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The influence of environment enrichment (gnawing stick) on some performance and carcass traits of male rabbits

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ABSTRACT

Housing of rabbits in individual wire cages enables the animals to satisfy only the basic vital necessities; their environment is much poorer than in the wild. In such poor environment the welfare of animals is questionable. However, the environment can be enriched in different ways. Very simple and inexpensive, but very effective enrichment represents the addition of gnawing wood. This kind of enrichment and the reaction of rabbits was studied in two experiments. Each, spring and summer experiment included 40, seven to thirteen weeks old fattening rabbits. All 80 animals were New Zealand White males line SIKA. In both experiments together rabbits gnawed 5.03±0.91 g of wooden stick, which means that on average each individual rabbit gnawed 0.14±0.02 g of wooden stick daily. Enrichment of environment with wood had no significant influence on weight gain, carcass weight, or weight of gastrointestinal tract. Rabbits fattened in summer experiment had 3.12±1.34 g (P=0.0226) higher average daily weight gain and 21.23±10.17 g (P=0.0408) lighter carcass weight than rabbits fattened in spring experiment. The reason for discrepancy between higher average daily weight gain and lighter carcass weight can be found in heavier gastrointestinal tract of rabbits fattened in summer experiment. The difference in weight of gastrointestinal tract between repetitions was 17.36±10.64 g, but it was not significant (P=0.1078).
(Keywords: rabbits, wire cages, environment enrichment)

INTRODUCTION

Several studies have shown that in spite of many years of selective breeding domesticated rabbits still perform or try to perform behavioural repertoire of wild rabbits. In the wild rabbits spend most of their time and energy on foraging, in contrast with domesticated rabbits, who often receive food in the form, which is easy to consume. The consequence is a lot of remaining time, which has to be filled with other activities. In many housing systems fattening rabbits are housed in traditional wire cages, which often restrict performance of normal behaviour repertoire (*Berthelsen* and *Hansen,* 1999). Rabbits are limited in their natural locomotion pattern of hopping, running, standing and rising on hind legs. Also their social behaviour and gnawing possibilities are very limited (*Maertens* and *Van Oeckel,* 2001*)*. Changes in animal behaviour are the first signs of poor environment. Animals fall into the state of stress, become more restless and frequently change the activities (*Lehmann,* 1987; *Metz*, 1987). Several kinds of abnormal behaviours such as bar biting, excessive grooming and stereotypic activities appear (*Hansen* and *Berthelsen*, 2000). Poor environment can be enriched with objects, which enable animals to perform desired activities. These kinds of objects are hay, straw,

grass, gnawing sticks or branches with leaves (*Lidfors,* 1997). Rabbits are rodents and even *Stauffacher* (cit. after *Lidfors,* 1997) found out, that in semi-natural enclosure they spent about 20% of the time chewing on wood and branches. That is why he suggested, that rabbits should have gnawing sticks also in their cages. Wood, as a material for gnawing, serves as environment enrichment, and in the form of sawdust as feed additive, which has a positive influence on rabbit's digestion (*Koritnik* and *Banožić*, 1974).

The aim of this study was to find out if the addition of gnawing stick as a material for environment enrichment influences the performance and carcass traits of fattening rabbits housed in individual wire cages.

MATERIALS AND METHODS

Animals

Each of our two experiments included 40 male New Zealand White rabbits line SIKA. The first experiment took place in spring, that is from 24.04. to 07.06.2001, and the second one in summer, from 14.06. to 26.07.2001. Animals were housed individually in wire cages, measuring 37.5×40×30 cm. Cages were equipped with automatic feeders and nipple drinkers. The duration of lighting was 12 hours (from 6 a.m. to 6 p.m.). Water and food were available ad libitum. Animals were fed in the morning between 7 and 8 a.m. with complete feed mixture for fattening rabbits. In the case of diarrhoea, rabbits were fed with the feed mixture with additional 0.3% of Farmatan (chestnut tannin). In the second experiment in order to prevent diarrhoea all the animals were fed only with Farmatan added to the feed mixture. At the beginning of the first experiment animals were 45 days old and at the first weighing, that is at the age of 47 days, the average weight of 1346.72±17.50 g was recorded. At the beginning of the second experiment rabbits were 44 days old and their average live weight was 1325.85±17.21 g.

After the individual housing in wire cages rabbits were divided into two groups of 20 animals each. Experimental group was treated with fir-wood sticks as a material for gnawing. To control group wooden sticks were not placed into the cages. At the beginning of the experiment there was no significant difference in live weight of animals between the experimental and control group.

