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EFFECT OF GROUP SIZE AND STOCKING DENSITY ON PRODUCTIVE, CARCASS, MEAT QUALITY AND AGGRESSION TRAITS OF GROWING RABBITS

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Abstract: The aim of the experiment was to examine the effect of group size and stocking density on productive, carcass and meat quality traits. The trial was conducted using 230 Pannon white rabbits weaned at 5 weeks and reared until the age of 11 weeks. Seven groups were formed with different cage/pen sizes (group size) and stocking densities: SC16=small cage (0.12 m^2), 16 rabbits/m^2 (2 rabbits/cage); LC16=large cage (0.50 m^2), 16 rabbits/m^2 (8 rabbits/cage); LC12=large cage, 12 rabbits/m^2 (6 rabbits/cage); SP16=small pen (0.86 m^2), 16 rabbits/m^2 (13 rabbits/cage); SP12=small pen, 12 rabbits/m^2 (10 rabbits/cage); LP16=large pen (1.72 m^2), 16 rabbits/m^2 (26 rabbits/cage); LP12=large pen, 12 rabbits/m^2 (20 rabbits/cage). Stocking density did not affect production significantly, as stocking densities lower than 16 rabbits/m^2 had no effect on the growing rabbits' performance. Group size (size of the cage or pen) had an effect on certain growth, carcass and meat quality traits. Increasing group size resulted in lower values for weight gain (SC: 39.2>LC: 39.0> SP: 38.7> LP: 37.8 g/d; P=0.22) and body weight (SC: 2506>LC: 2498> SP: 2487> LP: 2446 g; P=0.35), similarly to other results in the literature, but the differences were not significant. Aggressive behaviour was observed to be more frequent in the larger group sizes. At the age of 11 weeks the proportion of rabbits with ear lesions in the SC, LC, SP and LP groups were 0.0, 7.1, 8.7, and 17.4%, respectively, demonstrating that larger group size increases the risk of ear lesions. The effect of group size on the ratio of the fore part to the reference carcass (SC: 28.5, LC: 28.2, LP: 29.0%; P=0.02) and on the amount of perirenal fat (SC: 21.3, LC: 18.0, LP: 13.7 g; P<0.001) was significant. Meat quality traits (dry matter, protein, fat and ash content, drip loss, pH, L*, a*, b* values) were not affected by group size (cage *vs*. pen), but successful discriminations were performed using the NIRS method.

Key Words: growing rabbit, group size, stocking density, productive performance, meat quality, ear lesion.

INTRODUCTION

From the animal welfare viewpoint, provision of adequate space and a suitable environment is important for providing freedom of movement and comfort. The number of rabbits in a cage or pen is one of the most important factors from the well being and production aspects. The effects of stocking density (Maertens and Groote, 1984; Aubret and Duperray, 1992; Morisse and Maurice, 1997; Lambertini *et al.*, 2001; Mbanya *et al.*, 2004; Matics *et al*., 2005; Villalobos *et al*., 2008) and group size (cage/pen size) (Bigler and Oester, 1996; Rommers and Meijerhof, 1998; Xiccato *et al*., 1999; Eiben *et al*., 2001; Princz *et al*., 2008, 2009; Dalle Zotte *et al*., 2009), on the growth, carcass and meat quality traits, welfare and behaviour of growing rabbits has been investigated in several studies. Contrary to other domesticated species used

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for meat production, there are at present no EU directives on rabbit breeding. Recommendations based on experimental results were drawn up in the EFSA report (EFSA, 2005). However, one of its conclusions was the lack of scientific evidence concerning space and group size requirements in fattening rabbits.

The objective of the present analysis was to examine the effects of group size and stocking density on the growth, slaughter and meat quality traits of growing rabbits, and the occurrence of ear lesions due to aggression.

