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THE EFFECT OF STOCKING DENSITY ON CARCASS TRAITS, MUSCLE FIBRE PROPERTIES AND MEAT QUALITY IN RABBITS

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Abstract: The aim of the present work was to evaluate the effect of stocking density on the *biceps femoris* (BF) muscle fibre properties, meat quality and carcass traits of Czech White rabbits. A total of 20 rabbits (40 d old, 10 rabbits per treatment, sex ratio 1/1) were reared in cages at different stocking densities (10 rabbits/m^2 or 4 rabbits/m^2) for 49 d. There were no significant differences between groups with regard to hot carcass weight (HCW) or dressing-out percentage. The proportions of both perirenal (9.5 *vs.* 15.9 g/kg HCW; *P*=0.010) and total dissectible fat (14.9 *vs.* 25.1 g/kg HCW; *P*=0.001) were lower in rabbits reared at the lower stocking density. No significant differences in ultimate pH values, meat colour or proximate composition were observed. The hind leg meat of rabbits reared at the lower stocking density contained significantly less lauric acid (4.6 *vs.* 6.7 mg/100 g of muscle; *P*=0.008), myristic acid (52.2 *vs.* 64.4 mg/100 g of muscle; *P*=0.033) and Docosahexaenoic acid (0.3 *vs.* 0.5 mg/100 g of muscle; *P*=0.024). Significantly higher percentages of βR fibres (16.3 *vs.* 6.5%, *P*=0.001) and αR fibres (24.5 *vs.* 14.2%; *P*=0.001) and a significantly lower percentage of αW fibres (59.2 *vs.* 79.3%; *P*=0.001) were also observed in these rabbits. The mean cross-sectional area (1882 *vs.* 2744 μm^2; *P*=0.001) and diameter (47.9 *vs.* 58.5 μm; *P*=0.001) of βR fibres were smaller in rabbits reared at the lower stocking density. Thus, the different stocking density used in our study modified fibre type distribution and fibre histomorphological characteristics of the *biceps femoris* muscle of rabbits and significantly decreased concentrations of lauric acid, myristic acid and docosahexaenoic acid in the hind leg meat.

Key Words: rabbit, stocking density, meat, fatty acid, fibre muscle.

INTRODUCTION

Rabbit meat is highly valued for its nutritional and dietary properties (reviewed by Dalle Zotte, 2002). It is a lean meat with a low fat and cholesterol content and highly unsaturated lipids with noticeable quantities of linolenic acid (C 18:3n-3). Although rabbit meat naturally offers excellent nutritional and dietary properties, it can be further effectively fortified with bioactive compounds (reviewed by Dalle Zotte and Szendrő, 2011).

The effect of dietary manipulation on rabbit meat quality is thus well documented. However, there is a lack of meat quality information concerning the effect of housing system variables such as stocking density (reviewed by Dalle Zotte, 2002). Some authors have studied the effects of alternative rearing systems on some meat traits such as pH, meat colour or proximate composition, mostly under extensive conditions (Preziuso *et al.*, 2009; D'Agata *et al.*, 2009; Lazzaroni *et al.*, 2009a). Lower stocking density resulted in lower lightness of *Biceps femoris* and higher redness of *Longissimus lumborum* muscles of slow-growing rabbits reared outdoors (Paci *et al.*, 2013). In broiler rabbits, Xiccato *et al.* (2013) reported that the meat colour may be affected by the housing system, but to an extent that is hardly perceivable by the final consumer. More attention has been paid to the study of the stocking density on the growth performance (reviewed by Szendrő and Dalle Zotte, 2011). It has been stated that a stocking density lower than 16 rabbits/m^2 had no effect on the growth performance of growing rabbits (e.g., Trocino *et al.*, 2004; Szendrő *et al.*,

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2009). Verspecht *et al.* (2011) reported that feed conversion and feed intake were found to increase slightly with decreasing stocking density. Similarly, Xiccato *et al.* (2013) observed that the slaughter and carcass traits and meat quality were weakly affected by the housing system.

To our knowledge, however, no information regarding stocking density on muscle fibre characteristics is available.

Accordingly, the aim of the present work was to evaluate the effect of stocking density on carcass traits, muscle fibre properties and meat quality in Czech White rabbits.

