

EFFECT OF HOUSING AND ENVIRONMENTAL ENRICHMENT ON PERFORMANCE AND BEHAVIOUR IN FATTENING RABBITS

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ABSTRACT

Aim of this research was to test the effect of housing and environmental enrichment (presence of a wood stick inside the cage) on the performance and behaviour of fattening rabbits. The trial was carried out in a commercial farm, in the North-West of Italy (Lombardia region, Bergamo province). 72 rabbits were housed after the weaning period, at 35 days of age, in standard fattening cages at 2, 3, 4 animals per cage, (density: 1045 cm², 697 cm² and 522 cm² respectively). Half cages were enriched using a wood stick (*robinia pseudoacacia*) hanging from the ceiling of the cage. The animals were fed *ad libitum* a commercial feed, and were weighted at 35, 55 and 75 days of age and slaughtered at 75 days of age under commercial conditions. Behaviour was video recorded at the beginning (1st period of observation) and at the end of the fattening period (2nd period of observation), 24 hours for each period. Thus each cage was observed 48 hours in total (288 scans per cage). No significant differences were found in any selected productive parameter (live weight, daily weight gain) among treatment groups. In detail, the live weight at slaughtering (75 days of age) was: 2626, 2540g for animals housed without and with environmental enrichment respectively; 2597, 2562 and 2592g for animals housed at 2-3-4 subjects per cage respectively. The animals' housing significantly affected the rabbits' behaviour. In fact, animals housed 2 per cage showed a higher variety of natural behaviours. The environmental enrichment affected the behaviour and not the performance. In fact, it decreases both oral stereotypies such as gnawing the bars of the cage, and alert, aggressive behaviour and self-grooming. This might indicate a better satisfaction of the behavioural needs for the enriched caged rabbits, while the other ones may spend more time inactive and/or performing abnormal behaviours and consequently may show higher stress levels due to the frustration in a hypo-stimulating environment.

Key words: fatteners, housing, environmental enrichment, performance, behaviour.

INTRODUCTION

The conventional housing system in cages may sometimes negatively affect rabbits' welfare (MORISSE, 1998; VERGA, 2000), as far as the housing system and the whole environment are concerned. Fattening rabbits are mainly housed singly or, more frequently, in two animals per cage, according to the local tradition. In Europe at the

moment no EU Directive exists on cage dimensions for these animals, while in some Countries local Codes indicate the housing dimensions for rabbits ("Codes of recommendations for the Welfare of Livestock of the U. K" - 1987 and "German Section of WRSA" - 1991). Rabbits are social animals living in colony, and to allow this condition also in intensive husbandry systems, it is necessary to improve their possibility to have adequate social contacts (STAUFFACHER, 1992; ROMMERS and MEIJERHOF 1998), but too high density may result in lowered welfare and performance (MORISSE, 1998). Moreover, environmental enrichment may allow the animals to perform more natural behaviours (LIDFORS, 1997), thus improving their welfare. Aim of this research was to study the effect of housing and of the environmental enrichment (presence of a wood stick inside the cage) on performance and behaviour in fattening rabbits in a commercial intensive farm.

MATERIAL AND METHODS

Animals and environmental enrichment

The research was carried out in a commercial farm located in North-West of Italy. 72 hybrid rabbits were housed in standard cages with the same dimensions during the growing period, from 35 to 75 days of age. The animals were housed in 2, 3 or 4 per cage, (density: 1045 cm², 697 cm² and 522 cm² respectively). Half cages were enriched using a wood stick (*robinia pseudoacacia*), 24 cm length and 8 cm diameter, hanging from the ceiling of the cage, to study the effect of environmental enrichment. Animals were fed *ad libitum* a commercial feed. Weight and daily weight gain were recorded at weaning (35 d of age), at 55 days of age and at slaughter (75 d of age).