MATERIALS AND METHODS

The trial was conducted at the Kaposvár University with 230 Pannon White rabbits weaned at 5 weeks of age. The rabbits were reared in a specially adapted building. Daily lighting and temperature were 16 h and 16-18°C, respectively. The rabbits were fed a commercial pellet feed *ad libitum* [from 5 to 9 weeks: 10.3 MJ digestible energy (DE)/kg, 14.5% crude protein, 2.0 ether extract, 17.5% crude fibre, 50 ppm Tiamulin, 500 ppm Oxitetracycline, 1 ppm Diclazuril; from 9 to 11 weeks: 10.6 MJ DE/kg, 16.0% crude protein, 3.0 ether extract, 16.0% crude fibre]. Water was also available *ad libitum*. The rabbits were reared until the age of 11 weeks. Seven groups were formed with different cage/pen sizes and stocking densities:

SC16=small cage (0.12 m^2), 16 rabbits/m^2, (2 rabbits/cage), cage height: 30 cm, (n=36)

LC16=large cage (0.50 m^2), 16 rabbits/m^2, (8 rabbits/cage), cage height: 30 cm, (n=32)

LC12=large cage (0.50 m^2), 12 rabbits/m^2, (6 rabbits/cage), cage height: 30 cm, (n=24)

SP16=small pen (0.86 m^2), 16 rabbits/m^2, (13 rabbits/pen), open top pen, (n=26)

SP12=small pen (0.86 m^2), 12 rabbits/m^2, (10 rabbits/pen), open top pen, (n=20)

LP16=large pen (1.72 m^2), 16 rabbits/m^2; (26 rabbits/pen), open top pen, (n=52)

LP12=large pen (1.72 m^2), 12 rabbits/m^2, (20 rabbits/pen), open top pen, (n=40)

The feeder length and drinkers available per rabbit were identical in all groups. During the experiment body weight and feed consumption of the rabbits were measured weekly. Using these measurements, weight gain and feed conversion ratio were also calculated. Number of rabbits with ear lesions was recorded at 9, 10 and 11 weeks. All ear injuries due to biting or gnawing were considered as lesions.

Because of the similar weight of rabbits at 11 weeks of age in groups 12 and 16 rabbits/m^2 at the end of the growing period, only rabbits from groups SC16, LC16 and LP16 (n=30 per group) were slaughtered at a slaughterhouse 200 km from Kaposvár. The rabbits were removed from their cages/pens and were slaughtered in less than 4 h. Slaughter and dissection were carried out according to WRSA recommendations (Blasco and Ouhayoun, 1996). After chilling the carcasses for 24 h at a temperature of 4 °C, the chilled carcasses were dissected into three parts (between the 7^{th} and 8^{th} thoracic vertebra, and between the 6^{th} and 7^{th} lumbar vertebra). The following measurements were taken: live weight; hot carcass weight, chilled carcass weight, reference carcass weight, heart, lungs, liver and kidney weight, perirenal fat weight, head weight, fore part weight, intermediate part weight, hind part weight, dressing out percentage (chilled carcass weight divided by live weight *100), different carcass part weights and perirenal fat weight divided by the reference carcass weight.

Taking thigh muscle samples (from the right hind limb) of 15 rabbits, chosen at random from three different groups (n=3×15), the following meat quality measurements were carried out:

- meat colour (L*, a* and b* values) using Minolta Chromameter 300
- pH24 using Testo 205, 24 h after slaughter
- drip loss according to the Honikel method (chilling for 24 h in a ventilated cold room: 0-4 °C)

- chemical composition (dry matter, protein, fat and ash content)
- Near Infrared (NIR) Spectral Analyses: NIR reflectance spectra (between 1100-2500 nm in 2 nm intervals) were measured with a FOSS NIRSystems 6500 spectrometer (Foss NIRSystems INC., Silver Spring, MD, USA). Samples were scanned in fresh and freeze-dried forms, so that there were two spectral sets of meat samples from the total of 45 animals from three groups. Sample Transport Module and Small Ring Cup were used. WinISI II v1.50 spectral analytical software (InfraSoft International, Port Matilda, PS, USA) was used to operate the scanner and for data handling and evaluation procedures. PLS-based discriminant analysis (Murray *et al*., 2001) was performed to identify different rabbit groups by the spectra of homogenized fresh or freeze-dried rabbit meat. First derivative spectra were used with intervals of 4 nm for gap and smooth (WinISI format: 1,4,4,1), without scatter correction. Cross-validation was used to test the accuracy of the discriminator model. The cross-validation operated with 10 groups and a detection level of 2.5.