MATERIALS AND METHODS

Diet

Lists of the ingredients and chemical composition of the diet used are presented in Tables 1 and 2. The diet contained common feed components and met the nutritive recommendations of de Blas and Mateos (2010) for growing-fattening rabbits. The diet was offered as 3 mm pellets with a length of 5-10 mm. No medication was included in the feed or in the drinking water.

Animals and experimental design

The study was approved by the Ethics Committee of the Institute of Animal Science and the Central Commission for Animal Welfare at the Ministry of Agriculture of the Czech Republic and was conducted according to the guidelines for applied nutrition experiments in rabbits (Fernández-Carmona *et al.*, 2005). The study was held at an experimental rabbit unit at the Institute of Animal Science, accredited in accordance with EU standards. Animals were kept under controlled environmental conditions: room temperature between 19 and 21 °C, relative humidity of approximately 65% and 12 h of light per day.

Table 1: Diet ingredient list and chemical composition (g/kg, as-fed basis).

	g/kg
Ingredient	
Alfalfa meal	300
Sunflower meal, CP (280 g/kg)	170
Wheat bran	230
Sugar beet pulp	40
Oats	130
Barley	80
Rapeseed oil	20
Vitamin-mineral pre-mix[1]	10
Dicalcium phosphate	5
Limestone	10
Salt	5
Determined values	
Dry matter	885
Crude protein	169
Neutral detergent fibre	328
Acid detergent fibre	183
Ether extract	34
Starch	134
Ash	76
Calculated values[2]	
Digestible crude protein	107.3
Digestible energy (MJ/kg)	9.7

[1]Included per kg of feed: vitamin A, 12.000 IU; vitamin D_3, 2000 IU; vitamin E, 50 mg; vitamin K_3, 2 mg; vitamin B_1, 3 mg; vitamin B_2, 7 mg; vitamin B_6, 4 mg; niacinamide, 50 mg; Ca-pantothenate, 20 mg; folic acid, 1.7 mg; biotin, 0.2 mg; vitamin B_{12}, 0.02 mg; choline chloride, 600 mg; Co, 1 mg; Cu, 20 mg; Fe, 50 mg; I, 1.2 mg; Mn, 47 mg; Zn, 50 mg; Se, 0.15 mg; salinomycin, 22.5 mg; [2]Calculated from Maertens *et al.* (2002).

Table 2: Fatty acid profile (% of total fatty acid) of the rabbit diet.

	%
SFA	
Lauric (C 12:0)	0.03
Myristic (C 14:0)	0.14
Pentadecanoic (C 15:0)	0.07
Palmitic (C 16:0)	10.09
Margaric (C 17:0)	0.07
Stearic (C 18:0)	1.80
Other SFA	0.67
Total SFA	12.88
MUFA	
Myristoleic (C 14:1)	0.01
Palmitoleic (C 16:1)	0.27
Oleic (C 18:1n-9)	38.11
cis-vaccenic (C 18:1n-7)	1.54
Eicosenoic (C 20:1n-9)	0.85
Other MUFA	0.03
Total MUFA	40.81
PUFA	
Linoleic (C 18:2n-6)	36.84
α-linolenic (C 18:3n-3)	9.07
Eicosadienoic (C 20:2n-6)	0.07
Eicosatrienoic (20:3n-6)	0.01
Arachidonic (C 20:4n-6)	0.03
Eicosapentaenic acid (C 20:5n-3)	0.16
Docosapentaenoic (C 22:5n-3)	0.03
Docosahexaenoic acid (C 22:6n-3)	nd
Other PUFA	0.11
Total PUFA	46.32

SFA: Saturated fatty acids; MUFA: Monounsaturated fatty acids; PUFA: Polyunsaturated fatty acids; nd: not detected.

Czech White rabbits were used. This breed is one of 7 Czech rabbit breeds included in the National Program of Rabbit Genetic Resource Programme. The live weight of an adult Czech White rabbit is 4.0-5.0 kg (Tůmová *et al*., 2011).

