts through swing doors. The vertical sides of one part of both pens and cages were completely covered with mirrors while the other part was covered with white plastic panels (Figure 1). Individually-caged rabbits were isolated. The duration of the trial was 6 weeks (i.e. between 5 and 11 weeks of age).

A 24-hour video recording was performed twice a week using infrared cameras. On the days of recording nobody entered the room. Using the recordings, the number of rabbits in each pen and cage was counted with a frequency of 15 minutes (96 times a day).

Statistical analysis

The rabbits' preference in the various pens and cages was evaluated by Chi-Square test by means of the SPSS 10.0 software package (SPSS for Windows, 1999).



1: feeder; 2: nipple drinker; 3: swing door

Figure 1: Design of the experiment

RESULTS AND DISCUSSION

Individually caged rabbits

Throughout the entire rearing period 67% of the rabbits individually caged showed a preference for the part of the cage enriched with mirrors, although increasing the rabbit's age resulted in a decreased preference toward mirrors, ranging from 74.2% at 5.5 to 67.0% at 10.5 weeks of age (Table 1).

Although it is unlikely that rabbits are capable of self-recognition (Gallup, 1970; Reiss and Marino, 2001) they could theoretically interpret the image in the mirror as representing another animal. Indeed, Jones and Phillips (2005) found, in four rabbits that they were initially attracted to the mirror and spent more time scrabbling at it, apparently in an attempt to reach the image. Over one week, however, this behaviour decreased, presumably because the rabbits did not obtain confirmatory cues that the image was a conspecific.

The results from the present experiment confirm that rabbits are attracted by their image reflected in the mirror up to 11 weeks of age. The mechanisms underlying this attraction must be explored in future studies.

Table 1: Preference of individually caged growing rabbits for cages with or without mirrors depending on their age (%)

Age, weeks	Mirrors	Plastic panels	Prob.
5.5	74.2 ^c	25.8 ^a	<0.001
6.5	64.6 ^a	35.4 ^c	<0.001
7.5	64.1 ^a	35.9 ^c	<0.001
8.5	62.3 ^a	37.7 ^c	<0.001
9.5	68.3 ^b	31.7 ^b	<0.001
10.5	67.0 ^b	33.0 ^b	<0.001
Total	66.7	33.3	<0.001

Means in a column with different superscripts (a, b, c) were significantly different ($P \leq 0.05$)

The strong preference of the individually housed rabbits for the part of the cage provided with mirror walls was independent of the time of day (Table 2). During the active period the 70% of the rabbits were found in the mirror-side; nevertheless, the active period corresponds to the dark part of the day and rabbits cannot see their own reflected image. It's likely to that rabbits memorise, helped by olfactory signals, the part of the cage that gives them the best welfare.

Table 2: Preference of individually caged growing rabbits for cages with or without mirrors depending on the time of day (active or resting period) (%)

Part of the day	Mirrors	Plastic panels	Prob.
11:00 pm – 05:00 am (active period)	70.9	29.1	<0.001
11:00 am – 05:00 pm (resting period)	70.1	29.9	<0.001
Probability	0.583	0.583	

Group-penned rabbits

Rabbits housed in pens under different stocking densities (16 vs. 12 rabbits/m²) showed a clear preference for the part of the cage enriched with mirrors, at practically all the ages considered (Table 3). 65% of the rabbits living at the density of 16 and 61% of those living at the density of 12 rabbits/m² were found on the side with mirrors ($P < 0.001$) during all recordings. The preference toward mirrors was the highest at 5.5 weeks of age (about 87%) and it significantly decreased ($P < 0.05$) with age to 55.7 and 52.8%, for the densities 16 and 12 rabbits/m², respectively.

This result was not expected as the presence of conspecifics should have theoretically reduced the interest toward this kind of enrichment. Yet, the highest preference for the part of the cage with mirrors in most animals from 5.5 to 8.5 weeks of age confirms that young rabbits like to congregate and huddle together (Matics *et al.*, 2004).

Table 3: Preference of group-penned growing rabbits for pens with or without mirrors depending on the age and on the stocking density (%)

Age, weeks	16 rabbits/m ²			12 rabbits/m ²		
	Mirrors	Plastic panels	Prob.	Mirrors	Plastic panels	Prob.
5.5	86.9 ^e	13.1 ^a	0.001	86.7 ^d	13.3 ^a	<0.001
6.5	71.5 ^d	28.5 ^b	0.001	71.0 ^c	29.0 ^b	<0.001
7.5	62.7 ^c	37.3 ^c	0.001	59.3 ^b	40.7 ^c	<0.001
8.5	62.5 ^c	37.5 ^c	0.001	58.7 ^b	41.3 ^c	<0.001
9.5	59.1 ^b	40.9 ^d	0.001	50.8 ^a	49.2 ^d	0.426
10.5	55.7 ^a	44.3 ^e	0.001	52.8 ^a	47.2 ^d	0.006
Total	64.5	35.5	0.001	61.2	38.8	<0.001

Means in a column with different superscripts (a, b) were significantly different ($P \leq 0.05$)

Converse to the observations in individually caged rabbits, group-penned ones showed a larger preference for mirrors during the active (dark) period ($P < 0.001$). Although during the resting (light) period (11:00 am – 05:00 pm) the preference was still statistically significant ($P < 0.05$; Table 4), it was of a lower magnitude.

Table 4: Preference of group-penned growing rabbits for pens with or without mirrors depending on the time of day (active or resting period) and on the stocking density (%)

Part of the day	16 rabbits/m ²			12 rabbits/m ²		
	Mirrors	Plastic panels	Prob.	Mirrors	Plastic panels	Prob.
11:00 pm – 05:00 am (active period)	74.1	25.9	<0.001	70.7	29.3	<0.001
11:00 am – 05:00 pm (resting period)	54.9	45.1	<0.001	51.5	48.5	0.020
Probability	<0.001	<0.001		<0.001	<0.001	

Once again, our results show that rabbits like to stay in large groups, notably during the active period, when the social and investigatory behaviours are most evident (Princz *et al.*, 2007). During the resting period the animals are well-distributed all along the cage indicating a preference for a less crowded area. Independently of the rabbits' size, they preferred the area provided with mirrors and, in our opinion, this is an indicator of their improved welfare.

CONCLUSIONS

We can conclude that rabbits, either alone or grouped, prefer the cage side covered with mirrors. Further investigation must be performed to explain the exact reason for this choice; yet, it is clear that the provision of mirrors in rabbit cages offers some advantages to welfare and can thus be used as new environmental enrichments. However, taking into account the installation costs, the provision of mirrors could be suggested only for rabbits that are individually caged for a long time, such as those reared as laboratory or exhibition animals. The preference of group-penned rabbits for the side provided with mirrors also suggests that rabbits prefer to live in large groups, but this preference decreases as age increases.

ACKNOWLEDGEMENTS

Research helped by a Hungarian-Italian intergovernmental S&T cooperation programme (OMFB-00607/2005).

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