Measures

- *Fir-wood sticks* were weighed three times a week, on Monday, Wednesday and Friday, between 8 and 10 a.m.
- *Live weight of animals* was measured once a week, on Thursday, between 8 and 10 a.m.
- *Carcass weight of animals* was measured after the slaughter at the age of 89 and 86 days respectively. We weighed carcass with edible offal, without head and lower parts of extremities.
- *The weight of gastrointestinal tract* was measured without milt.

Statistics

For the statistical analysis of data we used GLM (General Linear Models) procedures of the SAS/STAT (*SAS/STAT User's Guide,* 1990) statistical program package. Basic statistical parameters were calculated with MEANS procedure, the 'estimate' sentence from GLM procedure was used for the estimation of differences between repetitions and treatment.

Weight gain of rabbits is expressed as the average daily weight gain in the entire six-week experimental period. Data were analysed by means of statistical model, which

included fixed influences of repetition (R_i) and treatment (T_j), and weight of animals at the beginning of experiment (x_{ijk}) as independent variable. Statistical model used for analysing *carcass weight and weight of gastrointestinal tract* included fixed influences of repetition (R_i) and treatment (T_j), and slaughter weight of animals (x_{ijk}) as independent variable.

MODEL: $y_{ijk=}\mu+R_i+T_j+b_x\ (x_{ijk}-\bar{x})+e_{ijk}$

RESULTS AND DISCUSSION

The amount of gnawed wood

On average rabbits gnawed only 3.53±0.80 g of fir-wood stick in spring experiment (*Table 1*), compared to summer period, when they gnawed 6.30±1.51 g. In spring the amount of gnawed wood ranged from 0 to 14 g, and in summer from 2 to 32 g. In both repetitions together rabbits gnawed on average 5.03±0.91 g of wooden stick, which means that on average each individual rabbit gnawed 0.14±0.02 g of wooden stick daily. *Maertens* and *Van Oeckel (2001)* also reported the low intake of wood although rabbits gnawed extensively on the wooden sticks. *Huls* et al., *Gunn* and *Brooks* et al. (all cit. after *Lidfors*, 1997) found out that rabbits showed interest for fir–wood sticks over a longer period of time.

Table 1

Basic statistical data for the amount of gnawed wood

Repetition	N	Average	SD	Min	Max
Spring	17	3.53±0.80	3.28	0	14
Summer	20	6.30±1.51	6.78	2	32
TOGETHER	37	5.03±0.91	5.57	0	32

In spring (*Figure 1a*) and in summer experiment (*Figure 1b*) the total amount of gnawed wood most often ranged from 2 to 4 g. This kind of intake of wood was in both repetitions together registered in 43.24% of cases (*Figure 1c*).

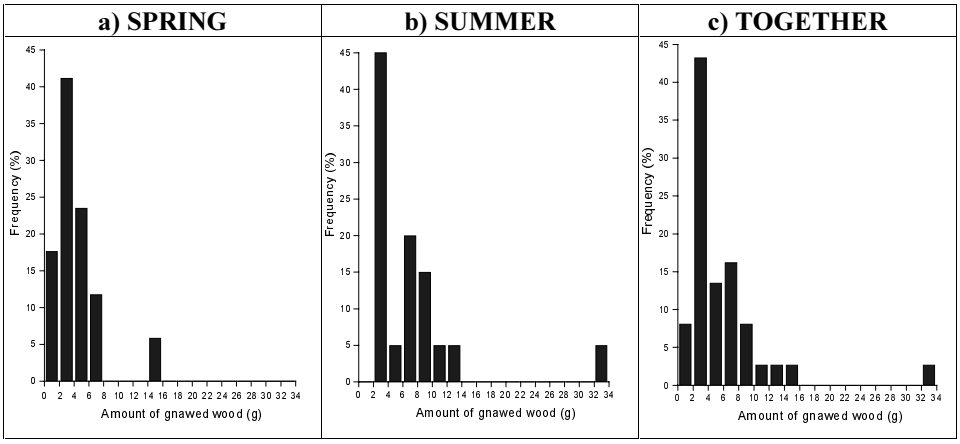
Weight gain

The significant influence ($P\leq0.05$) on the average daily weight gain was exerted by the repetition and the weight of animals at the beginning of experiment. Heavier rabbits grew faster. With each gram of rabbit's body weight at the beginning of experiment, the average daily weight gain increased 0.015 g/day ($P=0.0259$).