Productive data were analysed by means of two-factor analysis of variance, using the SPSS 10.0 software package. In the case of feed intake and feed conversion, the units of data analysis were cages and pens. Since interactions had no effect, they were omitted from the model. Percentage of ear lesions were compared by the χ^2 test. In the case of carcass and meat quality a one-way analysis was performed. For carcass traits, body weight at slaughter was considered as a covariate.

RESULTS

Productive performance

Stocking density only affected weight gain from 10 to 11 weeks of age, where the 16 rabbits/m^2 group showed slightly better performance (Table 1). Body weight was not affected by stocking density at either age.

Group size significantly affected weight gain from 5 to 7 and 10 to 11 weeks of age (Table 1). Body weight was significantly influenced by group size at the 7th, 8th and 9th week. The rabbits of the SC group had the highest body weight in all cases. The same tendency was observed at the 10th and 11th week.

Stocking density had no effect on feed consumption of growing rabbits (Table 2). Significant differences were only observed for feed conversion ratio from 5 to 6 weeks of age, when the 16 rabbits/m^2 group showed 24.6%.better performance.

Group size significantly affected feed consumption from 5 to 6 and 7 to 8 weeks of age. LC group rabbits consumed the least amount of feed. Significant differences were observed among the groups for feed conversion ratio from 5 to 6, 7 to 8 and 5 to 11 weeks of age. In most cases the LC group rabbits showed the best performance.

Ear lesions

At 9 weeks only a few ear lesions were detected but the number tripled from 9 to 11 weeks of age (Figure 1). Stocking density significantly affected the frequency of rabbits with ear injuries at the age of 11 weeks (Figure 2). Almost nine times more ear lesions were observed in the 12 rabbits/m^2 compared to the 16 rabbits/m^2 group.

The proportion of injured rabbits increased with increasing size of the cage or pen (Figure 3). When the rabbits were caged in pairs, no injured rabbits were detected, while the average percentage of injured rabbits kept in small pens was 7.9% (when 6 to 13 rabbits per cage). This percentage was doubled in large pens (20 to 26 rabbits per cage).

Table 1: Weight gain and body weight of growing rabbits according to stocking density and group size.

	Stocking density (Sd) rabbits/m^2		Group size (Gs)					*P*-value	
Age, week	12	16	SC	LC	SP	LP	SE	Sd	Gs
No.	146	84	36	56	46	92			
Weight gain, g/d									
5-6	34.2	37.2	39.7^{c}	38.1^{bc}	34.8^{ab}	34.1^{a}	0.62	0.140	0.020
6-7	42.2	42.4	43.8^{ab}	44.6^{b}	40.3^{a}	41.3^{a}	0.58	0.864	0.039
7-8	40.6	41.0	42.3	41.1	39.6	40.7	0.44	0.970	0.374
8-9	41.5	41.5	42.2	42.8	42.4	40.0	0.51	0.796	0.106
9-10	39.2	39.1	37.7	38.1	40.2	39.9	0.47	0.736	0.190
10-11	31.9^{a}	32.8^{b}	28.5^{a}	31.4^{b}	37.2^{c}	32.2^{b}	0.54	0.055	<0.001
5-11	38.0	38.8	39.2	39.0	38.7	37.8	0.25	0.273	0.222
Body weight, g									
5	858	861	861	861	861	858	6.8	0.827	0.998
6	1124	1149	1179	1145	1135	1124	8.8	0.406	0.367
7	1419	1446	1486^{b}	1457^{b}	1417^{ab}	1413^{a}	9.2	0.469	0.057
8	1703	1731	1782^{b}	1745^{b}	1695^{a}	1695^{a}	9.6	0.572	0.014
9	1994	2022	2077^{b}	2045^{b}	1992^{a}	1975^{a}	11	0.677	0.007
10	2268	2294	2341	2312	2268	2254	12	0.695	0.072
11	2455	2489	2506	2498	2487	2446	13	0.310	0.346

SC=small cage, LC=large cage, SP=small pen, LP=large pen
Means within a row with different superscripts differ at $P<0.05$.