Behaviour

Behaviour was video recorded at the beginning (1st period) and at the end of the fattening period (2nd period), 24 hours each period, using 3 cameras connected to a Multiplexer and VCR tape recorder. Thus each cage was observed 48 hours in total. Behaviour was recorded using a *scan sampling method* (MARTIN and BATESON, 1993) every 10min during the whole observation time (288 scans per cage). All cages were recorded at the same time. The following behaviours were recorded: lying, lying stretched, smelling another rabbit, smelling an object, self and allo-grooming, movement, drinking, eating, caecotrophy, hopping, standing, gnawing the bars of the cage the wood stick, motor stereotypies, aggressive behaviours. Only the more frequently performed behaviours are discussed.

Statistical analysis

The data were processed through the Analysis of Variance (General Linear Model) by SAS[®] (1998) using environmental enrichment and housing as main effects. Behaviours were also analysed through the Principal Component Analysis (PCA, TODESCHINI, 1998), and through their frequencies, according to the independent variables considered.

RESULTS AND DISCUSSION

The effects of the environmental enrichment (presence of a wood stick inside the cage) and of the housing system were not statistically significant on the rabbit performance (Table 1). These results support the findings of previous studies showing that environmental enrichment and housing have a low effect on productive performance and meat quality in rabbits (LUZI *et al.*, 2003).

Table 1 . Productive performances of rabbits (least square means+ *standard error*).

Parameter		Environmental Enrichment		Housing (n° of rabbits per cage)		
		Without	with	2	3	4
Rabbit	n	36	36	16	24	32
Live weight at 35 days of age	g	1049±15	1028±15	1071±22	1025±18	1019±16
Live weight at 55 days of age	g	1867±32	1847±32	1886±48	1814±39	1869±34
Live weight at 75 days of age	g	2626±37	2540±39	2597±58	2562±45	2592±39
Daily weight gain (35-75 days of age)	g/d	39.5±0.9	38.0±0.9	38.6±1.3	38.4±1.0	39.3±0.9

As far as the behaviour is concerned, the first explorative PCA showed that the two periods are very different. In fact, at the beginning, the animals showed mainly alert, movement and eating behaviours, while, at the end of the fattening period, they showed more exploration, both smelling the other rabbits and the environment and, for the enriched caged animals, smelling and gnawing the wood stick. The social behaviours, as well as the exploration, mainly directed to the object (environmental enrichment), are more evident according to the age of the rabbits. In this study we found that, as far as housing is concerned, rabbits housed 2 per cage have, during the whole day, resting frequencies significantly lower than all the other observed animals. This may be due to the higher quantity of space at disposal of these rabbits, thus allowing them to exhibit other behaviours of the ethogram, instead of resting, with respect to the other rabbits housed 3 or 4 per cage. This may be confirmed also by the frequencies of hopping, which is also higher in rabbits housed 2 per cage. Rabbits spent the most of the day lying according to other author (VERGA, 2000). SAMOGGIA (1985) found that adult non stressed rabbits spend 21-26% of daily time resting in an arousal state and 71% lying but not sleeping. The PCA on the second observation period shows that animals are well classified according to the environmental enrichment (Table 2 and Fig. 1). In fact, the enriched caged rabbits perform mainly movement, allo-grooming, smelling the other rabbits, the environment and gnawing the wood stick; on the contrary, the control animals showed mainly alert and self-grooming. This indicates that environmental enrichment allows the rabbits to perform a wider range of behaviours in the ethogram.

Table 2. Loadings of the behaviours of the 3 main Principal Components.

ID	Variables	PC1	PC2	PC3
1	Lying	-0.320	0.301	0.197
2	Lying stretched	0.378	0.041	-0.259
3	Drinking	0.057	-0.325	0.062
4	Hopping	-0.265	0.165	0.069
5	Smelling another rabbit	0.250	0.195	0.244
6	Smelling an object	0.276	0.006	0.466
7	Movement	0.316	-0.141	-0.073
8	Allo-grooming	0.327	0.216	-0.179
9	Gnawing cage	0.156	-0.422	0.279
10	Self-grooming	-0.350	-0.285	0.083
11	Alert	-0.302	0.189	-0.060
12	Gnawing the wood	0.178	-0.046	0.515
13	Aggressive behaviours	0.086	-0.324	-0.462
14	Eating	-0.243	-0.519	0.069