A total of 20 weaned Czech White rabbits of both sexes (sex ratio 1/1), 40 d old at the start of the experiment, were randomly allocated into 2 groups (10 rabbits per treatment) and reared at different stocking densities. The SC group (small cage, 40×50×43 cm) was reared at a density of 10 rabbits/m^2 (2 animals/cage) and the LC group (large cage, 60×80×43 cm) was reared at a density of 4 rabbits/m^2 (2 animals/cage). The diet was offered to rabbits *ad libitum*. Rabbits were weighed every 7 d and feed intake per cage was measured every day. At the end of the experiment (89 d of age), all rabbits were weighed and slaughtered without previous fasting in an authorised abattoir next to the Institute of Animal Science, to prevent animal suffering due to the stress caused by long transport time. Carcass traits were evaluated according to the methodology recommended by Blasco and Ouhayoun (1996). Briefly, the slaughtered rabbits were bled and the skin, genitals, bladder, gastrointestinal tract and distal portion of the legs were removed. Carcasses (including the head, thoracic cage organs, liver, kidneys, perirenal fat and scapular fat) were weighed to obtain the hot carcass weight. Then, the right hind leg meat was evaluated to determine the *biceps femoris* (BF) muscle fibre characteristics. Samples of BF muscle were frozen in liquid nitrogen-cooled isopentane and then stored at –80 °C until analysis. The left hind leg meat was chilled at 4 °C for 24 h in a ventilated room and used to determine the ultimate pH (pHu), meat colour, proximate chemical composition and fatty acid profile.

Analytical determinations

All analyses were performed in duplicate. Dry matter was determined by drying samples of the diet at 105 °C to a constant weight. AOAC International (2005) procedures were used to determine the crude protein (954.01), starch (920.40) and ash (942.05) contents. Ether extract was evaluated according to AOAC procedure 920.39 (1995). Crude

protein content (6.25×N) and ether extract in the diet were determined with a Kjeltec Auto 1030 Analyser and Soxtec 1043 instrument, respectively (FOSS Tecator AB, Höganäs, Sweden). Neutral detergent fibre content was determined using the Mertens method (2002), and the acid detergent fibre content was determined according to AOAC procedure 973.18 (2000).

Serial cross-sections (12 µm) from each BF sample were obtained with a cryostat at –20 °C. The sections were subjected to myofibrillar ATPase staining after successive preincubations in alkaline buffer, as recommended by Brooke and Kaiser (1970). The fibres were typed as βR (red slow twitch fibre), αR (red fast twitch fibre) or αW (white fast twitch fibre) according to the nomenclature described by Ashmore and Doerr (1971). For each muscle fibre type, the respective percentage, mean cross-sectional area (CSA, µm^2) and diameter (µm) were determined using NIS Elements AR 3.1 software (supplied by Laboratory Imaging s.r.o., Prague, Czech Republic).

The pHu of the BF muscle was determined with a portable pH-meter equipped with a glass electrode suitable for meat penetration. Meat colour, expressed as L* (lightness), a* (redness) and b* (yellowness), was measured with Minolta SpectraMagic™NX (Konica Minolta Sensing, Inc., Osaka, Japan) in a transversal section of the BF muscle surface. Values corresponded to the average of three measurements per sample.

Meat dry matter was determined by oven drying at 105 °C and neutral lipids content was obtained by extraction with petroleum ether without prior hydrolysis in a Soxtec 1043 apparatus (FOSS Tecator AB, Höganäs, Sweden). The determination of free fat was carried out as described in ISO 1444 (1996). The protein content of the meat was determined using a Kjeltec Auto 1030 Analyser. Hydroxyproline content was determined by acid hydrolysis as described by Diemair (1963). The fatty acid composition of the diet and hind leg meat was determined as previously described by Volek and Marounek (2011). Briefly, FA composition was determined after the chloroform-methanol extraction of total lipids (Folch *et al.*, 1957). Nonadecanoic acid (C 19:0) was used as an internal marker to quantify the FA present in the samples. Alkaline *trans*-methylation of FA was performed as described by Raes *et al.* (2003). Gas chromatography of methyl esters was performed using a HP 6890 chromatograph (Agilent Technologies, Inc.) with a programmed 60 m DB-23 capillary column (150-230 °C) and a flame-ionisation detector; split injections were performed using an Agilent autosampler. One µl samples of FAME in hexane were injected at a 1:40 split ratio. Separation was achieved using the following column temperature program: initially the column was operated at 60 °C for 7 min, then temperature programmed at 20 °C/min to 110 °C, held for 4 min, programmed at 10 °C/min to 120 °C, held for 4 min, programmed at 15 °C/min to 170 °C, programmed at 2 °C/min to 210 °C, held for 13.5 min, and finally programmed at 40 °C/min to 230 °C, held for 7 min. Fatty acids were identified by retention times compared with standards. PUFA 1, PUFA 2, PUFA 3 and 37 Component FAME Mix (Supelco, Bellefonte, PA, USA) were used as standards.