Of the rabbits kept in cages or pens of different sizes, more ear lesions were observed in the 12 rabbits/m^2 group (Figure 4), especially in the LP group.

Carcass and meat quality traits

When taking body weight into the model as covariate, significant differences for the different body parts were only found for kidney weight and perirenal fat weight (Table 3). Lower values were found in the LP16 group in both cases.

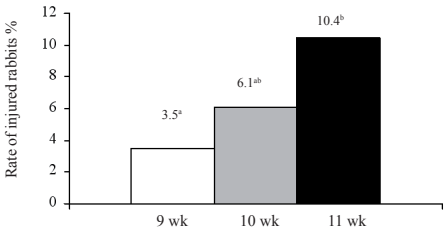

Figure 1: Effect of age on the frequency of ear lesions.
Means no sharing superscripts differ at $P<0.05$.

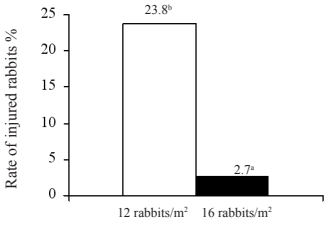

Figure 2: Effect of stocking density on the frequency of ear lesions at the age of 11 weeks.
Means no sharing superscripts differ at $P<0.05$.

Table 2: Feed consumption and feed conversion ratio of growing rabbits according to stocking density and cage size.

Age, week	Stocking density (Sd) rabbit/m²		Group size (Gs)				SE	*P*-value	
	12	16	SC	LC	SP	LP		Sd	Gs
No.	146	84	36	56	46	92			
Feed consumption, g/d									
5-6	101	94	91^{a}	88^{a}	114^{b}	115^{b}	2.5	0.934	<0.001
6-7	119^{b}	116^{a}	119	114	114	117	1.4	0.069	0.221
7-8	119	126	129^{b}	111^{a}	123^{b}	133^{b}	2.1	0.468	<0.001
8-9	143	142	143	143	142	140	1.6	0.713	0.940
9-10	151	148	149	148	149	147	1.9	0.209	0.771
10-11	150	150	150	149	155	149	1.6	0.769	0.744
5-11	131	129	130	125	133	134	1.3	0.514	0.229
Feed conversion, g/g									
5-6	3.09^{b}	2.48^{a}	2.32^{a}	2.53^{b}	3.33^{c}	3.44^{c}	0.08	0.013	<0.001
6-7	2.77	2.64	2.65	2.54	2.83	2.84	0.05	0.421	0.417
7-8	2.93	3.04	3.08^{b}	2.70^{a}	3.10^{b}	3.31^{b}	0.05	0.797	0.001
8-9	3.40	3.37	3.36	3.36	3.36	3.51	0.04	0.959	0.802
9-10	3.91	3.89	3.97	3.88	3.80	3.68	0.05	0.164	0.130
10-11	4.92	5.26	5.60	4.91	4.32	4.71	0.19	0.427	0.099
5-11	3.50	3.46	3.52^{b}	3.32^{a}	3.46^{ab}	3.58^{b}	0.04	0.103	0.041

SC=small cage, LC=large cage, SP=small pen, LP=large pen.
Means within a row with different superscripts differ at $P<0.05$.

The SC16 group had a slightly higher mean value for the dressing-out percentage, but the differences were not significant (Table 4). In the LP16 group, the proportion of the fore parts of the reference carcass weight was significantly higher than that of the LC16 group. The proportion of perirenal fat was significantly higher in the SC16 and LC16 rabbits compared to the LP16 group.

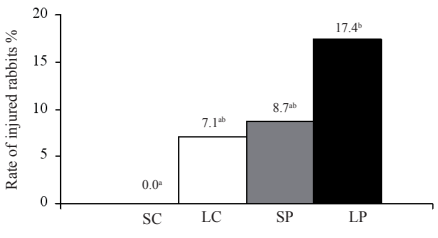

Figure 3: Effect of group size on the frequency of ear lesions at the age of 11 weeks.
SC=small cage, LC=large cage, SP=small pen, LP=large pen.
Means no sharing superscripts differ at $P<0.05$.