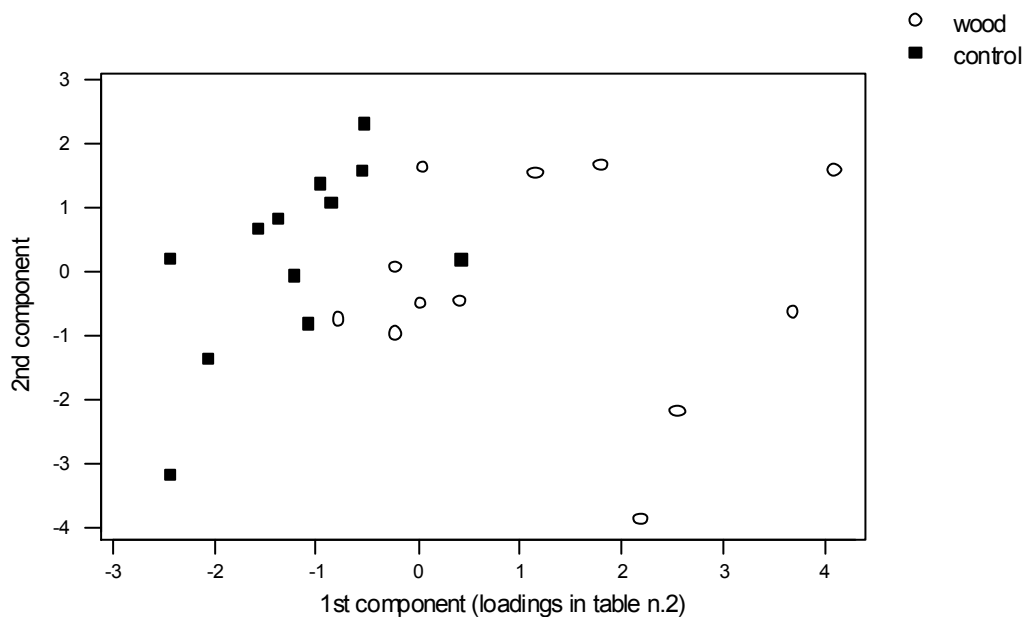


Figure 1. Scatter Plot of the subjects according to the behaviours.

MORMEDE (1988) found that high density may be related to lower movement frequencies and increased glucocorticoid levels, thus indicating high stress reactions. Moreover, the higher available space for the rabbits housed 3 or 2 per cage, with respect to the ones housed 4 per cage, allowed them to perform also higher locomotor activity and hopping ($P < 0.01$), which on the contrary is very low in the latter ones. LEHMAN (1987), observing hopping and jumping behaviours, showed that rabbits, in order to jump, need a cage two times as high as the animal's height, and in order to hop a cage as large as three times

the animal's length. As far as the environmental enrichment is concerned, we found also higher frequencies of lying not stretched in the rabbits housed in barren cages, which may be due to the lack of stimuli to perform other behaviours (HAMILTON and LUKEFAHR, 1993).

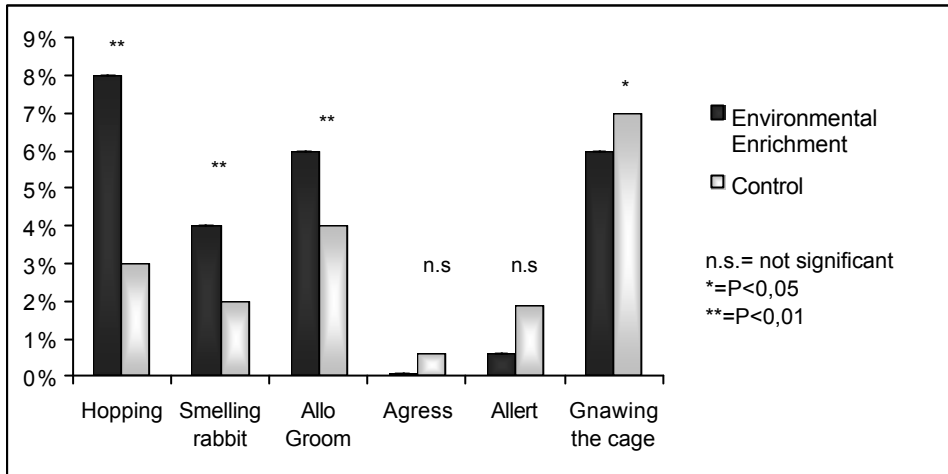


Figure 2. Behaviour of rabbits with and without environmental enrichment.