Calculations and statistical analyses

The peroxidisability index (PI), which describes the relative rate of the peroxidation reaction, was calculated from the following equation (Arakawa and Sagai, 1986): PI=(% monoenoic×0.025)+(% dienoic×1)+(% trienoic×2)+(% tetraenoic × 4) +(% pentaenoic×6)+(% hexaenoic×8).

Data on the performance, carcass characteristics, proximate and fatty acid composition, pHu, meat colour and BF muscle fibre characteristics of the rabbits were examined by one-way analysis of variance using the GLM procedure of the Statistical Analysis System Institute (SAS, 2001). Stocking density was considered as the main categorical factor. The individual rabbit (carcass traits, proximate and fatty acid composition, pHu, meat colour and BF muscle fibre characteristics) or cage (growth performance) was used as the experimental unit. Differences between means with $P<0.05$ were accepted as statistically significant.

RESULTS AND DISCUSSION

Growth performance and carcass characteristics

Data describing the growth performance and carcass characteristics are presented in Table 3. Rabbits showed normal figures for growth rate (on av. 39.7 g/d), feed intake (on av. 120.8 g/d) and feed conversion ratio (on av. 3.14).

Table 3: The effect of stocking density on rabbit growth performance and carcass characteristics.

	Stocking density			
	10 rabbits/m^2	4 rabbits/m^2	RMSE	*P*-value
Growth performance[1]				
Live weight 40 d (g)	846	809	84	0.549
Live weight 89 d (g)	2702	2652	216	0.758
Weight gain (g/d)	39.5	39.9	4.9	0.907
Feed intake (g/d)	114.9	126.7	7.5	0.066
Feed conversion	3.08	3.19	0.26	0.582
Carcass characteristics[2,3]				
HCW (g)	1568	1608	181	0.652
Perirenal fat (g/kg HCW)	15.9	9.5	3.7	0.010
Total dissectible fat[4] (g/kg HCW)	25.1	14.9	4.3	0.001
Dressing-out[5] (%)	59.4	60.6	1.9	0.182

RMSE: Root mean square error ([1]n=5 cages per group, 2 rabbits per cage; [2]n=10 rabbits per group); [3]Carcass characteristics of 89-day-old rabbits; HCW: Hot carcass weight; [4]Total dissectible fat includes the scapular, inguinal and perirenal fat; [5]HCW/slaughter weight×100.

However, further experimentation is essential to determine the growth performance using a higher number of rabbits per group. There were no significant differences between groups with regard to hot carcass weight or dressing-out percentage, consistent with the results of previous works (Trocino *et al.*, 2004; Villalobos *et al.*, 2008; Paci *et al.*, 2013; Xiccato *et al.*, 2013). The proportions of both perirenal and total dissectible fat, which includes scapular, inguinal and perirenal fat, were significantly lower in rabbits reared at the lower stocking density than in rabbits reared at the higher stocking density. Similarly, Lazzaroni *et al.* (2009b) observed decreased fat deposition in pen-housed rabbits (higher disposable space) compared with rabbits reared in individual cages. Villalobos *et al.* (2008) observed that the proportion of scapular fat increased linearly with increasing levels of stocking density, but perirenal fat was unaffected.

pHu, meat colour and proximate chemical composition of hind leg meat

Data on the effect of pHu, L*a*b* colour values and the proximate chemical composition of hind leg meat of rabbits are presented in Table 4. There was no significant effect of stocking density on the pHu values or proximate chemical composition of hind leg meat (Table 4), consistent with the findings of other authors (Trocino *et al.*, 2004; Preziuso *et al.*, 2009; Paci *et al.*, 2013; Xiccato *et al.*, 2013). Meat colour values a* and b*, assessed on the BF surface, were not significantly affected by stocking density. The L* colour values of the BF muscles of rabbits reared at the lower stocking density were only slightly lower (P=0.088) than those of rabbits reared at the higher stocking density, however consistent with the findings of Preziuso *et al.* (2009), D'Agata *et al.* (2009), and Paci *et al.* (2013) who reported that the BF muscle in rabbits reared in outdoor cages at a lower stocking density was darker than that in rabbits reared at the higher stocking density.