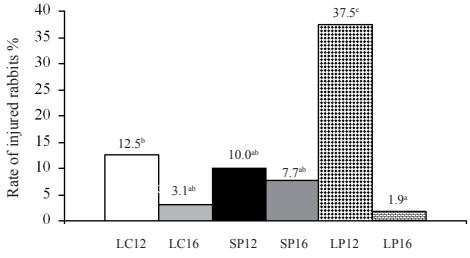

Figure 4: Joint effect of group size and stocking density on the frequency of ear lesions at the age of 11 weeks.
LC=large cage, SP=small pen, LP=large pen.
12 or 16=12 or 16 rabbits/m²
Means no sharing superscripts differ $P<0.05$.

Table 3: Weight of different body parts according to group size (body weight at slaughter was considered as a covariate).

	Group size			SE	*P*-value
	SC	LC	LP		
No.	30	30	30		
Weights, g					
Slaughter weight	2467	2475	2451	16.4	0.846
Hot carcass	1563	1535	1510	12.6	0.234
Chilled carcass	1515	1488	1481	10.4	0.372
Reference carcass	1268	1253	1242	9.04	0.534
Heart+lungs	25.1	23.3	24.0	0.60	0.500
Liver	75.6	70.9	75.2	1.32	0.270
Kidneys	17.1[b]	15.6[a]	15.0[a]	0.30	0.009
Perirenal fat	21.3[b]	18.0[b]	13.7[a]	0.86	0.001
Head	130	125	124	1.12	0.097
Fore part	361	353	361	2.83	0.496
Middle part	402	403	390	3.40	0.254
Hind part	484	479	478	3.87	0.798

SC=small cage; LC=large cage, LP=large pen.
Means within a row with different superscripts differ at $P<0.05$.

The fat content of the meat samples was not affected by group size ($P=0.67$). No significant differences were found in the protein content ($P=0.14$) or ash content ($P=0.19$) among the three groups (Table 5). In all cases the highest and the lowest values were in SC16 and LP16 groups, respectively, so the highest difference was in the DM content ($P=0.07$). Non-significant differences were found for drip loss. Almost identical pH values were observed in the SC16 and LP16 groups. Parameters characterizing meat colour such as lightness (L*), redness (a*) and yellowness (b*) were higher in the LP16 than SC16 group, although the differences were not significant.

Table 4: Dressing-out percentage and ratios of different carcass parts to reference carcass of growing rabbits according to group size.

	Group size			SE	*P*-value
	SC	LC	LP		
No.	30	30	30		
Dressing out percentage, %	61.6	60.1	60.4	0.40	0.394
Ratio to reference carcass, %					
Fore part	28.5[ab]	28.2[a]	29.0[b]	0.13	0.020
Middle part	31.7	32.1	31.4	0.15	0.153
Hind part	38.2	38.3	38.5	0.13	0.650
Perirenal fat	1.67[b]	1.43[b]	1.11[a]	0.06	0.001

SC=small cage; LC=large cage, LP=large pen.
Means within a row with different superscripts differ at $P<0.05$.

Table 5: Meat quality parameters of right thigh muscle of growing rabbits according to group size.

	Group size				
	SC	LC	LP	SE	*P*-value
No.	15	15	15		
Weight, g,	145	141	140	4.3	0.439
Dry matter content, %	27.2	26.6	26.3	0.40	0.066
Protein content, %	22.8	22.8	22.6	0.26	0.668
Fat content, %	3.28	2.78	2.73	0.30	0.141
Ash content, %	1.21	1.17	1.16	0.03	0.186
Drip loss	0.92	0.81	0.99	0.11	0.246
pH24	5.78	5.82	5.76	0.03	0.173
L*	50.5	51.9	51.2	1.06	0.416
a*	3.87	4.06	4.93	0.51	0.096
b*	0.59	1.15	1.22	0.33	0.131

SC=small cage; LC=large cage, LP=large pen.