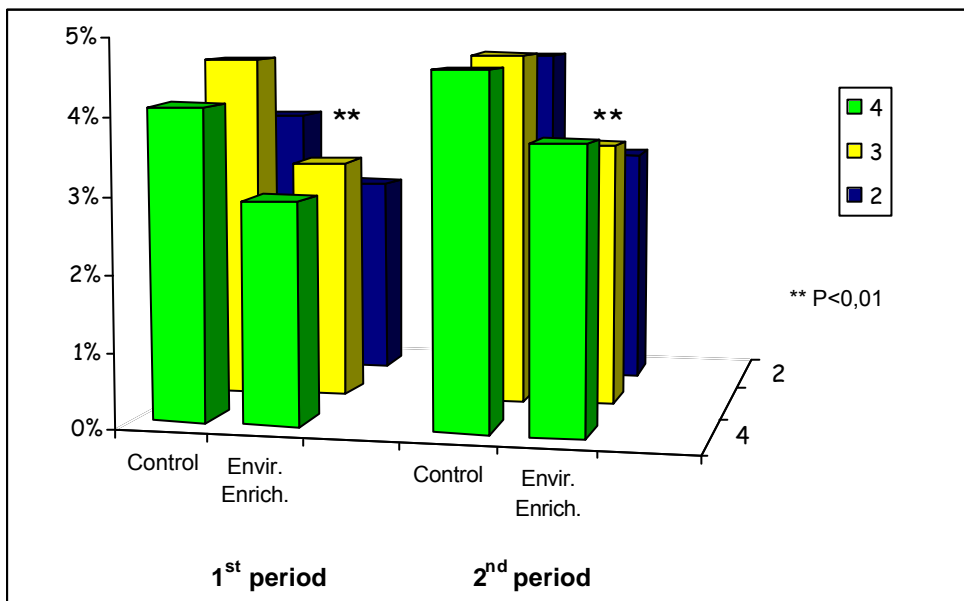


Figure 3. "Gnawing the bars" with and without environmental enrichment.

In fact, rabbits in an enriched environment are more active, performing more exploration and less resting, mainly lying, than the ones housed in non enriched cages (Figure 2). Moreover, we found a significant effect of the presence of a wood stick inside the cage also on stereotypies. In fact, rabbits in enriched cages show lower frequencies of ($P < 0,01$) gnawing the bars of the cage (Figure 3). LIDFORS (1997) showed a significant reduction of stereotypies and increase of exploration in New Zealand White rabbits reared in enriched cages with straw and a little wood stick inside. Another effect of the

environmental enrichment that we found was that the animals caged in a barren environment show also a trend to higher alert and aggressive behaviour frequencies, as well as statistically higher frequencies of self-grooming ($P < 0.01$). STAUFFACHER (1992) too, found that an object inside the cage may reduce self-grooming and stimulate rabbits to perform a larger range of behaviours.

CONCLUSIONS

In conclusion housing didn't affect significantly the growth rate, but significantly affected some rabbits' behaviour. In fact, animals at lower density showed a higher variety of natural behaviours. Environmental enrichment too affects the behaviour and not the performance. It decreases both oral stereotypies such as gnawing the bars of the cage, and alert, aggressive behaviours and self-grooming. This may indicate a better satisfaction of the behavioural needs for the enriched caged rabbits, while the other ones may spend more time inactive and/or performing abnormal behaviours and consequently a higher stress level due to the frustration in a hypo-stimulating environment.

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