Table 4: The effect of stocking density on the pHu, L*a*b* colour values and proximate chemical composition of rabbit hind leg meat.

	Stocking density			
	10 rabbits/m^2	4 rabbits/m^2	RMSE	*P*-value
pHu	5.61	5.58	0.04	0.179
L* (lightness)	63.40	59.71	4.18	0.088
a* (redness)	–2.19	–2.11	0.79	0.823
b* (yellowness)	10.47	10.86	1.02	0.444
Proximate composition (g/kg)				
Dry matter	255	257	8	0.636
Protein	214	212	5	0.265
Neutral lipids	25.9	26.1	4.8	0.401
Hydroxyproline	1.3	1.4	0.1	0.431

RMSE: Root mean square error (n=10 rabbits per group).

Fatty acid profile in hind leg meat

The fatty acid profile is presented in Table 5. The hind leg meat of rabbits reared at the lower stocking density contained less lauric acid (*P*=0.008), myristic acid (*P*=0.033), oleic acid (*P*=0.053) and DHA (*P*=0.024). The lower lauric and myristic acid content can be explained by the different oxidation rates of individual fatty acids, which have been well documented in humans. In fact, DeLany *et al.* (2000) observed that lauric acid, a medium-chain fatty acid (MCFA), was the most rapidly oxidised fatty acid, followed by the unsaturated fatty acids; the long-chain saturated fatty acids were the least rapidly oxidised. Indeed, it was stated that among fatty acids usually found in adipose tissue triacylglycerols (12-24 carbon atoms and 0-6 double bonds) a fatty acid is more readily mobilised, as its carbon chain is shorter and more unsaturated (Raclot, 2003). Oleic acid content was non-significantly (P=0.053) lower in the hind leg meat of rabbits reared at the lower stocking density, which may be related to the fact that unsaturated fatty acids are more rapidly oxidised than saturated fatty acids (DeLany et al., 2000). Szabó et al. (2002), however, observed that exercise increased the proportion of oleic acid in muscles of rabbits. Similar findings have also been published by other authors (Helge et al., 1999, 2001). In the present study, the oxidation of MCFA apparently covered a higher energy requirement in more physically active rabbits reared in cages with the higher disposable space compared to rabbits reared at the higher stocking density. These results indicate that rabbits reared at the lower stocking density yielded hind leg meat with a lower MCFA content, which may provide a nutritional benefit to humans. In fact, lauric, myristic, and palmitic acids are responsible for increasing total plasma and LDL cholesterol concentrations (reviewed by Ulbricht and Southgate, 1991).

Table 5: The effect of stocking density on the fatty acid profile (mg per 100 g of muscle) of rabbit hind leg meat.

	Stocking density			
	10 rabbits/m^2	4 rabbits/m^2	RMSE	*P*-value
SFA				
Lauric (C 12:0)	6.7	4.6	1.3	0.008
Myristic (C 14:0)	64.4	52.2	10.3	0.033
Pentadecanoic (C 15:0)	12.9	12.0	2.7	0.813
Palmitic (C 16:0)	679.6	620.3	83.3	0.179
Margaric (C 17:0)	14.7	13.6	2.0	0.732
Stearic (C 18:0)	242.4	220.6	37.5	0.264
Other SFA	9.9	8.9	2.1	0.682
Total SFA	1030.6	932.2	121.3	0.157
MUFA				
Myristoleic (C 14:1)	5.6	5.9	2.5	0.787
Palmitoleic (C 16:1)	52.2	53.9	18.4	0.645
Oleic (C 18:1n-9)	953.1	849.8	97.8	0.053
cis-vaccenic (C 18:1n-7)	47.0	45.7	7.5	0.724
Eicosenoic (C 20:1n-9)	10.0	10.8	2.2	0.423
Other MUFA	9.4	9.6	1.5	0.775
Total MUFA	1077.3	975.7	128.7	0.137
PUFA				
Linoleic (C 18:2n-6)	706.6	660.3	75.3	0.141
α-linolenic (C 18:3n-3)	121.7	117.3	15.7	0.583
Eicosadienoic (C 20:2n-6)	9.0	8.6	1.5	0.601
Eicosatrienoic (C 20:3n-6)	6.6	6.4	0.8	0.456
Arachidonic (C 20:4n-6)	55.6	60.3	6.5	0.154
Eicosapentaenic acid (C 20:5n-3)	1.5	1.5	0.3	0.763
Docosatetraenoic (C 22:4n-6)	7.7	8.0	1.0	0.504
Docosapentaenoic (C 22:5n-3)	8.2	7.6	2.3	0.573
Docosahexaenoic acid (C 22:6n-3)	0.5	0.3	0.1	0.024
Other PUFA	9.3	7.7	1.1	0.009
Total PUFA	926.8	877.9	77.5	0.228
PUFA n-6/PUFA n-3 ratio	5.75	5.94	0.52	0.467
Peroxidisability index	45.28	45.60	3.19	0.838