Between the age of 7 and 13 weeks average daily weight gain of rabbits was 34.6 g/day, but between repetitions (*Table 2*) there were some significant differences. Animals had lower weight gain in spring than in summer experiment, namely 3.12±1.34 g/day. These results are in contradiction with the findings of *Cifre et al.* (1999), who reported lower weight gain in summer. Feeding the animals strictly with the addition of Farmatan to the basic feed mixture, could explain the increased weight gain in summer period. After weaning the addition of Farmatan in the concentration of 0.3 and 1% had a positive effect on growth and feed conversion efficiency *(Štruklec* and *Kermauner,* 1994). *Zimmermann* and *Bessei* (2001) also reported similar results with the addition of Farmatan in the concentration of 0.4%.

Figure 1

Distribution of the amount of gnawed wood



Addition of gnawing stick did not influence on daily weight gain of rabbits. In their studies *Lidfors* (1997) and *Maertnes* with *Van Oeckel* (2001) also found no significant differences in average daily weight gain between treatments.

Table 2

The least squares means, estimates and statistical significance of the estimates in the average daily weight gain between repetitions and treatments

	LSM (g)	Estimate±SEE (g)	P - value
Repetition			
Spring	33.0	-3.12±1.34	0.0226
Summer	36.1		
Treatment			
Control	34.5	-0.10±1.34	0.9395
Experimental	34.6		

P≤0.05 statistically significant; LSM: least squares means; SEE: standard error of estimate

Carcass weight and weight of gastrointestinal tract

The repetition and slaughter weight of animals had significant influence (P≤0.05) on carcass weight. Weight of gastrointestinal tract was significantly influenced only by slaughter weight of animals. The heavier the rabbits were before slaughter, the higher was their carcass weight (b=0.627, P=0.0001) and the weight of gastrointestinal tract (b=0.067, P=0.0008).

Treatment had no significant influence on carcass weight and weight of gastrointestinal tract. This kind of result was expected due to low intake of wood. Perhaps the influence of wood addition would be greater at older rabbits.

In spring experiment the average slaughter weight of animals was 2738.47±49.27 g, and in summer experiment 2836.15±46.72 g. The average dressing percentage in spring repetition was 54.26±0.30% and 53.64±0.30% in summer repetition.

The average carcass weight of rabbits fattened in spring period was 1497 g (*Table 3*) and the average carcass weight of animals fattened in summer period was 1476 g. Carcass weights in spring experiment were significantly higher (P=0.0408) 21.23±10.17 g than carcass weights in summer experiment. This is surprising in regard to significantly higher daily weight gain of rabbits in summer experiment (*Table 2*). The reason for discrepancy between higher average daily weight gain and lighter carcass weight can be found in heavier gastrointestinal tract of rabbits fattened in summer experiment. The difference in weight of gastrointestinal tract between repetitions was 17.36±10.64 g, but it was not significant (P=0.1078).

Even between treatments there were some differences in carcass weight and weight of gastrointestinal tract, but they were not significant (P≥0.05). Carcass weights of animals in the control group were on average 3.93±10.14 g lighter than carcass weights of animals in the experimental group. The gastrointestinal tract of animals in the control group was also 15.41±10.63 g lighter than gastrointestinal tract of rabbits in the experimental group.

Table 3

The least squares means, estimates and statistical significance of the estimates in the carcass weight and weight of gastrointestinal tract between repetitions and treatments

	LSM (g)	Estimate±SEE (g)	P - value
Carcass weight (g)			
Repetition			
Spring	1497	21.23±10.17	0.0408
Summer	1476		
Treatment			
Control	1484	-3.93±10.14	0.6998
Experimental	1488		
Weight of gastrointestinal tract (g)			
Repetition			
Spring	405	-17.36±10.64	0.1078
Summer	422		
Treatment			
Control	406	-15.41±10.63	0.1518
Experimental	421		

P≤0.05 statistically significant; LSM: least squares means; SEE: standard error of estimate

CONCLUSIONS

On the base of our results we can conclude, that the addition of wooden stick as a material of environmental enrichment did not significantly influence the weight gain, carcass weight and weight of gastrointestinal tract. Between spring and summer experiment there were significant differences in weight gain and carcass weight. There were great differences between rabbits in the interest of the wooden stick, which is shown in very different amount of wood intake.

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