As for NIR spectral analysis, classification of fresh rabbit meat samples gave weak results. Only 49.5% of samples were classified correctly when all three groups were compared. When groups were compared in pairs, the largest difference was found between the SC16 and LP16 groups (73.3% of the samples were classified correctly), but combination of LC16 *vs*. LP16 or SC16 *vs*. LC16 gave weaker discrimination results (68.8% or 68.6%, respectively). Better results were obtained when freeze-dried samples were used, as 64% of the samples were identified correctly when the three groups were classified simultaneously (Figure 5). The best classification was again in the same double combination: SC16 *vs*. LP16 (96.7% of the samples were classified correctly). Discrimination of groups LC16 and LP16 gave an 86.2% success rate, while SC16 and LC16 were 73.3% successful.

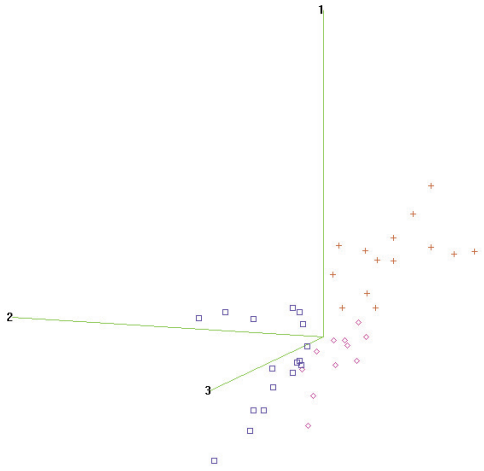

Figure 5: Graphic representation of the NIR classification result obtained for freeze-dried hind leg meats originated from three different rearing (+ SC16; ◊ LC16; □LP16).
SC=small cage, LC=large cage, LP=large pen.

DISCUSSION

Stocking density

Analyzing the whole fattening period, stocking density had no effect on weight gain, feed consumption and feed conversion ratio. Maertens and Groote (1984), Aubret and Duperray (1992), Hamilton and Lukefahr (1993), Eiben *et al*. (2001) and Verga *et al*. (2004) also concluded that applying a lower than 16 rabbits/m^2 stocking density had no effect on the growing rabbits' production.

As the 12 and 16 rabbits/m^2 groups showed very similar body weights, no rabbits were slaughtered from the 12 rabbit/m^2 group to compare carcass and meat quality traits. This was justified by Trocino *et al*. (2004) noting that rabbits of similar body weights are not expected to differ in carcass traits.

Frequency of ear lesions due to aggression increased from 3.5% to 10.4% between the ages of 9 and 11 weeks, similarly to Rommers and Meijerhof (1998) and Maertens and Van Herck (2000). This phenomenon is generally explained by increasing sexual maturity.

Higher ear-injury frequency was found for the stocking density of 12 than that of 16 rabbits/m^2. This tendency was similar in both cages and pens of different sizes. The reason for this unexpected result is unclear. The large difference found in the LP group can be explained by the 75% of the injured rabbits in the first repetition, while no injured rabbit was found in the second. This result proves that an aggressive individual can injure all the other rabbits in a pen and thus can bias the results.

Group size

The rank order of groups in weight gain from 5 to 11 weeks and weight at 11 weeks of age SC>LC>SP>LP were in accordance with the literature (Maertens and Van Herck, 2000; Maertens and Van Oeckel, 2001; Dal Bosco *et al*., 2002; Princz *et al*., 2008). Keeping the rabbits in larger groups resulted in increased activity and reduced weight gain and body weight (Dal Bosco *et al*., 2002). By the end of the experiment (11 weeks of age) the differences observed at the age of 9 weeks had decreased and were not significant among the groups. This finding can probably be explained by the fact that during the last two weeks the rabbits received non-medicated feed. Alteration of the occurrence of digestive disorders due to the pelleted feed decreased weight gain and also influenced the performance (weight gain, body weight) for the whole fattening period.