RMSE: Root mean square error (n=10 rabbits per treatment); SFA: Saturated fatty acids; MUFA: Monounsaturated fatty acids; PUFA: Polyunsaturated fatty acids.

Table 6: The effect of stocking density on the fibre type distribution and fibre histomorphological characteristics of rabbit *Biceps femoris* (BF) muscles.

	Stocking density		RMSE	*P*-value
	10 rabbits/m^2	4 rabbits/m^2		
Fibre type distribution (%)				
βR	6.5	16.3	5.4	0.001
αR	14.2	24.5	5.2	0.001
αW	79.3	59.2	5.7	0.001
Fibre cross-sectional area (μm^2)				
βR	2744	1882	456	0.001
αR	1773	1739	296	0.810
αW	2882	2752	403	0.506
Diameter (μm)				
βR	58.5	47.9	5.2	0.001
αR	46.9	45.6	4.0	0.511
αW	56.0	57.6	5.8	0.569

RMSE: Root mean square error (n=10 rabbits per group); βR: Red slow twitch fibre; αR: Red fast twitch fibre; αW: White fast twitch fibre.

On the other hand, DHA content, which has a positive effect on human health (reviewed by Ulbricht and Southgate, 1991), was significantly decreased in rabbits reared at the lower stocking density. In the present study, the peroxidisability index (PI), which reflects the relative rate of peroxidation because the PI is calculated from the composition ratio and reactivity of each fatty acid (Arakawa and Sagai, 1986), was not affected by stocking density. Similarly, no significant effect of stocking density on the polyunsaturated fatty acids (PUFA) n-6/PUFA n-3 ratio was observed.

Fibre type distribution and fibre histomorphological characteristics of BF muscle

The effect of stocking density on fibre type distribution and the fibre histomorphological characteristics of rabbit BF muscles is presented in Table 6. A significantly higher percentage of βR fibres (oxidative type, red slow twitch fibres) and αR fibres (oxidative type, red fast twitch fibres) and a significantly lower percentage of αW fibres (glycolytic type, white fast twitch fibres) was observed in rabbits reared at the lower stocking density, a finding that may be explained by the greater physical activity of the rabbits reared in cages with the higher disposable space. Oxidative metabolism is the principal source of energy for foetal rabbits. At birth, all muscle fibres are of the oxidative type, and glycolytic metabolism dramatically increases during the first weeks after birth (reviewed by Picard *et al.*, 2002). αR fibres are then converted to αW fibres. However, this conversion is reversible; for instance, exercising increases the number of mitochondria in αW fibres and hence turns them into αR fibres (reviewed by Ouhayoun and Dalle Zotte, 1993). Indeed, Gondret *et al.* (2009) observed that the fast-twitch BF muscle of rabbits trained with jumping exercises showed greater percentages of type I (βR fibres) and type IIA (αR fibres) fibres and a concomitant decrease in the proportion of type IIb+X (mainly αW fibres) fibres compared to sedentary rabbits. In the present study, however, we observed very extensive modifications in myofibre type frequencies in rabbits housed in bicellular cages compared with the previous study (Gondret *et al.*, 2009), where rabbits were housed in pens and jump exercise was forced, a finding which may be explained by the genetic origin of the rabbits used (Vigneron and Bacou, 1976; Dalle Zotte and Ouhayoun, 1998). In the present study, the mean cross-sectional area and diameter of βR fibres were significantly smaller in rabbits reared at the lower stocking density than those of rabbits reared at the higher stocking density.

CONCLUSION

It may be concluded that the different stocking density used in our study modified fibre type distribution and fibre histomorphological characteristics of the *biceps femoris* muscle of rabbits, and significantly decreased concentrations of lauric acid, myristic acid and docosahexaenoic acid in the hind leg meat.

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