Contrary to the literature (Maertens and Van Herck, 2000; Maertens and Van Oeckel, 2001; Dal Bosco *et al*., 2002), no clear association was found between group size and feed consumption. Generally the rabbits kept in pens consumed 4-7% less feed than those kept in cages. Rabbits consume pellets for weight gain and for locomotor behaviour, if housed in pens. The same or lower consumption in pens, as compared to caged rabbits, could be the effect of stress caused by aggressive animals. Chronic social stress often leads to a depression of the immune function and can result in reducing digestive efficiency (Peeters *et al*., 1984) and increasing the risk of diseases (e.g. coccidiosis). In larger groups, not only the risk of infection but also the side-effects of stress could have an effect on feed intake and growth rate. It would be interesting to investigate these effects in group housing.

No mortality was observed throughout the experiment in either group as a consequence of feeding a medicated diet. Most authors (Maertens and Van Herck, 2000; Maertens and Van Oeckel, 2001; Dal Bosco *et al*., 2002) found smaller or larger differences in mortality in pens that can be explained by the higher risk of infections.

The occurrence of ear injuries increased with group size (cages and pens), in agreement with Bigler and Oester (1996), and Princz *et al.* (2008). The increasing frequencies of injuries with increased group size

is logical, as even if the number of aggressive individuals remains the same in larger groups, these rabbits can injure more of their counterparts than in smaller groups.

Chemical composition of hind leg muscles was not affected by group size. Dal Bosco *et al*. (2002) observed that both fat depots and fat content of the meat were also lower, although no significant difference was found between the groups of rabbits reared in cages or pens. Dalle Zotte *et al*. (2009) found a higher DM and protein content in caged rabbits compared to the pen-housed group.

Similarly to our results, no differences were found between the pH values of biceps femoralis and m. longissimus dorsi by Jehl *et al*. (2003), Combes *et al*. (2003) while Dal Bosco *et al*. (2002) and Dalle Zotte *et al*. (2009) measured significantly higher pH values in m. longissimus dorsi of rabbits kept in pens. It thus seems that group size has no significant effect on muscle pH value.

Comparing the characteristics that define meat quality, no differences were detected for L*, a* and b* values but they were slightly higher in group LP. In the experiments of Dal Bosco *et al*. (2002), Combes *et al*. (2003) and Dalle Zotte *et al*. (2009) L*, a* and b* values were slightly or significantly higher for rabbits kept in pens. The results characterizing meat quality can be explained by the fact that rabbits reared in large groups are subjected to higher stress. Based on ear lesions, it can be presumed that rabbits were exposed to stress in the groups containing aggressive individuals. Experiments conducted using other species (pig, duck, Japanese quail) show that the examined meat quality traits are dependent on each other and show a tendency to increase in case of stress (Chen *et al*., 1991; Gregory, 1996; Remington *et al*., 1998).

Although the chemical composition of the hind leg was not affected by group size, NIR spectra of meat samples showed differences between groups. Far more successful discriminations were performed when freeze-dried samples were used, which seems to show that freeze-drying is important if such slight differences are to be detected. The results of NIR spectral analysis (for both fresh and freeze-dried conditions) show that meat from the LP16 group differed significantly from the SC16 group and slightly from the LC16 group. A slighter difference was found between SC16 and LC16. This shows that NIR spectra based differences are in harmony with the differences of group size. High NIRS spectra successfully (98%) distinguished between conventional and organic meat samples, as published by Pla *et al*. (2007).

CONCLUSIONS

Our results show that stocking densities lower than 16 rabbits/m^2 had no favourable effects on the growing rabbits' production data. The increased frequency of ear lesions when housed at 12 rabbits/m^2 needs attention, but since no clear explanation can be given for this finding, further investigation is necessary.

The most serious disadvantage of larger groups is the increased frequency of aggression. This compromises animal welfare and thus questions the practice of rearing rabbits in large groups.

NIR spectroscopy offers possibilities as a tool to monitor the effect of group size on meat quality, since detectable differences were found in spectra of meats of rabbits reared under different conditions.

The study also uncovered other arguments in favour of housing fattening rabbits in groups no larger than a maximum 8 rabbits per cage.

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